The Dissertation Committee for Michael Damian McCarthy certifies that this is the approved version of the following dissertation:

The Psychometric Properties and Clinical Utility of the Air Force Post-Deployment Health Reassessment (PDHRA) for Airmen with Posttraumatic Stress Disorder (PTSD) or Depression

Committee:

Sanna J. Thompson, Supervisor

David W. Springer

Arthur J. Schwab Jr.

Roberta R. Greene

Alfred J. Ozanian

The Psychometric Properties and Clinical Utility of the Air Force Post-Deployment Health Reassessment (PDHRA) for Airmen with Posttraumatic Stress Disorder (PTSD) or Depression

by

Michael Damian McCarthy, B.S.; M.S.W.

Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin
May 2011

Dedication

To my beautiful children, Sydney and Isaac, for the joy and purpose they bring to my life.

Acknowledgements

There is no way I could have completed this work without the tireless and unflagging support of my wonderful wife **Bree**. She has been an amazing partner who has given up more than I could have fairly asked so that I could pursue my goals. I am blessed and grateful to share my life and accomplishments with her. I owe a debt of gratitude to many others who made tremendous contributions to this work. Foremost among these is **Sanna Thompson**, whom I consider the finest educator I have ever studied under. She gave selflessly and patiently of her time and wisdom. To me she is the epitome of a mentor and servant leader. **Alfred Ozanian,** who guided me on this journey long before I arrived at the University of Texas. His willingness to share his experience and insight, in his uniquely self-deprecating way, has contributed to my development as a social worker, an academic and an Airman. **David Springer,** whose example taught me a great deal about leadership and self-discipline. His incredible knowledge in areas where I had none was so valuable to this research. "Toe nails are for wimps." **Roberta Greene,** whose dedication to the men and women in uniform was a source of both support and inspiration to me. Her generous contributions of time and expertise were critical to the theoretical development of this paper. **Jim Schwab,** for introducing me to statistics and teaching me to love them. He never allowed me to settle for less than I was capable of. To **Nate Marti** who saved me from despair several times by helping me with my statistics.

I want to thank my family who understood challenges involved in completing this work and who supported me throughout. My mother **Shelly** and father **Doug** who were my greatest cheerleaders. Thank you for teaching me the value of a good work ethic by

the example you set. To my daughter **Sydney** and son **Isaac** who were the best reminder of what is truly important, during the times that I took this process too seriously.

I also want to thank members of my Air Force family and social work cohort who were significant contributors to this journey. **Robert Campbell,** for taking time to guide me along the way in my military career and facilitating my selection as an AFIT fellow. **Julian Cano,** for commiserating throughout this process and being a great friend to my family and me. **Rebecca Myatt & Celan Alo** for their help developing the data set used in this study. Finally, a special thanks to **Scott Moxham** for his friendship, his couch, his proof reading and for always reminding me that polar bears can be your friend or your foe.

The Psychometric Properties and Clinical Utility of the Air Force Post-Deployment Health Reassessment (PDHRA) for Airmen with Posttraumatic Stress Disorder (PTSD) or Depression

Michael Damian McCarthy, Ph.D.
The University of Texas at Austin, 2011

Supervisor: Sanna Thompson

Operation Enduring Freedom (OEF) (Afghanistan) and Operation Iraqi Freedom (OIF) represent one of the longest wartime deployments in the history of the American military. To date, 1.6 million American military members have deployed. Of these, an estimated 300,000 have returned with a mental health condition, such as depression or PTSD. The Department of Defense has established a robust screening program to identify and track deployment-related physical and psychiatric illnesses. The Post-Deployment Health Reassessment (PDHRA) is a primary tool to identify physical and psychiatric risk following a deployment. The PDHRA is a web-based survey, which is administered between 90-180 days after a deployment. This study seeks to evaluate the psychometric properties and clinical utility of the Post-Deployment Health Reassessment (PDHRA) for accurately identifying truama and depression among Airmen following a deployment. Descriptive statistics, confirmatory factor analysis and structural equation modeling were used to address separate research aims. Study aims assessed the impact of deployment on military members and the clinical utility and psychometric properties of the Post-Deployment Health Reassessment. Findings suggest that the Post-Deployment Health Reassessment is a useful triage tool to identify trauma and depression among Airmen

following deployment. The study makes recommendations for improving the clinical utility and psychometric properties of the Post-Deployment Health Reassessment (PDHRA).

Table of Contents

List of Tables

List of Figures

I. INTRODUCTION

I.1. Problem Statement: Study Background and Significance

The re-assimilation of combat veterans into society has been a social issue in the United States that has gained increasing visibility since the Vietnam War (Herman, 1992). Large numbers of veterans from the conflicts in Iraq and Afghanistan have mental health conditions that may impact their ability to reintegrate in to their family, social networks and society (Hoge, Castro, Messer et al., 2008). Effectively identifying at-risk individuals is the first step to providing evidence-based care for deployment-related mental health conditions. Efficiently identifying and servicing at-risk individuals following a military deployment may significantly impact the wellness of these individuals and the communities to which they return.

In addition to the social impact of mental health issues among military members who return from combat, mental health concerns can have a tremendous impact on the efficacy of military units in the field. As far back as the Napoleonic Wars physicians have noted the deleterious impact of war on the mental health of combatants (Jones & Wessely, 2005). An estimated one-third of casualties evacuated from combat zones in conflicts prior to the Gulf War were due to psychiatric dysfunction (Jones & Wessely, 2001). As military members leave their units because of emotional distress the remaining members of the unit are made more vulnerable because they have less support and are required to accomplish more tasks. Decreased unit efficacy in military activities creates the potential for negative outcomes in combat exchanges with an adversary (Darley, 2006; Fogleman, 1995). The consequence of this can be serious injury or death. Effective intervention may increase the ability of military members to return to their

occupational responsibilities in as safe and productive a manner as possible (Peterson, Baker, & McCarthy, 2008).

The American military is a huge organization, whose members experience significant occupational strain (Lacquement, 2003). Approximately 2.9 million individuals serve in the United States military (Bicksler, Gilroy, & Warner, 2004). American military members have been engaged in continuous combat operations since the October 2001 invasion of Afghanistan and the subsequent invasion of Iraq in 2003. Present demands represent one of the longest war time engagements in the history of the United States military (Salter, 2010; Jordan, Taylor, & Mazarr, 1999; Leckie, 1992). The impact of the current operational environment on military members is only beginning to be understood.

The military is unique from the society from which it is drawn in many ways. Men and some ethnic minorities are over-represented in the demographics of the American military (Klein, 2008). Military members experience unique stressors secondary to their martial occupation. Prolonged exposure to combat is a common occupational requirement and military members are often heavily involved in the response to natural disasters, like Hurricane Katrina and the recent earthquake in Haiti. Prolonged exposure to combat and natural disasters can increase the risk an individual will develop a psychiatric disorder such as depression or Posttraumatic Stress Disorder (PTSD) (Garnett & Kouzmin, 2009; Iezzoni & Ronan). Additionally, military members are often deployed for long periods of time and frequently must permanently relocate (Coker, 2007). This lifestyle can strain family and social support networks. The

combination of these factors makes members of the military uniquely vulnerable to mental health problems. Recent research suggests trauma-related and depressive symptoms are becoming increasingly prevalent among some military members (Hoge et al., 2008).

The protracted nature of present conflicts suggests that increased mental health needs may be present among military members. 1.6 million American military members have deployed in support of Operation Enduring Freedom (OEF) (Afghanistan) and Operation Iraqi Freedom (OIF). Of these, an estimated 300,000 have returned with a mental health condition, such as depression or PTSD (Rand, 2008). Exposure to violent combat is often a precursor to emotional dysfunction, most notably an increased risk of post-traumatic stress disorder and depression (Shalev et al., 1998). Previous research has identified a number of factors that are correlates of emotional dysfunction in the wake of trauma; these factors will be discussed in detail below (Brewin, Andrews, & Valentine, 2000; Grieger et al., 2006).

I.1.1. Trauma and Posttraumatic Stress Disorder (PTSD)

Dysfunctional responses to traumatic incidents often cause acute or chronic emotional crisis. Previous research has placed the lifetime prevalence rate for Posttraumatic Stress Disorder (PTSD) between 5% and 8%, making PTSD one of the most common mental health disorders (Frans, Rimmo, Aberg, & Fredrikson, 2005; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Marmar, 2009). The prevalence rate of PTSD among vulnerable populations, such as combat veterans and victims of natural disasters has been reported at much higher levels. Samples of at-risk groups, such

as combat veterans and survivors of natural disasters, have had PTSD prevalence rates ranging from 3%-58% in previous studies (Campbell et al., 2007; American Psychiatric Association, 2000).

PTSD is precipitated by exposure to traumatic stimuli that cause the individual to fear death or significant injury to themselves or others (American Psychiatric Association, 2000). Common catalysts of the disorder are natural or man-made disasters or experiencing a serious accident or illness. The ubiquity of such events means that many individuals, between 39% and 84%, have been exposed to stimuli of adequate severity to cause posttraumatic symptomotology (Keane, Weathers, & Foa, 2000; Kessler et al., 1995). Although, not everyone who is exposed to a traumatic event will develop PTSD, a traumatic experience is a necessary precondition of a PTSD diagnosis.

PTSD is characterized by three distinct symptom domains: Re-experiencing, Avoidance and Hyper-arousal (American Psychiatric Association, 2000). The re-experiencing spectrum of symptoms that accompany a diagnosis of PTSD is characterized by intrusive thoughts about the trauma. Often these intrusive thoughts manifest in the form of dissociative flashbacks (Bisson et al., 2007). Re-experiencing the trauma in nightmares is also common. PTSD is also characterized by having very strong emotional and physical reactions to stimuli reminiscent of the event. Individuals with PTSD may experience the psychological need to avoid activities, thoughts, feelings or conversations that remind them of the event (Olff, Sijbrandij, Opmeer, Carlier, & Gersons, 2009). Feeling numb to one's surroundings, or being unable to remember details of the event are common symptoms of PTSD. Experiencing a loss of interest in

important activities, feelings of isolation, having a constricted range of affect or feeling that there is nothing to look forward to in the future are also common symptoms (Nutt & Malizia, 2004; Wright, Crawford, & Sebastian, 2007). Finally, hyper-vigilance, or an inability to relax often occurs in the aftermath of trauma. This may manifest in difficulty sleeping, irritability, overreacting when startled, angry outbursts or poor concentration (American Psychiatric Association, 2000).

The concept of psychological trauma has relevance to nearly all of the specialty areas of practice within the social work profession: domestic violence, substance abuse, homelessness, poverty, crime and disaster victimization, displaced populations, Veteran's affairs and medical social work involve working with clients who are at increased risk to develop PTSD (Brewin et al., 2000). De Zulueta (2007) posited that in communities with high levels of violence, PTSD can have generational and community wide impact. Lamprecht and Martin (2002) note that psychological trauma catalyzes protracted consequences in the biological, intra-psychic and social organization of individuals. "Traumatic events destroy the victim's ability to envisage a world in which they belong, a world hospitable to human life," (Herman, 1992, p. 51).

Traumatized individuals may be impacted by wide spread emotional dysfunction within their community (de Zulueta, 2007). In fact, individual and community resiliency often diminish over time in communities that experience mass violence. The psychic impact of violent events may even be passed inter-generationally, which may negatively impact the community long after mass violence has abated (de Zulueta, 2007).

PTSD symptoms among Gulf War veterans, for instance, were characterized in one study by two distinct growth curves. The first growth curve was characterized by low levels of PTSD with little increase over time. This pattern of symptoms was present in 57% of the sample. The second growth curve was characterized by higher levels of initial PTSD symptoms with a significant increase over time. This pattern of symptoms was present in 43% of subjects (Orcutt, Erickson, & Wolfe, 2004). The expectation that more than 40% of an affected population will deteriorate points to the chronic and debilitating nature of PTSD. Family and community members who interact with Gulf War veterans with PTSD may be impacted be the persistence of trauma-related symptoms for extended periods of time. Dohrenwend, Turner, Turse, Adams, Koenen, and Marshall (2007) found a 9.1% current rate of PTSD in Vietnam War veterans more than three decades after experiencing trauma.

Isolated or oppressed communities are uniquely vulnerable to mass trauma as illustrated by the 2004 tsunami and 2005 Hurricane Katrina disasters (Frankenberg et al., 2008; Galea, Tracy, Norris, & Coffey, 2008). PTSD is exacerbated by the presence of inadequate resources and pre-existing dysfunctional dynamics (Galea et al., 2008). Numerous natural and man-made disasters have increased the visibility of trauma. Media coverage of the Southeast Asian tsunami in 2004, Hurricane Katrina in 2005, terrorist attacks in New York, Washington D.C., Bali, Madrid and Oklahoma and the wars in Iraq, Afghanistan and Sudan have illustrated the impact of trauma on the human psyche.

I.1.2. Trauma and Depression

Depression is a common mental health phenomenon that is associated with significant social, health and emotional risks. The lifetime prevalence rate for Major Depressive Disorder in community samples is as high as 25% (American Psychiatric Association, 2000). Depression is also frequently a chronic condition with symptoms such as a depressed mood, diminished interest in pleasurable activities and altered appetite and sleep patterns. An estimated 6% of the population suffers from Dysthymic Disorder which is indicative of depressive symptoms persisting for at least 2 years (Riolo, Nguyen, Greden, & King, 2005). Additionally, up to 60% of subjects who experience a major depressive episode will experience a second such episode (American Psychiatric Association, 2000). Most depressive episodes are the result of very stressful experiences (Hammen, Brennan, Keenan-Miller, Hazel, & Najman, 2010).

Depression is characterized by a pattern of emotional, physical and functional difficulties. Emotional characteristics of depression commonly include overwhelming feelings of sadness, helplessness, remorse, guilt and contemptibility (Gaynes et al., 2007). In addition to emotional symptoms depression often results in physical symptoms. Depression individuals commonly experience loss of energy (fatigue, lethargy, restlessness, weakness). Complications with sleep may also occur during a depressive episode. Insomnia or increased sleep and abnormal sleep schedule are common physical characteristics associated with depression (Ferentinos, Kontaxakis, Havaki-Kontaxaki & et al., 2009). Finally depression is typified by diminished functioning in important aspects of life. For instance, depression is often associated with diminished productivity

and absenteeism at work (Lerner & Henke, 2008). Similarly, depression may reduce satisfaction in marital and social relationships (Hollist, Miller, Falceto, & Fernandes, 2007; Veiel, Kühner, Brill, & Ihle, 1992).

Many studies have documented a clear relationship between a traumatic experience and depressive pathology. Recent research suggests that depression may be a growing problem among recently returned combat veterans. Among combat veterans, depression significantly increased from pre-deployment to post-deployment among military members deployed to Iraq and Afghanistan (Hoge et al., 2008). Among National Guard soldiers (N=50), 37% screened positive for depression (Renshaw, Rodrigues, & Jones, 2009). Among military members, those with Operation Iraqi Freedom (OIF) or Operation Enduring Freedom (OEF) in Afghanistan deployment experience are three times more likely to have major depressive disorder than among those who have not deployed (Kline, Falca-Dodson, Sussner. et al., 2010). Among Vietnam veterans, depression rates range from 7-9% (Boscarino, 1995). Residents of Manhattan experienced rates of depression in excess of 10% following the September 11th attacks on the World Trade Center (Galea et al., 2002). With a large number of military members deployed to prolonged combat assignments in Iraq and Afghanistan, the potential for widespread depressive disorders among this group is a reality. Estimates suggest that hundreds of thousands of returning military members will need mental health care in the near future (Rand, 2008). The enormity of the potential mental health needs of returning service members suggests that limited helping resources may be strained. Therefore, it is

important for at-risk military members to be differentiated from military members who are not in need in an accurate and efficient manner.

I.1.3. Identification of Combat-Related Physical and Mental Health Issues

The American military has come under heavy scrutiny for inadequately identifying the post-combat health and mental health needs of service members. Following the previous two major combat operations, the Gulf War and the Vietnam War, service members experienced a well publicized pattern of physical and emotional ailments (Bicksler, Gilroy, & Warner, 2004). These aliments were attributed to Agent Orange exposure in Vietnam. The culprit of the "Gulf War Syndrome" proved more elusive. In fact, epidemiologists dispute whether a syndrome existed at all. These two experiences highlighted the fact that combat zones are rife with physical and psychological hazards (Haley, Kurt, & Hom, 1997; Kim, Lim, Cho, Cheong, & Lim, 2003). In the Gulf War and Operation Iraqi Freedom (OIF)/ Operation Enduring Freedom (OEF), common hazards included direct combat exposure, exposure to dead bodies, smoke exposures from oil well and trash fires, extreme hot and cold weather, petroleum products and fumes, depleted uranium, pesticides and endemic infectious diseases. Additionally, the preparations for war, including training in chemical warfare, immunization against certain biological warfare agents, and use of the nerve agent protection pill, pyridostigmine bromide were also hazards (Murphy, 1999).

In response to the hazards of pre and peri-deployment exposures, the Department of Defense established a robust program to screen and track deployment-related physical and psychiatric illnesses (Hoge, Auchterlonie, & Milliken, 2006; Mazzuchi, Trump,

Riddle, Hyams, & Balough, 2002). The screening process is required for all military members returning from deployment and occurs at least twice for all returning service members. The first screening, the Post-Deployment Health Assessment (PDHA) occurs immediately upon return from deployment. A nearly identical assessment, the Post-Deployment Health Reassessment (PDHRA) is administered between 90-180 days later (Milliken, Auchterlonie, & Hoge, 2007). Additional screening may occur at the discretion of medical providers or military members' commanders (Ozanian, Middleton, Myatt et al., 2008).

While a significant amount of resources have been dedicated to identifying post-deployment health and mental health issues, the efficacy of the instruments used to accomplish this identification, has not been established (Gates, 2009; Ozanian, 2010). The PDHA and PDHRA were developed and rapidly deployed in response to a Congressional mandate. The measures were developed by consensus in professional working groups (Ozanian, 2010). Because of the timeline set forth by Congress, no scaling or testing of these measurements was conducted prior to or since the implementation of this screening battery (Ozanian, 2010). Therefore the reliability and validity of the screening assessments used by the Department of Defense (DoD) to identify at risk military members following a deployment has not been established. It is not known if the Post-Deployment Health Assessment (PDHA) and Post-Deployment Health Reassessment (PDHRA) are effective tools for identifying at-risk military members following a deployment.

A number of factors may prevent the identification of post-deployment health issues. These will be discussed in detail later in this study. The vulnerability of military members after a deployment and the large investment of health care resources for post-deployment needs make the effective leveraging of these resources vital. This study will assess usefulness and psycho-metric properties of the Post-Deployment Health Reassessment (PDHRA) for identifying post-deployment depression and PTSD.

I.2. Definitions

Post-traumatic Stress Disorder (PTSD)

For the purposes of this study, the term post-traumatic stress disorder (PTSD) will include both PTSD and acute stress disorder. These diagnosis share symptom criteria and are distinguished only by the duration of the condition (American Psychiatric Association, 2000).

Figure 1. Diagnostic Criteria for Post-Traumatic Stress Disorder

> A. The person has been exposed to a traumatic event in which both of the following have been present:
> (1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others (2) the person's response involved intense fear, helplessness, or horror. Note: In children, this may be expressed instead by disorganized or agitated behavior.
> B. The traumatic event is persistently re-experienced in one (or more) of the following ways:
> (1) recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. Note: In young children, repetitive play may occur in which themes or aspects of the trauma are expressed.
> (2) recurrent distressing dreams of the event. Note: In children, there may be frightening dreams without recognizable content.
> (3) acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when

intoxicated). Note: In young children, trauma-specific reenactment may occur.
(4) intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
(5) physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:
(1) efforts to avoid thoughts, feelings, or conversations associated with the trauma
(2) efforts to avoid activities, places, or people that arouse recollections of the trauma
(3) inability to recall an important aspect of the trauma
(4) markedly diminished interest or participation in significant activities
(5) feeling of detachment or estrangement from others
(6) restricted range of affect (e.g., unable to have loving feelings)
(7) sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span)
D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:
(1) difficulty falling or staying asleep
(2) irritability or outbursts of anger
(3) difficulty concentrating
(4) hyper-vigilance
(5) exaggerated startle response
E. Duration of the disturbance (symptoms in Criteria B, C, and D) is more than one month.
F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning (American Psychiatric Association, 2000, pp 424-429).

Figure 2. Diagnostic Criteria for Acute Stress Disorder

A. The person has been exposed to a traumatic event in which both of the following were present:
(1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others
(2) the person's response involved intense fear, helplessness, or horror. Note: In children, this may be expressed instead by disorganized or agitated behavior.
B. Either while experiencing or after experiencing the distressing event, the individual has three (or more) of the following dissociative symptoms:

(1) a subjective sense of numbing, detachment, or absence of emotional responsiveness
(2) a reduction in awareness of his or her surroundings (e.g., “being in a daze”)
(3) de-realization
(4) depersonalization
(5) dissociative amnesia (i.e., inability to recall an important aspect of the trauma)
C. The traumatic event is persistently re-experienced in at least one of the following ways: recurrent images, thoughts, dreams, illusions, flashback episodes, or a sense of reliving the experience; or distress on exposure to reminders of the traumatic event.
D. Marked avoidance of stimuli that arouse recollections of the trauma (e.g., thoughts, feelings,
conversations, activities, places, people).
E. Marked symptoms of anxiety or increased arousal (e.g., difficulty sleeping, irritability, poor
concentration, hyper-vigilance, exaggerated startle response, motor restlessness).
F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning or in:; the individual's ability to pursue some necessary task, such as obtaining necessary assistance or mobilizing personal resources by telling family members about the traumatic experience.
E. The disturbance lasts for a minimum of 2 days and a maximum of 4 weeks and occurs within 4 weeks of the traumatic event.
F. The disturbance is not due to the direct physiological effects substance (e.g., a drug of abuse, a
medication) or a general medical condition, is not better accounted for by Brief Psychotic Disorder, and is not merely an exacerbation of a preexisting Axis I or Axis II disorder (American Psychiatric Association, 2000, pp 429-432).

Diagnostic Depression

For the purpose of this paper the term diagnostic depression or depression diagnosis will include the four uni-polar depressive disorders: Major Depressive Episode, Major Depressive Disorder, Dysthymic Disorder and Depressive Disorder Not Otherwise Specified. There is significant overlap and co-morbidity among these disorders (Rhebergen et al., 2009). These disorders have unique diagnostic criterion, but share

important similarities. The differences tend to be associated with duration and severity. Similarities include sleep disturbance, diminished interest and depressed mood (American Psychiatric Association, 2000).

Figure 3. Diagnostic Criteria for Major Depressive Episode

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure. Note: Do not include symptoms that are clearly due to a general medical condition, or mood-incongruent delusions or hallucinations.
1) depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful). Note: In children and adolescents, can be irritable mood.
2) markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others)
3) significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. Note: In children, consider failure to make expected weight gains.
4) insomnia or hypersomnia nearly every day
5) psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)
6) fatigue or loss of energy nearly every day
7) feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)
8) diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)
9) recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide
B) The symptoms do not meet criteria for a Mixed Episode
C) The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
D) The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism)

E) The symptoms are not better accounted for by Bereavement, i.e., after the loss of a loved one, the symptoms persist for longer than 2 months or are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation. (American Psychiatric Association, 2000, pp 320-327)

Figure 4. Diagnostic Criteria for Major Depressive Disorder

A. A minimum of five symptoms from the following list have been present during the same 2-week period and represent a change from previous functioning. One of the symptoms must be #1 or #2, as listed below:
1) Depressed mood most of the day, nearly every day, as indicated either by subjective report (e.g. feels sad or empty) or observation made by others (e.g. appears tearful)
2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day, as indicated either by subjective account or observation made by others. Do not include symptoms that are clearly due to general medical condition or mood-incongruent delusions or hallucinations
3) Significant weight loss when not dieting or weight gain (e.g. a change of more than 5% of body weight in a month) or decrease or increase in appetite nearly every day
4) Insomnia or hypersomnia nearly every day
5) Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)
6) Fatigue or loss of energy nearly every day
7) Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)
8) Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)
9) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or specific plan for committing suicide
B. The symptoms do not meet the criteria for a mixed episode
C. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning
D. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism)

E. The symptoms are not better accounted for by bereavement, i.e., after the loss of a loved one, the symptoms persist for longer than 2 months or are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation (American Psychiatric Association, 2000, pp 339-345).

Figure 5. Diagnostic Criteria for Dysthymic Disorder

A. Depressed mood for most of the day, for more days than not, as indicated either by subjective account or observation by others, for at least 2 years. Note: In children and adolescents, mood can be irritable and duration must be at least 1 year.
B. Presence, while depressed, of two (or more) of the following:
(1) poor appetite or overeating
(2) Insomnia or Hypersomnia
(3) low energy or fatigue
(4) low self-esteem
(5) poor concentration or difficulty making decisions
(6) feelings of hopelessness
C. During the 2-year period (1 year for children or adolescents) of the disturbance, the person has never been without the symptoms in Criteria A and B for more than 2 months at a time.
D. No Major Depressive Episode has been present during the first 2 years of the disturbance (1 year for children and adolescents); i.e., the disturbance is not better accounted for by chronic Major Depressive Disorder, or Major Depressive Disorder, In Partial Remission.
Note: There may have been a previous Major Depressive Episode provided there was a full remission (no significant signs or symptoms for 2 months) before development of the Dysthymic Disorder. In addition, after the initial 2 years (1 year in children or adolescents) of Dysthymic Disorder, there may be superimposed episodes of Major Depressive Disorder, in which case both diagnoses may be given when the criteria are met for a Major Depressive Episode.
E. There has never been a Manic Episode, a Mixed Episode, or a Hypomanic Episode, and criteria have never been met for Cyclothymic Disorder.
F. The disturbance does not occur exclusively during the course of a chronic Psychotic Disorder, such as Schizophrenia or Delusional Disorder.
G. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).

H. The symptoms cause clinically significant distress or impairment in social,
occupational or other important areas of functioning (American Psychiatric Association, 2000, pp 345-349).

Figure 6. Diagnostic Criteria for Depressive Disorder not Otherwise Specified

The Depressive Disorder Not Otherwise Specified category includes disorders with depressive features that do not meet the criteria for Major Depressive Disorder, Dysthymic Disorder, Adjustment Disorder with Depressed Mood or Adjustment Disorder with Mixed Anxiety and Depressed Mood. Sometimes depressive symptoms can present as part of an Anxiety Disorder Not Otherwise Specified. Examples of Depressive Disorder Not Otherwise Specified include:

1. Premenstrual dysphoric disorder: in menstrual cycles during the past year, symptoms (e.g., markedly depressed mood, marked anxiety, marked affective labiality, decreased interest in activities) regularly occurred during the last week of the luteal phase (and remitted within a few days of menses). These symptoms must be severe enough to markedly interfere with work, school or usual activities and be entirely absent for at least 1 week post-menses.
2. Minor depressive disorder: episodes of at least 2 weeks of depressive symptoms, but with fewer than five items required for Major Depressive disorder.
3. Recurrent brief depressive disorder: depressive episodes lasting from 2 days up to 2 weeks, recurring at least once a month for 12 months (not associated with the menstrual cycle).
4. Post-psychotic depressive disorder of Schizophrenia: a Major Depressive Episode that occurs during the residual phase of Schizophrenia.
5. A Major Depressive Episode superimposed on Delusional Disorder, Psychotic Disorder Not Otherwise Specified or the active phase of Schizophrenia.
6. Situations in which the clinician has concluded that a depressive disorder is present, but is unable to determine whether it is primary, due to a general medical condition or substance induced (American Psychiatric Association, 2000, pp 349-350).

Military Member

Although the term “military member” may seem unambiguous, there is significant heterogeneity among military members. There are several important laws and codes that define this group. According to Title 10 of the U.S. Code (2007), the term military member includes uniformed personnel from the department of the Army, the Navy and the Air Force, the Coast Guard, the National Aeronautics and Space Administration and the Public Health Service under the term “armed forces” or “uniformed services.” (*U.S. Code: Title 10- Armed Forces* 2007).

Broadly the military is divided into two populations: commissioned officers and enlisted personnel. A commissioned officer is an officer in any of the Military Services in the Department of Defense whose authority comes from a commission signed by Presidential authority (Chu, 2006). A commission may be resigned at the officer’s discretion unless the officer has entered in to a service contract for additional pay or benefits. The officer corps is the primary provider of management and leadership within the military (Jordan, Taylor, Mazarr et al., 1999).

Enlisted personnel are employed under a service contract that obliges the member to serve for a given period. Enlisted military members provide specific technical expertise and serve as the labor force of the military (Jordan et al., 1999). While standards vary there are higher educational requirements for officers than for enlisted personnel. Both officers and enlisted personnel agree to an unconditional liability waiver as a condition of service, which means that they can be ordered to serve in life threatening situations (*U.S. Code: Title 10- Armed Forces* 2007). For this paper the term military members will include both enlisted and commissioned individuals.

Military members are separated in to different branches of service. Each branch of the military has a unique role that creates specific stressors on its members. The Army provides ground forces and close air support forces that conduct prompt, sustained combat and stability and reconstruction operations (Harvey & Schoomaker, 2005). Engagement in ground combat and protracted stability operations exposes soldiers to long deployments characterized by frequent exposure to combat. The demands of service in the Army may create significant stress on family dynamics and mental health status (Renshaw et al., 2009).

Similarly, the Marine Corps serves as the nation's force-in-readiness with a historical emphasis on littoral operations. They are expected to deal with a situation at any intensity across the entire spectrum of conflict, typically as first responders (Krulak, 1997). This focus of operations results in significant levels of direct conflict.

Meanwhile, the role of the Navy focuses on the projection of power from naval platforms as a deterrent to hostile forces anywhere on the globe. The Navy also emphasizes the ability to prevail at sea (Winter, 2008); however in the present conflict environment the Naval mission does not expose sailors to significant levels of direct combat. Similarly, the Air Force's mission is to provide full spectrum dominance in air, space and cyberspace (Moseley, 2005). Few Airmen have a direct role in ground combat operations. Additionally, Air Force deployments are typically half as long as deployments in other branches.

Each branch of the military consists of active duty and reserve components (Jordan et al., 1999). The Army and Air Force also have National Guard components.

Active duty military members work full time in their military role. The active duty members constitute the largest part of the military (Lacquement, 2003). Reservists do not work full time in the military, but drill monthly to maintain military skills. Reservists can be called to active duty by the President under his Title 10 authority (*U.S. Code: Title 10- Armed Forces* 2007).

National Guard members have a similar service schedule to reservists. National Guard members serve under the authority of the Governor of their state. National Guard units can be federalized in the case of a national security emergency. In this event, authority over Guard members shifts to the President (Jordan et al., 1999; *U.S. Code: Title 10- Armed Forces* 2007).

While the mission and service requirements vary widely between branches and among service components within each branch, the Department of Defense (DoD) is a joint entity. Each branch of the military interacts with and supports the others (Buchanan, Davis, & Wight, 2009). Members of each branch and intra-branch component may experience repeated traumatic exposure and lengthy deployments away from family and social support. The sample for this paper was drawn only from Air Force members from the active, guard and reserve components.

Pay Grade

Pay grades are used by the uniformed services of the United States to determine wages and benefits based on the corresponding military rank of a member of the services. While different titles or ranks may be used among the seven uniformed services, pay grades are uniform and equivalent between the services and can be used to determine

seniority among a group of members from different services. They are also essential when determining a member's entitlements such as basic pay and allowances (Bicksler et al., 2004; *U.S. Code: Title 10- Armed Forces* 2007). Pay grades are divided into three groups: Enlisted (E), Warrant Officer (W), and Officer (O). Enlisted pay grades range from E-1 to E-9; Warrant Officer pay grades range from W-1 to W-5; and Officer pay grades range from O-1 to O-10. Not all of the uniformed services use all of the grades; for example, the Air Force does not use the grade W (Bicksler et al., 2004; *U.S. Code: Title 10- Armed Forces* 2007). Pay grade is a reflection of an individual's education and length of time in service. Pay grade is an imperfect proxy for socio-economic status in this study because members of different career fields receive often substantial retention bonuses and specialty pays. Thus, the net pay of a E-1 in one career field may be different that the net pay of another E-1 in a different career field.

I.3. Study Purpose

The goal of this study is to understand the extent to which United States Air Force personnel who have been deployed in support of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) have been affected by that experience. Further, this study seeks to evaluate the psychometric properties and clinical utility of the Post-Deployment Health Reassessment (PDHRA) for accurately identifying trauma and depression among Airmen following a deployment. Using Structural Equation Modeling, this study aims to identify clinically relevant information that is not captured in the present PDHRA traige process. The study seeks to show whether improving the clinical utility of the PDHRA could improve the traige of, and service delevery to, vulnerable

service members who have recently returned from deployment. Four specific aims guide this study.

Specific Aim 1: Describe the sample

Three research questions will be used to achieve this aim:

Research Question 1.1. What are the characteristics of the study sample, regarding demographics and frequency of deployments and deployment experiences?

Frequencies and descriptive statistics will be used to describe sample demographics, the frequency of deployments and types of deployment experiences that were encountered by study participants.

Research Question 1.2. What are the rates of diagnostic PTSD, diagnostic depression and co-morbid PTSD and depression within the sample?

Frequencies and descriptive statistics will be used to describe the prevalence of trauma and depressive disorders among participant Airmen.

Research Question 1.3. Are there gender differences in pay grade, rate of deployment, alcohol use and rate of diagnostic depression and PTSD?

Independent samples t-tests will be used to compare genders across pay grades, deployment rate and mental health diagnoses.

Specific Aim 2: Examine the Internal Consistency of the Post-Deployment Health Reassessment (PDHRA) subscales for depression, alcohol use, and trauma. Describe the means, standard deviations and Cronbach's Alphas of the supplemental Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version

(PCL-M) and the Patient Health Questionnaire (PHQ-9). Describe how these measures contribute to the factor structure of the Post-Deployment Health Reassessment (PDHRA).

Four research questions will be used to achieve this aim.

<u>Research Question 2.1.</u> *What is the Cronbach's Alpha for PDHRA question sets used to identify subjects who will be offered the AUDIT, PCL-M and PHQ-9?*

<u>Research Question 2.2</u> *What are the means, standard deviations and Cronbach's α for the AUDIT, PCL-M and PHQ-9 for this sample?*

The PDHRA is a multi-dimensional scale. As no analysis of the reliability or validity of the PDHRA has been conducted (Ozanian, 2010), the Cronbach's α will be computed for each scale used in this study.

<u>Research Question 2.3.</u> *Do PDHRA questions intended to measure depression, trauma, alcohol concerns, level of alcohol use, support network conflict and traumatic exposure related symptoms load on to unique factors? What is the model fit (X^2, CFL, TLI, RMSEA) of the confirmatory factor analysis model?*

A confirmatory factor analysis will be conducted to determine the structural validity of six latent factors within the Post-Deployment Health Reassessment (PDHRA). These factors are exposure symptoms, support network conflict, alcohol concerns, level of alcohol use, trauma and depression. This confirmatory factor analysis will not include the supplemental assessment measures, the AUDIT, PCL-M and PHQ-9.

<u>Research Question 2.4.</u> *Do PDHRA items intended to measure level of alcohol use load on to a unique factor with the AUDIT? Do PDHRA questions intended*

to measure trauma load on to a unique factor with the PCL-M? Do PDHRA items intended to measure depression load on to a unique factor with the PHQ-9? What is the model fit (X^2, CFI, TLI and RMSEA) of the confirmatory factor analysis when the AUDIT, PCL-M and PHQ-9 variables are added?

The confirmatory factor analysis described in RQ 2.3. will be augmented with the Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version (PCL-M) and the Patient Health Questionnaire (PHQ-9). The AUDIT will be added to the level of alcohol use factor, the PCL-M will be added to the trauma factor and the PHQ-9 will be added to the depression factor.

Specific Aim 3: How do PDHRA items designed to identify depression and trauma and items hypothesized to impact these conditions contribute to the overall identification of depression and trauma in this sample?

Two research questions will be used to achieve this aim:

<u>Research Question 3.1.</u> *To what extent do the PDHRA questions that measure exposure symptoms, alcohol concerns, level of alcohol use, support network conflict, injury type (gunshot above the shoulders, vehicle crash, explosion/blast), total deployments, pay grade and gender effect the depression and trauma factors? What is the model fit, X^2, CFI, TLI and RMSEA, of the measurement model?*

A structural measurement model will be developed to examine how PDHRA items hypothesized to impact depression and trauma interact.

Research Question 3.2. To what extent do the PDHRA questions that measure exposure symptoms, alcohol concerns, level of alcohol use, support network conflict, injury type (gunshot above the shoulders, vehicle crash, explosion/blast), total deployments, pay grade and gender effect the depression and trauma factors when the AUDIT, PCL-M and PHQ-9 variables are added? What is the model fit, X^2, CFI, TLI and RMSEA, of the measurement model?

In the structural measurement model described in RQ 3.1., the Alcohol Use Disorders Identification Test (AUDIT) will be added to the level of alcohol use factor, the PTSD Checklist-Military Version (PCL-M) will be added to the trauma factor and the Patient Health Questionnaire (PHQ-9) will be added to the depression factor.

Specific Aim 4: Describe the psychometric properties and clinical value of the PDHRA for identifying individuals with a depressive or trauma-related diagnosis.

Five research questions will be used to achieve this aim:

Research Question 4.1. Are depression diagnoses or PTSD diagnosis more common among individuals with a PDHRA that is positive for behavioral health concerns than among individuals with a PDHRA that is negative for behavioral health concerns?

Research Question 4.2. What are the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the PDHRA for a depressive diagnosis?

<u>Research Question 4.3.</u> What are the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the PDHRA for post-traumatic stress disorder?

The following formulas will be utilized for these research questions:

$$\text{sensitivity} = \frac{\text{correct positives}}{\text{correct positives+false negatives}}$$

$$\text{specificity} = \frac{\text{correct negatives}}{\text{correct negatives+false positives}}$$

$$\text{positive predictive value} = \frac{\text{correct positives}}{\text{correct positives+false positives}}$$

$$\text{negative predictive value} = \frac{\text{correct negatives}}{\text{correct negatives+false negatives}}$$

<u>Research Question 4.4.</u> What is model fit and variance explained for endogenous variables when adding paths to clinical diagnoses of PTSD and depression to the Post-Deployment Health Reassessment (PDHRA) Measurement Model 1? What is the model fit, X^2, CFI, TLI and RMSEA of the PDHRA Path Model 1?

Two paths will be added to the PDHRA measurement model 1. These paths will be from the latent variable trauma to the variable of PTSD diagnosis; also, from the latent variable depression to the variable measuring depression diagnosis.

<u>Research Question 4.5.</u> What is model fit and variance explained for endogenous variables when adding paths to clinical diagnosis of PTSD and depression to the PDHRA Measurement Model 2? What is the model fit, X^2, CFI, TLI and RMSEA, of PDHRA Path Model 2?

Two paths will be added to PDHRA measurement model 2. These paths will be from the latent variable trauma to a diagnosis of PTSD and from the latent variable depression to a diagnostic depression variable.

II. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

II.1. Risk and Protective Factors associated with the Development of PTSD

A plethora of variables have been identified that suggest an individual may be at risk for developing PTSD subsequent to a traumatic event. Conversely, many factors that enhance resilience following trauma are noted in the literature on trauma. Meichenbaum (1994) identified an individual's degree of avoidance, self-blame and lack of social support as the primary variables in the development of Post-Traumatic Stress Disorder. Empirical data has demonstrated that attitude toward emotional expression, self-esteem, spirituality, educational level and prior trauma all influence the probability that an individual will develop PTSD (Bradley, Schwartz, & Kaslow, 2005; Lowery & Stokes, 2005; Schumm, Briggs-Phillips, & Hobfoll, 2006). While many predictive factors have been identified, there is a dearth of literature exploring ways to utilize the observed preventative quality of these factors.

PTSD is the result of traumatic friction between the homeostatic cognitive structures of an individual and a dynamic environment (Biro, Novovi, & Gavrilov, 1997). Research has identified a litany of characteristics that decrease the potential that this friction will develop into psychological dysfunction. Research on trauma points toward integrating successful treatment interventions with strategies to enhance identified protective characteristics (Bisson et al., 2007).

II.1.1. Gender and PTSD

One of the most consistent findings in the development of PTSD is the higher risk of this disorder in women (Breslau, 2009; Tolin & Foa, 2006). In fact, a national

representative sample (N=5,877) using survey data indicated that rates of PTSD among women are twice as high as rates among males (Kessler et al., 1995). Researchers have attributed these differences to an array of variables. Women's higher PTSD risk has been attributed to the different type of traumas women experience compared to men, their younger age at the time of trauma exposure, their stronger perceptions of threat and loss of control, higher levels of peri-traumatic dissociation, insufficient social support resources, and greater use of alcohol to manage trauma-related symptoms such as intrusive memories and dissociation, as well as gender-specific acute psychobiological reactions to trauma (Baron, 2004; Breslau & Anthony, 2007; Johnson, Rew, & Kouzekanani, 2006; Lilly, Pole, Best, Metzler, & Marmar, 2009; Miranda, Draijer, Langeland, & Gersons, 2007). However, in a meta-analysis of 290 articles, when researchers controlled for other theoretically relevant factors, findings indicated that gender has an independent effect on the epidemiology of PTSD (Tolin & Foa, 2006). In another meta-analysis of 77 articles which compared military samples to civilian samples, the effect of gender, while still significant in the military sample seemed to be less important than was found in studies with civilians (Brewin et al., 2000).

The role of gender is particularly conspicuous within the military culture. Some critics of military culture have characterized it as patriarchal and inadequately sensitive to gender issues (Harrison, 2006). An indisputable reality is that women are significantly under-represented in the military. The status of women as a significant minority within the military may further exacerbate their vulnerability (Feske, 2008; Ullman & Filipas, 2001).

II.1.2. Socio-Economic Status and PTSD

Several researchers have posited that socio-economic status impacts an individual's level of resilience following a traumatic event. Research of pre-trauma socio-economic status in relation to trauma outcomes, however, remains inconclusive (Witvliet, Phipps, Feldman, & Beckham, 2004). However, there is some evidence that socioeconomic status is predictive of PTSD. Among subjects exposed to chronic political violence, Hobfoll and colleagues (2009) found that PTSD prevalence increased as socioeconomic status decreased. Similar findings have been produced with samples exposed to the terrorist attacks in lower Manhattan (DiGrande et al., 2008). However, other studies with adult survivors of a natural disaster and adolescent accident survivors have found that while post-trauma financial loss contributed significantly to the explanation of the variance of PTSD in a traumatized population, pre-trauma socioeconomic status did not (Frankenberg et al., 2008; Olofsson, Bunketorp, & Andersson, 2009). Further complicating the understanding of the relationship between socioeconomic status and PTSD is the finding that among adolescent survivors of a natural disaster (N=447) being in a middle economic strata was more predictive of having PTSD than among those in upper or lower socioeconomic status (Kar et al., 2007).

Some of the variability of findings among these studies may have been caused by the variety of operational definitions of socioeconomic status. For instance, in one study subjects living in a combat zone who experienced food shortages were considered to belong to a lower socioeconomic stratum (Seino, Takano, Mashal, Hemat, & Nakamura, 2008). It seems feasible that individuals from all pre-trauma socioeconomic groups could

be exposed to food shortages within a combat zone. The relationship between socioeconomic status and PTSD has theoretical support, but requires further inquiry to clarify relationships (Herman, 1992).

The data that was gathered for this study did not include a direct measure of socio-economic status. The hypothesized relationship between socio-economic status and PTSD provides theoretical was used to support the inclusion of the variable pay grade. Pay grade may be an adequate proxy for income level and educational level in a military sample (Jordan, Taylor, & Mazarr, 1999).

II.1.3. Level of Education and PTSD

Educational level has been studied extensively as a predictor of PTSD; however, the body of literature produced by this inquiry is inconclusive. In a study of displaced Bosnian women (N=55), level of education was the strongest predictor of PTSD compared to other validated predictors like self-esteem and locus of control (Schmidt, Kravic, & Ehlert, 2008). Other studies have produced statistically significant relationships between PTSD and education level with smaller effect sizes than the study described above. Research has linked education level to PTSD caused by man-made and natural disasters. Among survivors of the 2001 attacks in lower-Manhattan (N=11,037), lower levels of education were predictive of PTSD (DiGrande et al., 2008). A study conducted in India with adolescent survivors of a super-cyclone (N=447) also found a relationship between lower education levels and higher rates of PTSD (Kar et al., 2007). Similarly, lower educational level was predictive of PTSD in a large (N=1680)

representative sample of individuals who experienced the 2002 earthquake in rural Italy (Priebe et al., 2009).

While the majority of studies have found a relationship between education level and PTSD, this relationship has not been consistently replicated. Among adults admitted to a medical trauma center (N=355) which measured PTSD using the Civilian PTSD checklist, no correlation was observed between education level and PTSD (Harris, Young, Rae, Jalaludin, & Solomon, 2008). A study with a sample of Indian-American veterans (N=362), which also used the PTSD checklist, found no difference in PTSD rates due to education level (Westermeyer et al., 2009). Another study (N=135) examined the severity of PTSD symptoms among heart attack survivors and found no relationship between symptom severity and education level (Whitehead, Perkins-Porras, Strike, & Steptoe, 2006). Perhaps a closer examination of the indirect relationships between education level and PTSD would result in a clearer understanding of the relationship between PTSD and education level.

The data gathered for this current study did not include a direct measure of education. The body of literature that suggests a possible relationship between education level and PTSD provides further theoretical justification for the inclusion of the variable pay grade as this measure may act as a proxy for educational level.

II.1.4. Age and PTSD

Some research suggests that younger age may be associated with an increased potential for developing PTSD. A meta-analysis of 77 articles concluded that younger age is a risk factor of developing PTSD (Brewin et al., 2000). More specifically, a study

of Vietnam War veterans (N=260) explored factors that were related to chronic PTSD. This study found a weak relationship between younger age and PTSD (Dohrenwend, Turner, Turse, Lewis-Fernandez, & Yager, 2008). Another study of accident survivors (N=355) found that younger age was significantly associated with PTSD (Harris et al., 2008). A large study (N=20,500) conducted after the 2001 South-east Asian tsunami replicated these findings, suggesting that being younger when exposed to trauma is a significant risk for developing PTSD (Frankenberg et al., 2008).

The data gathered for this current study did not include a direct measure age. Previous research that suggests a relationship between age and PTSD provides additional theoretical support for the inclusion of the variable pay grade. Military members of lower pay grade should typically be younger, because advancement in pay grade is accomplished largely as a result of time in the military. Thus lower pay grade may serve as a proxy for younger age, while higher pay grade may indicate older age.

II.1.5. Prior Trauma and PTSD

As the number of traumatic events an individual experiences increases, so too does the potential for that individual to develop PTSD if they are traumatized again (Lowery & Stokes, 2005; Renshaw et al., 2009). Many researchers have hypothesized about the ways prior trauma reduces post-trauma resiliency. Research suggests that a history of trauma results in neurobiological change that increases subsequent potential to develop PTSD (Pervanidou, 2008). In meta-analysis of studies focusing on the impact of prior trauma, particularly childhood trauma, findings suggested that previous experiences of trauma produced larger effect sizes than other factors. In a large study (N=777) of

inner-city women who were survivors of adult rape or child abuse, those with cumulative traumas scored higher on the PTSD Symptom Scale–Self-Report measure of trauma related symptoms (Schumm et al., 2006).

Much of the research on prior trauma has focused on childhood trauma. However, studies that have focused on the impact of later-life traumas have produced similar effect sizes to studies focused on the effect of prior childhood trauma (Brewin et al., 2000). The idea that previous trauma results in permanent neuro-biological changes is bolstered by the finding that the relationship between prior trauma and PTSD persists even in individuals who successfully completed mental health treatment and experience symptom resolution (Ozer, Best, Lipsey, & Weiss, 2003; Schumm et al., 2006). Similarly, the type of trauma experienced by an individual does not seem to mediate the impact on PTSD (Schumm et al., 2006). While repeated deployments are an exacerbating factor, simply being informed of an upcoming deployment does not increase the risk of developing PTSD. A recent study found that symptoms of PTSD, alcohol misuse and depression remained constant or decreased in soldiers who had been informed that they were going to be deployed (Duma, Reger, Canning, McNeil, & Gahm, 2010).

The measures used to collect data for this study did not include a standardized measure of previous trauma. However, the importance of previous traumas to the development of PTSD provides a theoretical rationale for the inclusion of the number of previous deployments. Exposure to combat and the separation from family and support networks can be a traumatic experience (Cabrera, Hoge, Bliese, Castro, & Messer, 2007;

Hoge et al., 2008). As the number of deployments a military member is sent on increases the potential for a traumatic experience may increase.

II.1.6. Perceived Threat to Self and PTSD

The first criterion for a diagnosis of PTSD is the perceived threat of death or significant injury to self or others (American Psychiatric Association, 2000). Not surprisingly the more completely this criterion is satisfied the more likely PTSD will develop. Perceiving a threat to ones' life during a traumatic event has been consistently predictive of PTSD in prior research (Ozer et al., 2003). The subjective experience of a trauma victim is often one of the strongest predictors of an adverse reaction to the trauma. Individuals who believe that they were exposed to a significant risk of death are at elevated risk to develop PTSD regardless of pre or post trauma factors (Jeavons, Greenwood, & de L. Horne, 2000). This phenomenon persists in cases of individual trauma or mass casualty events (Ullman & Filipas, 2001; Zara-Page, Kaplan, Erdogan, & Guler, 2009). Interestingly, experiencing life threatening is not predictive of PTSD if the individual does not perceive the threat as life threatening. Individuals who perceive a significant life threat even when one does not exist appear to be at elevated risk of developing PTSD, while an individual who experiences few or no alarming cognitions during a life threatening event is not (Aisenberg, Ayan, & Orozco-Figueroa, 2008; Laubmeier & Zakowski, 2004).

II.1.7. Trauma Severity and PTSD

It seems intuitive that severity of exposure to traumatic events would increase the risk of developing PTSD regardless of the type of event. There is research to support this

supposition, but this finding has not been consistently replicated. Studies following a series of natural disasters found that severity of exposure to traumatic events was predictive of PTSD. For example, in the wake of the 2004 tsunami in Southeast Asia the severity of exposure to the tsunami was predictive of PTSD in a sample of children (Vijayakumar, Kannan, & Daniel, 2006). Similar findings were produced by research in the aftermath of Hurricane Katrina, as the severity of traumatic exposure was predictive of PTSD (Norris, VanLandingham, & Lung, 2009). A sample of earthquake victims also demonstrated a relationship between the level of traumatic exposure and PTSD (Bal, 2008).

Other studies have failed to replicate the relationship between the severity of exposure to trauma and PTSD (Gabriel et al., 2007). In one study, level of combat exposure was not predictive of PTSD (Kulenovic et al., 2009). Several studies have found that level of exposure to combat in a war zone was a factor that increases the rate PTSD in the civilian population. However, the authors operationalized the level of exposure in a way that did not differentiate it from the 'number of prior traumas' variable discussed above (Roberts, Damundu, Lomoro, & Sondorp, 2009; Roberts, Ocaka, Browne, Oyok, & Sondorp, 2008). Results with military samples have also resulted in inconsistent findings. Other research has found that the level of exposure to grotesque injuries was predictive of PTSD (Epstein, Fullerton, & Ursano, 1998). The preponderance of the research on the level of traumatic exposure suggests that the severity of the traumatizing event seems to be a significant predictor of trauma related disorders regardless of the type

of traumatic event. However, more inquiry is needed to explain a number of contradictory findings.

The data used in this study did not include a direct measure of trauma severity. However, several variables which describe traumatic, combat-related experiences are included on the PDHRA. PDHRA question 9a1 asks respondents if they were exposed to a blast or explosion during their deployment. PDHRA question 9a2 asks respondents if they were involved in a vehicle or aircraft crash or accident. PDHRA question 9a3 asks respondents if they were wounded above the shoulders by a bullet or explosive fragment. Each of the experiences described in PDHRA questions 9a1, 9a2 and 9a3 could have endangered the lives of PDHRA respondents. Therefore, these questions will be included in the analysis of the current study to approximate trauma severity.

II.1.8. Peri-Traumatic Emotions and PTSD

The emotional response during a traumatic event is an area that has been understudied. This may be due to the difficulty involved in accurately recalling peri-traumatic emotions retrospectively (McKinnon, Nixon, & Brewer, 2008). While little research has focused on this area, peri-traumatic emotional content, particularly intense fear has been a harbinger of PTSD (Ozer et al., 2003; Tucker & Pfefferbaum, 2000). In addition to fear, experiencing anxiety, helplessness or shame during a traumatic event is associated with the development of PTSD (Bernat, Ronfeldt, Calhoun, & Arias, 1998; Brewin et al., 2000). For example, in a study comparing female law enforcement officers to a female civilian sample (N=283), lower PTSD rates among the law enforcement cohort were attributed to lower peri-traumatic emotional intensity (Lilly et al., 2009). A

significant limitation of the study of peri-traumatic emotional response is determining the point at which the peri-traumatic period becomes the post-traumatic period. Epstein and colleagues (1998) identified a relationship between emotional numbness after a traumatic event and developing PTSD. In their (2003) meta-analysis, Ozer and colleagues classified Epstein et al.'s (1998) numbing as a peri-traumatic emotional response. This variable could easily be considered a post-traumatic factor instead.

The PDHRA does not include a direct measure of peri-traumatic emotions. However, PDHRA questions 12a, 12b, 12c and 12d ask respondents if they have "had an experience that was so frightening, horrible or upsetting" that it caused nightmares, avoidance, hyper-vigilance or detachment or numbness. The importance of peri-traumatic emotions provided the theoretical rationale for including these questions in the analysis of the current study. These questions may reflect the level of peri-traumatic distress PDHRA respondents experienced.

II.1.9. Social Support and PTSD

After a trauma, few external systems are as important as the social support structure of the traumatized individual. Inadequate social support has been identified as a primary precipitant of Post-Traumatic Stress Disorder in prior research (Aflakseir & Coleman, 2009; Galea et al., 2008). The frequency of social contact, number of individuals within the social network, and subjective perception of the quantity and quality of social interactions have all been used to operationalize the concept of social support (Ullman, Townsend, Filipas, & Starzynski, 2007b). Negative dynamics such as being disbelieved or treated differently within the social support network following a

traumatic event diminish resilience and enhance the potential for an individual to develop PTSD (Ullman, 1999). Such interactions may be stigmatizing to the traumatized individual and result in maladaptive coping or diminished self-image. As negative dynamics within the social support network increase, PTSD symptoms increase in frequency and severity (Campbell et al., 1999; Campbell, Wasco, Ahrens, Sefl, & Barnes, 2001). Beyond increased intensity, social stressors have also been associated with prolonging the duration of active symptomotology (Galea et al., 2008). Not surprisingly, a nurturing support network seems to enhance resilience and facilitate recovery from PTSD (Cieslak et al., 2009).

The importance of social support has been replicated within a military sample. Research has demonstrated that a nurturing social support network diminished the risk of PTSD among military veterans (Dikel, Engdahl, & Eberly, 2005). In the military parlance social support is synonymous with 'unit cohesion.' Unit cohesion includes social cohesion and task cohesion of a unit (Siebold, 2007). Social cohesion refers to the nature and quality of the emotional bonds of friendship, liking, caring, and closeness among group members. Task cohesion refers to the shared commitment among members to achieving a goal that requires the collective efforts of the group (Gully, Devine, & Whitney, 1995). Unit cohesion studies have found that unit cohesion is ameliorative of PTSD symptoms (Brailey, Vasterling, Proctor, Constans, & Friedman, 2007).

Traumatic events can tax a social network emotionally, physically and financially. The vulnerability and importance of social support in the wake of trauma suggests that effective screening tools for PTSD should include an effective measure of social support.

Identifying effective ways for helping professionals to intervene to strengthen these networks could enhance individual and community resilience following traumatic events.

In the current study, two items on the PDHRA ask about the presence of conflict within the family, social network or at work. These items will be used in the current study to assess the influence of social support.

II.1.10. Alcohol Abuse and PTSD

Misuse of alcohol subsequent to a traumatic event is a common and maladaptive response. Recent research has documented the complex interaction between PTSD and alcohol abuse (Milliken et al., 2007). Studies with civilian and military samples with PTSD have found that alcohol abuse is the most common co-occurring mental health disorder (Jacobsen, Southwick, & Kosten, 2001). A comprehensive literature review identified a number of important relationships between PTSD and alcohol abuse (Jacobsen, Southwick, & Kosten, 2001). For instance, there is a significant overlap of symptoms between PTSD and alcohol withdrawal. This may result in more acute symptomotology in individuals with PTSD and alcohol withdrawal compared to individuals with only one of these conditions (Jacobsen et al., 2001). In a study of female rape victims (N=2,313), researchers identified a causal relationship with PTSD leading to alcohol abuse. Other studies have illustrated the exacerbating effect alcohol abuse has on the symptoms of PTSD (Bremner, Southwick, Darnell, & Charney, 1996). Thus, PTSD may be predictive of alcohol abuse and alcohol abuse may exacerbate PTSD symptomotology (Jacobsen et al., 2001). While post-traumatic alcohol abuse is clearly related to the development of PTSD, there is some evidence that peri-traumatic alcohol

intoxication may be associated with a diminished risk of PTSD (Maes, Delmeire, Mylle, & Altamura, 2001). The relationship between PTSD and alcohol abuse provided the theoretical rationale for the inclusion of PDHRA questions related to alcohol use in the current study.

II.2. Risk and Protective Factors Associated with the Development of Depression

Depression is a common, and often overlooked, complication in the wake of trauma. (Bleich, Koslowsky, Dolev, & Lerer, 1997). Like PTSD, a number of variables have been identified that impact an individual's vulnerability to depression in the aftermath of a traumatic experience and place them at increased risk for developing a depressive disorder (Breslau et al., 2000; Conradi, de Jonge, & Ormel, 2008; Galea et al., 2002). Protective factors have also been identified that help prevent the development of depressive disorders and enhance resilience in response to trauma.

II.2.1. Gender and Depression

Research has consistently found significantly higher levels of depressive disorders among women than men. A nationally representative study (N=9,282) of adults found that female subjects were 1.5 times more likely to have a depressive disorder than their male counterparts (Kessler, Berglund, Demler, Jin, & Walters, 2005). A similar study with a slightly smaller sample (N=8,098) suggests that the likelihood of female subjects experiencing a depressive disorder during their lifetime is 1.7 times higher than males (Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993). A recent cross-sectional study with adolescent subjects replicated the correlation between female gender and higher

rates of depression (Kessler et al., 2005; Kessler et al., 1993; Schwinn, Schinke, & Trent, 2010). A comprehensive review of gender differences in depression examined if gender differences were due to research artifacts and concluded that gender differences in depression are genuine (Piccinelli & Wilkinson, 2000).

Research suggests that men and women experience depression related impairment differently and tend to adapt different coping strategies (Angst et al., 2002). Women are more likely to have somatic complaints associated with a depressive disorder than their male counterparts (Silverstein, 2002). These differences have been inadequately studied. Consequently, the cause of depression related to gender differences remains inadequately understood.

II.2.2. Socio-economic Status (SES) and Depression

In a large (N=11,909) longitudinal, population study researchers found that lower socioeconomic status was associated with an increased incidence of depressive disorders (Lorant et al., 2007). This finding was replicated in a large study (N=32,891) with a sample of elderly Japanese subjects (Murata, Kondo, Hirai, Ichida, & Ojima, 2008). Another large (6,715) longitudinal, cohort study confirmed the relationship between current lower SES and elevated depression. This study found that present financial hardship exacerbated the relationship between SES and depression (Butterworth, Rodgers, & Windsor, 2009). While the association between SES and depression is well established, the impact of lower SES is transitory. Past low SES status is not strongly associated with present depression (Stansfeld, Clark, Rodgers, Caldwell, & Power, 2008). A number of hypothesis have been put forth to explain the relationship between

socioeconomic status and depression. Diet and health status are often negatively impacted by lower SES and can contribute to depressive symptoms (Smith & Brunner, 1997).

The data that was gathered for this study did not include a direct measure of socio-economic status. The well established relationship between socio-economic status and depression provides theoretical support for the inclusion of the variable pay grade. Monetary reimbursement in the military is determined by a military members pay grade. Military members with lower pay grades have lower income levels, an important aspect of socioeconomic status.

II.2.3. Education Level and Depression

Education level is closely related to socio-economic status. In fact, many studies include education level as a measure of socio-economic status (Brown, 2000; Dohrenwend et al., 1992). Lower education levels are associated with the development of depression (Brown, 2000; Godin et al., 2009). In a population-based cohort study (N=2,200), lower education level was a risk factor for depressive symptoms (Smits et al., 2008). This finding was confirmed in a sample of chronic pain patients (N=254) (Averill, Novy, Nelson, & Berry, 1996) and a sample of cardiac patients with lower education levels (N=974) (Frasure-Smith et al., 2009). In addition to predicting depressive symptoms lower education level is also associated with increased severity of symptoms in depressed subjects (Conradi et al., 2008). Studies suggest that subjects with higher levels of education engage in healthy behaviors like exercise and medication compliance

more regularly that less educated peers (Bambauer et al., 2007; Chen et al.), which may help to explain the association between education level and depression.

While a significant body of research has found a correlation between lower education levels and depression, a number of studies have failed to replicate this finding. A recent study of entry level military members (N=1,184) did not find a statistically significant relationship between education level and depression (Warner et al., 2007). A large, longitudinal study (N=9,396) identified gender differences associated with the impact of educational level on depression. When researchers controlled for gender, education level was only predictive of depression in males (Godin et al., 2009).

The data that was gathered for this study did not include a direct measure of education. The fact that a large part of the body of literature regarding education level and depression suggests that a correlation exists between these two variables, provided the theoretical impetus for the inclusion of the variable pay grade. Military members in lower pay grades typically have lower education levels. Lower education levels in lower pay grades are a function of different educational requirements for officers and enlisted personnel. Officers are required to have a college degree, while enlisted service members are only required to have a high school diploma or equivalent.

II.2.4. Social Support and Depression

The impact of social support on depression has been consistently described in previous literature. High levels of social support are protective against depressive disorders and inadequate social support is a risk factor for depressive disorders. A study with a large sample of combat veterans (N=4,462) found that lower levels of social

support were associated with the development of depressive disorders (Boscarino, 1995). A recent study of returning Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) veterans (N=272) found that high levels of post-deployment social support were protective against depressive disorders (Pietrzak, Johnson, Goldstein, Malley, & Southwick, 2009). A large study conducted by the Veteran's Administration (N=8,547) found that inadequate social support increase the prevalence and severity of depressive symptoms among military veterans (Kilbourne, McCarthy, Post, Welsh, & Blow, 2007). Social support, as measured by unit cohesion, has been associated with diminished trauma related psychological dysfunction among military samples (Brailey et al., 2007). Another study with combat veterans (N=1,626) found that social support within the military unit and from social resources external to the military were important protective factors against depression (Gahm, Lucenko, Retzlaff, & Fukuda, 2007).

Social support my also enhance resilience by improving treatment responses among subjects who are depressed. In a 16-week randomized clinical trial (N=238) which examined treatment outcomes among clinically depressed subjects receiving outpatient, psychiatric care higher levels of social support were associated with better treatment outcomes (Sotsky et al., 2006). A four-year longitudinal study (N=80) examining the influence of social support on treatment found that social support improved treatment compliance, which improved outcomes (Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005). Not all research on the relationship between social support and the treatment of depression has found a significant correlation. A longitudinal study of chronically depressed subjects concluded that there was not an important relationship

between social support and clinical results (Paykel, Cooper, Ramana, & Hayhurst, 1996). While the relationship between social support and the incidence of depression is well established, the influence of social support on clinical treatment warrants further study. The relationship between social support and depression provide the theoretical basis for including Post-Deployment Health Reassessment questions that assess support network functioning in the analysis of the current study.

II.2.5. Alcohol Abuse and Depression

Alcohol misuse has been associated with higher levels of depression in previous research. The results of a large nationally representative study (N=42,862) found the co-morbidity of alcohol use disorders and depression is pervasive (Grant & Harford, 1995). Alcohol abuse is a harbinger of later depressive episodes (Marmorstein, Iacono, & Malone, 2010). This paradigm is aggravated by the consistent finding that depressive symptoms are also predictive of later alcohol misuse (Gamble et al., 2010; Schwinn et al., 2010; Trim, Schuckit, & Smith, 2010). In individuals with depression the presence of an alcohol use disorder may diminish the efficacy of treatment and prolong the duration of depressive symptoms (Davis et al., 2010). A recent longitudinal study (N=1055), which employed advanced statistical modeling techniques, found that alcohol dependence is more likely to proceed depressive disorders than vice versa (Fergusson, Boden, & Horwood, 2009). A recent comprehensive literature review concluded that depression and substance abuse are the two most significant contributing factors to suicidality (Galaif, Sussman, Newcomb, & Locke, 2007).

II.2.6. PTSD-Depression Co-morbidity

PTSD and depression are frequently co-occurring conditions. Recently researchers have developed evidence that suggests a shared cognitive vulnerability between PTSD and depression (Breslau, Davis, Peterson, & Schultz, 2000; Ellis, Nixon, & Williamson, 2009). This may be particularly true among combat veterans. Among Israeli war veterans with PTSD (N=60) the lifetime co-morbidity rate for PTSD and depression was a staggering 95% (Bleich et al., 1997). A randomized sample drawn from the American Veteran's Administration system (N=677) found that 36% of subjects with a depressive disorder screened positive for PTSD (Campbell et al., 2007). Subjects with co-morbid depression and PTSD had more severe psychiatric symptoms than subjects with only depression or PTSD (Campbell et al., 2007). A large retrospective study (N=1,007) found that young adults with PTSD were nearly twice as likely to suffer from depression as those without PTSD (Breslau et al., 2000). Similarly, a study of cancer patients (N=127) found that PTSD and depression were co-occurring in nearly 5% of the sample (Anja & Uwe, 2007).

Section Summary

Military members experience occupational and social stressors that are unique (Aldwin, 1994; Coker, 2007; Grant, 2004). These demands can create vulnerability for emotional dysfunction. PTSD and depression are of particular concern (Hoge et al., 2006; Hoge et al., 2008). A number of factors have been identified in previous research that influences the level of risk for the development of PTSD and depression. It is crucial

to address these factors in any effort to re-integrate military members in society following a deployment.

II.3. Risk and Resiliency Theory

Risk and Resiliency Theory began as an inquiry into the childhood roots of resilience 80 years ago (Van Breda, 2001). Due to this heritage, much of the early literature on risk and resiliency theory focuses on interventions in the educational and juvenile justice systems. However, over the last 3 decades the framework of risk and resiliency theory has been applied to adults, families, communities, organizations and the military (Van Breda, 2001). Risk and resiliency theory is a well-established theory which helps explain individual responses to difficult life experiences, and the personal and environmental factors that influence positive adaptation during or following adversity (Greene, 2002).

Perhaps the most fundamental constructs of risk and resiliency theory are risk and protective factors. Kirby and Fraser (1997) define risk as "any influences that increase the probability of onset, digression to a more serious state or maintenance of a problem condition" (Kirby & Fraser, 1997, pp. 10-11). Some risk factors associated with depression or PTSD identified in previous research include having a history of victimization, drug or alcohol abuse, poor coping skills, poor self-esteem, lower levels of education and spiritual involvement, pre-existing psychopathology, deficient social support and chaotic family functioning (Bradley et al., 2005; Dixon, Howie, & Starling, 2005; Gardner et al., 2008; Gilligan, 2008; Guay et al., 2006; Ostaszewski & Zimmerman, 2006; Palmer, 1997; Vaillant & Davis, 2000; Zimmerman, Bingenheimer, & Notaro, 2002).

Protective factors are those that "buffer, interrupt or even prevent risk" (Greene, 2001, p. 34). Like risk factors, a number of protective traits have been identified in previous research. Self-determination, social support, flexibility, a sense of humor, self-esteem, and self-efficacy are primary protective attributes (Earvolino-Ramirez, 2007). Protective mechanisms can originate from three sources: (1) personal characteristics, (2) families or social networks, and (3) the larger social environment (Fraser & Richman, 1999). Protective personal characteristics include intelligence, self-confidence, competence, and self-efficacy (Wald, Taylor, Asmundson, Jang, & Stapelton, 2003). Protective family factors include supportive parenting, mutual support, adequate social and economic resources, spirituality, and strong leadership (Greene & Livingston, 2002). Protective social factors include having a collective identity, community empowerment, and community organizing (Greene, 2001).

Determining whether a factor or process is protective or a risk is based on its effect on the individual (Rutter, 1987). While risk and protective factors have been significantly detailed, the interplay between the two remains an issue of contention among resiliency theorists. During the nascence of resiliency inquiry, risk and protective factors were viewed as antithetical (Masten, 1994; Strümpfer, 1995). This conjecture has been questioned in subsequent studies. Some theorists posit that risk and protective factors interact to produce unique outcomes (Greene, 2001). There is debate about the impact of risk and protective factors as levels of stress and adversity vary. Some theorists have opined that protective factors are less impactful than risk factors when levels of distress are low (Kirby & Fraser, 1997).

Resilience

Risk and Resiliency theorists have broadened the theoretical framework beyond risk and protective factors to include the interaction between personal protective characteristics and the environmental dynamics that impact resiliency (Walsh, 2003, 2006). Resilience can be conceptualized as the ability to overcome and adapt to adversity or challenges (Greene & Conrad, 2002). Resilience is a positive outcome that results from the cognitive, emotional or spiritual growth necessary to successfully manage adversity (Masten, 1994; Richardson, 2002).

Resilience is a dynamic process which involves positive adaptation within the context of significant adversity (Luthar, Cicchetti, & Becker, 2000, p. 543). Protective intra-personal, social and societal factors can enhance resilience, but the presence of protective factors does not ensure resilience (Earvolino-Ramirez, 2007). Resilience is a multidimensional trait that varies by individual as well as context, time, age, gender, and cultural origin (Connor & Davidson, 2003). Resilience is influenced by the genetic and psychological traits of the individual. Insight, independence, nurturing relationships, initiative, creativity, humor and morality are key characteristics of resilient individuals (Greene & Conrad, 2002).

Significant outcomes of resilience include mastery, effective coping, and positive adaptation (Earvolino-Ramirez, 2007). Resilience is more than recovering a previous level of functioning following loss or adversity. Resilience involves post-traumatic growth that results in healthy functioning and positive emotions over time during and following loss or adversity (Bonanno, 2005).

Research has also examined the impact the environment has on the development of adversity inoculating traits and how development of such traits can be maximized (Werner & Smith, 1992). Research has identified numerous social, socio-economic and societal factors that impact resiliency. Among these factors poverty, exposure to crime and violence, social support, family functioning and the presence of community resources are noteworthy (Cowger, Anderson, & Snively, 2006; Fraser, 1997; Gardner, Dishion, & Connell, 2008; Gilligan, 2008; Hawkins, Catalano, & Miller, 1992; Ostaszewski & Zimmerman, 2006). The specific influence of these important resiliency-impacting factors on a military population will be discussed in detail below.

Vulnerability

The opposing construct to resilience in risk and resiliency theory is vulnerability. Vulnerability is the notion that some individuals may be more susceptible to risks associated with the development of problematic behaviors, symptomatology, or psychopathology than others (Greene, 2002). Vulnerability factors are biological or psychological characteristics that make disordered states possible. Vulnerability is typically considered a latent, enduring trait activated by a life event, stressor, or challenge, in contrast to the concept of risk which is ephemeral (Grant & McMahon, 2005). Biological and psychological attributes that result in greater maladjustment during adversity create vulnerability (Luthar, Cicchetti, & Becker, 2000).

Although genetic characteristics are considered stable, psychological characteristics can fluctuate due to cognitive and neural plasticity and the natural maturation process (Grant & McMahon, 2005). Therefore, it may be possible to

minimize vulnerability with effective cognitive interventions; however vulnerability is less transient than risk.

II.3.1. Applicability of Risk and Resiliency Theory as Guiding Framework for Current Study

In the current study, the framework of risk and resiliency was applied to military members who recently returned from deployments. Military members often experience traumatic and life-threatening exposures in the combat setting (Aldwin, 1994). At the time this paper was written, 3,868 military members had been killed in action in Operations Iraqi Freedom and Enduring Freedom in Afghanistan since 2001. Another 33,856 service members were wounded in action (Defenselink, 2009). Research suggests that prolonged and repeated exposure to combat can increase the risk of vulnerability to mental health disorders among combat veterans (Dedert et al., 2009; Dohrenwend, Turner, Turse, Lewis-Fernandez, & Yager, 2008). Additionally, many military members experience, often first hand, the death of unit members. Such exposures are associated with an increased risk of mental health complications such as depression and PTSD (Ursano, Fullerton, Kao, & Bhartiya, 1995; Wright, Ursano, Bartone, & Ingraham, 1990).

In addition to the physical risk a military member faces, social and family structures are often disrupted by the demands of military service. For military service members, deployment may cause uncertainty and fear about the welfare of their family in their absence (Peebles-Kleiger & Kleiger, 1994). Concerns about the conditions of the deployment location and fear of encountering traumatic combat scenarios are also common (Peebles-Kleiger & Kleiger, 1994). These dynamics can cause conflict or

distress within the family system which may increase emotional risks among vulnerable Airmen they deploy (Hoge, Auchterlonie, & Milliken, 2006).

Services members are also frequently relocated. In addition to deployment in support of combat operations which and range in length from 4 to 18 months temporary, non-combat, assignments such as conference attendance, working groups and "back filling" at an under-manned location are typical job requirements (Burrell, Adams, Durand, & Castro, 2006). Finally, military members permanently move to new duty locations every few years (Jehn, 1990). Frequent deployments, temporary duty assignments and permanent changes of station challenge protective family and social dynamics (Spera, 2009). This isolation and adversity can erode protective structures and have a deleterious effect on the mental health of military members (Rona et al., 2007).

While the risks of military service are considerable, military members also benefit from a number of protective factors. Military communities offer stable housing with very low crime rates (Bicksler et al., 2004). These communities are homogeneous. The American military is an all volunteer force. Choosing a life of service dedicated to the protection of others is a source of pride and satisfaction central to the ethos of the volunteer American military (Bicksler et al., 2004; Fogleman, 1995). This ethos may help military members find meaning in adversary encountered in the line of duty and foster resilience and post-traumatic growth (Armour, 2003). Living in a community with members who have shared life experience and a common sense of purpose may enhance the sense of connectedness within the community (Christensen, 2004; Coker, 2007). Military leaders promote a tight-knit community and emphasize social support and

connectedness (Fogleman, 1995; Frank, 2008). The dynamics within the military community may serve as a protective factor for military members.

Within the military, leaders, medical providers and mental health professionals attempt to diminish vulnerability and enhance resilience by identifying at-risk Airmen by implementing supportive structures that are commensurate to the Airman's level of risk. Airmen who are functioning at or near an optimal level and who have encountered few occupational risk factors rely primarily on other unit members and unit leadership for support. Within the military preventative support interventions consist primarily of education and training. This process is designed to enhance unit cohesion and morale which may influence the resilience of individual unit members (Brailey, Vasterling, Proctor, Constans, & Friedman, 2007). In fact, an empirical study has demonstrated that one of the most important factors influencing a military member's resilience is unit cohesion (Brailey et al., 2007).

Military training is also designed to create a healthy cognitive process about the risks military members may encounter which may be protective. Military members are taught conceptualize the traumatic aspects of their vocation differently than their civilian counterparts (Gabriel et al., 2007; Lilly, Pole, Best, Metzler, & Marmar, 2009). The concept of "mission" is organizationally paramount within the military (Michael, 2008). The phrase "mission first" is ubiquitous. Mission describes a relative determination to engage in martial operations in a precise and efficient manner to achieve the objectives of the state (Darley, 2006; Lunsaco & Bredlow, 2008). The concept of mission also includes the subordination of the individual to a larger cause. Self-sacrifice and a

willingness to go beyond the call of duty are characteristics that have uniformly been esteemed within the warrior culture (*Air Force Manual 10-100: Airman's Manual*, 1999; Coker, 2007). In the American military, “service before self” is a core value (Fogleman, 1995). Within the military culture the concepts of mission and service may foster a sense of belonging and connectedness which are protective factors during adversity (Greene & Conrad, 2002).

Pre-deployment training stresses the honor and an opportunity for self-actualization intrinsic to military service (Fogleman, 1995; Lunsaco & Bredlow, 2008; Wilson, 2008). Military members receive awards and decorations for “valor” in combat. Exposing one’s self to life threatening situations is revered as behavior that protects the freedoms of the American people and the lives of other military members (Lunsaco & Bredlow, 2008; Wilson, 2008). Such beliefs may be protective cognitive traits in military members for military members (Christensen, 2004; Coker, 2007).

Self-reliance and resourcefulness are key components of military training (Budd, 2007; "Deployment Relevant Training," 2010; Air Force Instruction 44-154, 2006). Resourceful, self-reliant military members are more likely to be resilient in the combat environment (Strümpfer, 1995). Walsh (2006) opined that beliefs are the “heart and soul of resilience” (Walsh, 2006, p. 49). Individuals who perceive an element of control over the events in their lives are less likely to experience dysfunctional responses to trauma than those who perceive an external locus of control. In the strengths-based tradition of risk and resiliency theory, Rosenbaum and Ben-Ari (1985) developed the concept of learned resourcefulness as a response to the learned helplessness conceptualized by

trauma theorists. The premise of learned resourcefulness is that self-regulation enables a person to continue with goal-directed and self-sustaining activities, even in the absence of external reinforcement.

When a military member is informed that they are going to deploy they may experience stress associated with managing day to day tasks such as paying bills while they are away. They may also experience stress, anticipating a separation from their loved ones (Lunsaco & Bredlow, 2008). Many military members will experience a stress response that could impact their performance as a result of a deployment. Some of these responses, hyper-vigilance for instance, may be adaptive to the combat environment, but maladaptive in a civilian setting (Castro et al., 2006). Other stress responses, like insomnia, isolation, or depression may negatively impact mission readiness (Lunsaco & Bredlow, 2008).

Protective Factors in the Military

To maintain mission readiness the military increases the supportive resources involved with a military member as the risks they encounter in the combat environment increase (See figure 7). Prior to a deployment all military members are assessed by medical personnel and receive supportive services from legal and family support personnel (Chu, 2006). This process increases the protective structures available to military members in response to the potential for increased risk.

Within the military a number of protective mechanisms exist to support family systems that are not available to other populations (Green, 1995; Lichte, 2006). The unit and installation resources function to support military members and families to enhance

resilience and mission readiness. The support a military family receives is important because military spouses and children often have to cope with traumatic separations from loved ones. Additionally, they may live with anxiety related to the safety of their loved ones while they are deployed (Burrell, Adams, Durand, & Castro, 2006). The presence of dysfunctional family dynamics during a deployment may reduce the resiliency of the deployed military member (Palmer, 2008). This in turn, may diminish the military member's mission readiness and increase the risk of a traumatic exposure. Within the military, maintaining healthy family dynamics is viewed as a key component of enhancing the resilience of military members (Newton, 2008). Several studies have validated the risk and resiliency framework as a guide to enhancing familial resilience (Coco & Courtney, 1998; Slesnick & Prestopnik, 2004; Slesnick & Prestopnik, 2005).

Risk and Protective Factors Included in the Current Study

In the current study the concepts of risk and protective factors guided the selection of exogenous variables that were used to measure the presence of trauma-related symptoms and depressive symptoms in a post-deployed military sample. Military service presents a unique set of occupational risks and protective factors. Many of the risks that are unique to military service are related to deployment.

Following a deployment, The Post Deployment Health Reassessment (PDHRA) is one of the key instruments used to identify at-risk military members. The PDHRA is used to determine the type and degree of protective support mechanisms that are offered to military members depending on their position on the continuum of health versus dysfunction. All returning military members receive educational interventions following

a deployment (Ozanian et al., 2008). They also receive support from their unit leadership. Military members who are identified as at risk by the PDHRA following a deployment are offered additional medical and mental health services to mitigate risk. This relationship is depicted in Figure 7 below. Because the PDHRA is the primary tool used to identify at risk military members, it is important that it is an effective screening tool.

The PDHRA screens for a number of combat related risk factors. These factors are discussed in detail above in the review of the literature regarding risk factors for depression and PTSD. In this study, risk and resiliency theory was used to guide the selection of PDHRA questions that represented risk and protective factors for depression and trauma following a deployment.

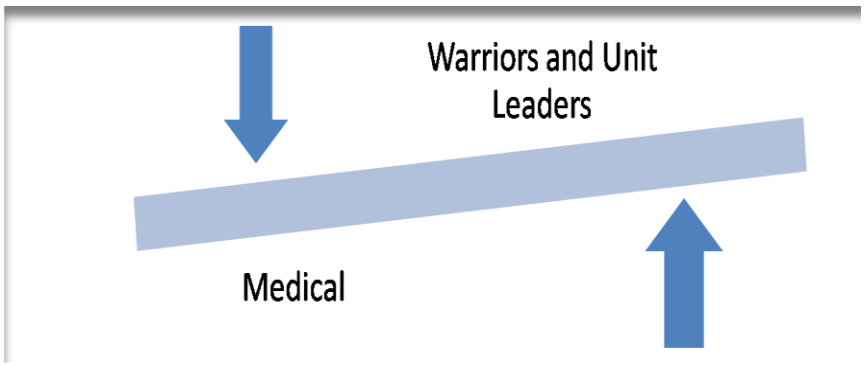
These factors include gender, exposure to traumatic events and symptoms related to those events, alcohol use, support network functioning, post-traumatic symptoms, depressive symptoms and socio-economic factors.

Section Summary

Risk and protective factors are the central constructs of risk and resiliency theory. The role of risk and protective factors has evolved with the development of risk and resiliency theory. Military members encounter unique risk factors due to their vocation. Military members are expected to expose themselves to combat, natural and man-made disasters as they carry out their occupational responsibilities (Christensen, 2004). However, they also enjoy significant protective dynamics that are unique to military membership. Military members benefit from unusually high access to medical care and

the support of a supportive, tight-knit community (Bicksler et al., 2004; Fogleman, 1995; Gates, 2009). Systemically, the military increases the level of support systems as risk factors increase or individual vulnerability becomes evident. The PDHRA is a primary tool used to identify at-risk Airmen. Drawing on risk and resiliency theory, this study aims to assess the relationship between risk and protective factors measured by the PDHRA and the identification of *depression* and *trauma* by the PDHRA.

Figure 7. Risk and Resiliency in the Military

Optimal	**Reacting**	**Injured**	**Ill**	
Peak Performance Positive Outlook Sense of Purpose Embrace Challenge **Mission Ready**	Irritable Overwhelmed Insomnia Tense Poor Focus **Stress Response**	Guilt Low Energy Anxiety Loss of Interest Isolation **Persistent Distress**	Depression Anxiety Anger Aggression Threat to self/others **Mission Impaired**	
				**Risk** Physical Injury Casualty Exposure Direct Combat Indirect Combat Operational Stress
Education and Training	Risk Mitigation	Acute Care and intervention	Treatment and Reintegration	
Protective Factors				

(Lunsaco & Bredlow, 2008)

II.4. CLASSICAL MEASUREMENT THEORY

If a thing exists, it exists in some amount. To understand a phenomenon thoroughly involves knowing its quantity as well as it quality (Thorndike, 1918). This philosophy was an important paradigm shift in the behavioral sciences where many of the important constructs are latent and difficult to measure. In fact, a major criticism of the social sciences compared to physical sciences has been the limited degree to which things are measured (Roberts, 1979). The importance of measurement within the social sciences is encapsulated by Walter Hudson's two axioms on measurement. "If you cannot measure the client's problem, it does not exist. "If you cannot measure the client's problem you cannot treat it" (Hudson, 1978, p. 65).

The limitations of measurement were discussed thoroughly in the early 1900's in research conducted by Spearman (Crocker & Algina, 1986). He illustrated that with few exceptions identifying imperfect correlations between constructs is the limit of the accuracy that can be achieved by empirical inquiry in the social sciences (Spearman, 1904). The observed correlation between physical events and subsequent symptoms or behaviors is not an accurate representation of the true relationship between them because of the error inherent in measurement (Spearman, 1907).

True Score

The assumption inherent to Spearman's research is that a true score or correlation does exist, but cannot be adequately measured. A number of factors including experimental conditions, chance, instrumentation issues and sampling contribute to variation from the true relationship (Spearman, 1913). Therefore, to understand the

relationship between what is observed by researchers and the true nature of a phenomenon, the formula for a true score is used. The formula for true score is

$$x = T + E_x$$

Where X is the observed score, T is the true ability of the subject and E_x represents the error that occurred during measurement (Nitko & Brookhart, 2007). The true score, T, can be conceptualized as the result of the perfect measure given under perfect conditions (Nitko & Brookhart, 2007). This existence of a true score and attempts to minimize error are fundamental tenants of Classical Measurement Theory. This study will assess the efficacy of a screening tool used by the military to identify depression and PTSD. The true score of a depressed subject on this assessment should indicate the level of depression present. The error involved in this measurement will diminish the accuracy of the assessment and the identification of a depression disorder.

II.4.1. Reliability

Reliability describes the consistency a given tool has when measuring a psychological phenomenon. A reliable tool should be able to produce consistent results for a subject across multiple measurements (Rubin & Babbie, 2008). Each item within a measurement tool should be a comparable indicator of the construct that is being examined (Crocker & Algina, 1986). Reliability can be defined mathematically as the ratio of the variation of the true score and the variation of the observed score. It can also be described as one minus the ratio of the variation of the error score and the variation of the observed score.

$$\rho_{xx'} = \frac{\sigma_T^2}{\sigma_X^2} = 1 - \frac{\sigma_E^2}{\sigma_X^2}$$

In this equation $\rho_{xx'}$ is the symbol for the reliability of the observed score, *X*. σ_X^2 is the variation of the observed score, σ_T^2 is the variation on the true score and σ_E^2 is the variation of the error score (Crocker & Algina, 1986).

Standard Error of Measurement

Standard error of measurement is a statistic designed to estimate the extent to which an observed score deviates from a true score. The standard error of measurement on a test refers to the standard deviation of test scores that would have been obtained from a single subject had that subject been tested multiple times. It is a measure of the spread of scores that would be produced by a subject on a given measure (Dudek, 1979). It is unnecessary for a subject to complete a measure repeatedly to determine the standard error of measurement. It can be estimated from a single testing of a given sample. With the sample mean score, standard deviation and reliability score on the measure in question, an estimate of the standard error of measurement can be computed using the following formula:

$$SEM = s\sqrt{1} - r$$

In the equation above s is the standard deviation for the test and r is the reliability coefficient for the test, describe above, when the true score is held constant (Shultz & Whitney, 2005). While it is never possible to precisely establish the amount of error present in a give measurement, the standard error of measurement provides a useful

estimate of the variation between the true score and observed scores across a sample (Springer, 1997).

II.4.2. Validity

Validity is the degree to which measurement and interpretation of that measurement approximate a subject's true score in relationship to the underlying theoretical construct. Validity is defined as the extent to which the scale measures what it purports to measure (Nunnally & Bernstein, 1994). A measure is deemed valid if it offers an accurate approximation of a phenomenon. A number of strategies for assessing validity have been developed.

In the early 1950s the American Psychological Association attempted to clarify the standards for scholarly psychological research and publishing. Central to this discussion was the concept of validity. At the time the APA recognized four types of validation: predictive validity, concurrent validity, content validity, and construct validity that are essential to scientific inquiry (Cronbach & Meehl, 1955). A number of types of validity have been deemed important to scholarly research and publishing have been added to those that were initially identified by the APA.

Validity cannot be wholly established as a singular concept; rather different kinds of validity evidence are compiled to establish a measure's validity (Nitko & Brookhart, 2007). In fact, the definitions of the various types of validities are often used in an inconsistent manner. Significant overlap exists in the criterion of different type of validity between authors (Chonody, 2009).

Construct Validity

Construct validity refers to whether a scale measures or correlates with the theorized psychological construct that it purports to measure (Rubin & Babbie, 2008). Construct validity is dependent on the theoretical conceptualization of the trait under consideration. A scale developer must operationalize a construct, typically measuring several observable phenomena that supposedly reflect the underlying psychological concept (Netemeyer, Bearden, & Sharma, 2003). Construct validity is the degree to which an assessment accurately represents the construct.

A construct is not restricted to one set of observable indicators or attributes. It is common to a number of sets of indicators. Thus, "construct validity" can be evaluated by statistical methods that show whether or not a common factor can be shown to exist underlying several measurements using different observable indicators (Ulrich, 2010). A construct will never be perfectly represented by the measure that is used to operationalize it. Construct validity is a measure of the degree that the measure successfully approximates the construct (Peter, 1981).

Assessing the convergent and discriminant validity of a scale are fundamental strategies to determine construct validity. Comparing a measure to some other instrument or variable that it should, theoretically, relate to is one strategy for establishing construct validity. This type of construct validity is called convergent validity (Cocker & Algina, 1986; Springer, 1997). If the experimental measure is highly correlated with other scales that measure the same construct, convergent validity is suggested. Discriminant validity involves a process that is opposite to convergent validity. Discriminant validity is suggested when a measure does not correlate as highly

with measures of other constructs as it does with measures of the target construct (Rubin & Babbie, 2008). Comparing a scale to established measures of the construct in question and other constructs is a helpful means of establishing the scales validity.

There are two primary threats to construct validity. The first of these is construct under-representation. Construct underrepresentation occurs when the measure is too narrow and fails to account for important facets of the construct (Messick, 1995). The second primary threat to construct validity is construct-irrelevant variance. Construct-irrelevant variance, the opposite of construct under-representation, occurs when a measure is too broad and includes features that are extraneous to the construct being represented (Thomas & Steven, 2004). Evaluation of construct validity requires that the correlations of the measure be compared to variables that are known to be theoretically related to the construct, convergent validity (Ruben & Babbie, 2008). Correlations that fit the expected pattern contribute evidence of construct validity. Construct validity is a judgment based on the accumulation of correlations from numerous studies using the instrument being evaluated (Ulrich, 2010).

Criterion Validity

Criterion validity is based on an external, gold standard measure of the same theoretical construct. The degree to which the experimental measure is associated with the selected measure defines the level of criterion validity (Netemeyer et al., 2003). Criterion validity has two primary components, concurrent validity and predictive validity. Concurrent validity can be assessed using known-groups and known-instruments. Known-groups validity involves being able to distinguish between two

groups of people that should score high and low on a target criterion, with the experimental measure. For instance, a depression scale should yield a statistically significant variation in mean scores among people diagnosed with untreated depression and those who have been assessed for depression and did not have a diagnosable condition. Known-instruments validity involves identifying a validated instrument that measures the target construct. The degree that the experimental scale correlates with the known scale establishes the level of known-instrument validity (Schultz & Whitney, 2005)

Predictive validity is the extent to which a score on a scale or test predicts future outcomes on some criterion. In a study of predictive validity, the test scores are collected first; then at some later time the criterion measure is collected (Cronbach & Meehl, 1955). It is the future measurement of a subject that determines the predictive validity of an instrument (Nitko & Brookhart, 2007). Predictive validity is a description of how well a measure correlates to criterion in the future. In this study the results of the Post-deployment Health Reassessment will be used to predict the development of depressive and trauma related diagnostic conditions. The PDRHA uses several scales that have been extensively validated. These measures are discussed in detail below. However, a number of the items used to assess a subject for PTSD and depression have not been examined for reliability or validity (Ozanian, 2010). This may result in screen that does not consistently or accurately recognize the presence of trauma or depressive disorders.

II.4.3. Measurement Error

As discussed above, measurement is an imperfect science. No measure can exactly represent a latent construct. Many factors contribute to the presence of error. These factors can be organized in to two distinct types of error. The first is systematic error. Systematic error is characterized by consistency. If a pattern of mischaracterization of the target construct is present across the sample systematic error has occurred (Rubin & Babbie, 2008). Conversely, random errors lack uniformity. Random errors are produced by the unique circumstances within the subject and environment that occur during the measurement process (Kline, 2005).

Systematic Error

Many theorists have noted that the act of measuring a phenomenon can alter its nature. The relationships between variables that are measured with the same instrument may be distorted because of common variance intrinsic to the measurement tool or method (Spector, 2006). For instance, survey data can be completed in a number of ways. Respondents can complete the survey independently on paper or electronically. Survey data can also be gathered by an interviewer in person or on the telephone. Such interviewers will have varying levels of training. Inadequate training or the absence of culturally sensitive, alternative versions of the measure can influence results. This is particularly the case among vulnerable populations. These methodological variations will influence variance from the true score of the measure (Dillman et al., 2009).

Survey respondents often leave items blank. Research suggests that items that are not completed on surveys are not randomly distributed. Survey respondents may be less

likely to respond to sensitive items, significantly impacting the validity of the data gathered (Tourangeau, Groves, & Redline, 2010). Additionally, when researchers attempt to measure sensitive subjects, respondents may alter their responses to provide answers that they believe are socially acceptable or desired by the researcher (Rubin & Babbie, 2008). Such distortion can seriously influence results. Research suggests that methods can account for as little as 18% to as much as 72% of the variance in statistical analysis (Lance, Dawson, Birkelbach, & Hoffman, 2010; Mount, Judge, Scullen, Sytsma, & Hezlett, 1998). Systematic error is problematic because it biases the results of the measurement.

Random Error

Random error is not due to a systemic pattern within the measurement tool making it more difficult to identify and remedy than systematic error. Random error is more likely to occur on longer assessments which fatigue respondents and diminish concentration. It is also important that the measure be written in language that minimizes the potential for respondents to misunderstand questions (Rubin & Babbie, 2008). The presence of random error does not bias results, but it does decrease the reliability of a measure.

II.4.4. Applicability of Risk and Resiliency Theory as Guiding Framework for Current Study

In the current study classical measurement theory is applied to the Air Force Post-Deployment Health Reassessment (PDHRA). The PDHRA is a multi-dimensional assessment. The present study seeks to assess the degree to which the PDHRA

accurately measures symptoms related to PTSD and depression. The present study also seeks to determine how accurately the PDHRA identifies individuals with PTSD and depression. To this end, the current study will assess the internal consistency of subscales within the PDHRA. The internal consistency of PDHRA subscales will be reflective of the reliability of the PDHRA (Netemeyer, Bearden, & Sharma, 2003).

The two most common ways to assess the clinical value of a test are sensitivity and specificity (Gunnarsson & Lanke, 2002). Sensitivity is the proportion, for a given condition, of actual positives which are correctly identified. Specificity is the proportion, for a given condition, of actual negatives that are correctly identified (Mayer, 2004; Nugent, 2009). Specificity is related to the Type 1 error of a measure. Higher specificity suggests a low Type 1 error rate. Sensitivity is related to the Type II error of a measurement. Higher sensitivity suggests a low Type II error rate (Spiegel, 1999).

The use of predictive value as measure of the clinical utility of an instrument has become more common (Gunnarsson & Lanke, 2002). Supplementing measures of sensitivity and specificity with the use of predictive values may provide additional useful information on how to assess the clinical value of a test.

Additionally, classical measurement theory will be used as a guide to evaluate differences between observed scores for *trauma* and *depression* on the PDHRA and subjects' true score for *trauma* and *depression.* The classical measurement framework will guide suggestions for reducing the variance between the true and observed scores on PDHRA variables of interest in this study.

III. METHODOLOGY

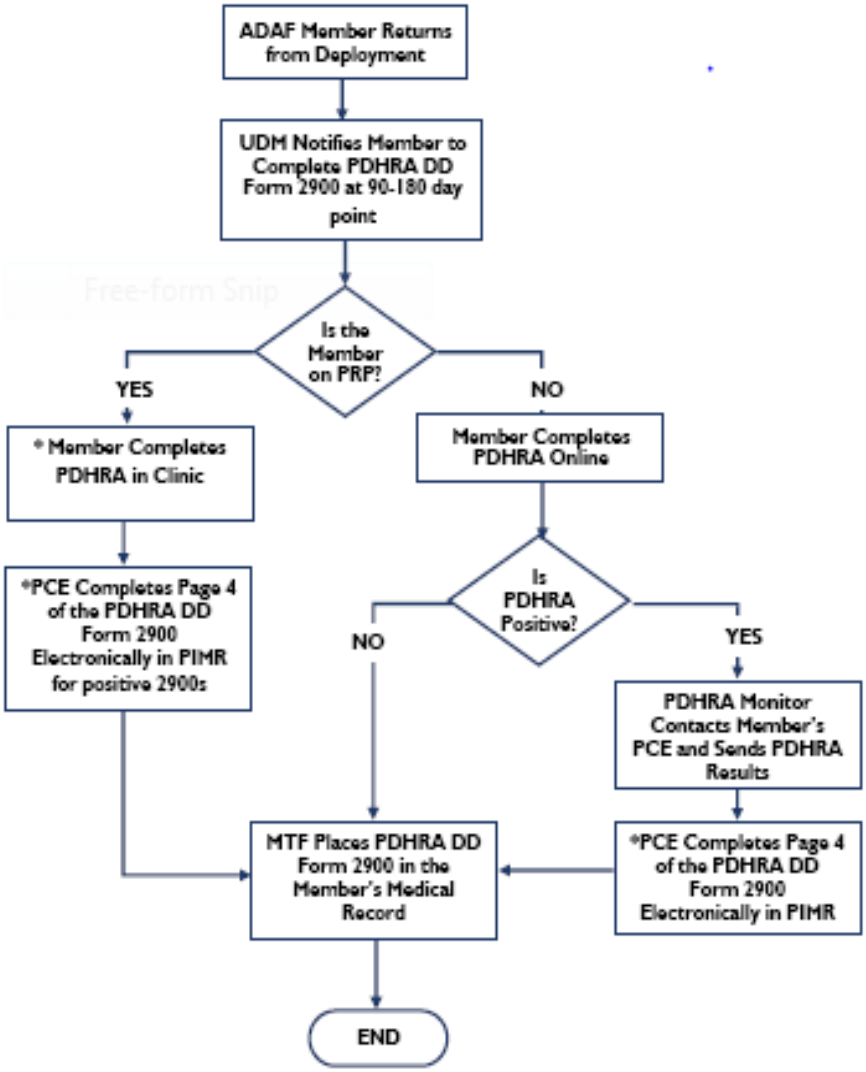
III.1. Data and Study Sample

The Post-Deployment Heath Reassessment (PDHRA) has been used since 2005 to assess the health of military members in the months following a deployment (Ozanian et al., 2008). It was augmented in 2008 to capture important health related data and enhance the health and resilience of Airmen returning from combat. This was accomplished by broadening questions about traumatic brain injury (TBI) and alcohol misuse (Loftus, 2008). The PDHRA is part of a broader military public health monitoring system. It primarily augments the Post-Deployment Health Assessment (PDHA) that is given to military members immediately upon their return from deployment. The PDHRA serves to identify health issues that arise in the months following assessment using the PDHA (Ozanian et al., 2008).

The PDHRA is an automated assessment that is completed online by service members 90-180 days after their return from a deployment. Military members are only required to complete one PDHRA per calendar year regardless of the number of deployments they participate in during that year. As soon as an individual completes the PDHRA the results are available to the medical treatment providers that care for that service member. Military medical personnel have access to the PDHRA results electronically via Preventive Health Assessment and Individual Medical Readiness (PIMR) software. This software is networked across the military medical system and is available on the desk top of most computers in a military hospital.

When a PDHRA is completed, a process is initiated to assess and respond to the needs of the individual who completed the assessment. This process varies slightly for military members who have access to nuclear weapons (PRP) (Darnell, 2006; Ozanian et al., 2008). Individuals with nuclear access must complete the PDHRA at the military treatment facility where their care is provided. The process for responding to a positive PDHRA also varies slightly between installations.

Figure 8. Post-Deployment Health Reassessment (PDHRA) Flow Chart



Flow Chart Acronym Key:

ADAF- Active Duty Air Force	UDM- Unit Deployment Manager
PRP- Personnel Responsibility Program (Nuclear Access)	MTF- Military Treatment Facility
PCE- Primary Care Element	PIMR- Preventive Health Assessment and Individual Medical Readiness Database

(Ozanian et al., 2008)

The PDHRA was developed at the direction of the United States Congress to improve the identification and treatment of three primary conditions in returning service members; depression, PTSD and traumatic brain injury (TBI). The assessment was developed and implemented in six months. No formal evaluation of the PDHRA's psychometric properties has been conducted to date (Ozanian, 2010). The PDHRA, as completed by Air Force personnel, is the primary data source for this study.

III.1.1 Sampling and Subject Eligibility

The study employed a comprehensive population sampling strategy. Cases were drawn from the United States Air Force, active, reserve and National Guard components. The sampling frame included individuals who completed the Post-deployment Health Reassessment (PDHRA) between January 1, 2008 and December 1, 2009. Study participants were all at least 17 years of age due to Department of Defense regulations (Chu, 2007). Study participants included all pay grades from Airman Basic (E-1) to Major General (O-8).

Participants were notified by their Unit Deployment Manager (UDM) that they were required to log-on to the PDHRA website and complete the survey or indicate that they were declining to participate. The UDM is an individual assigned by the squadron commander to manage the inbound and outbound deployment process within the unit.

This notification occurred between 90-180 days after the airman's return from deployment (Ozanian et al., 2008). Over 99% of eligible Airmen completed the survey (N=58,242).

III.2 Measurement of Variables

III.2.1. The Post-Deployment Health Reassessment (PDHRA)

The PDHRA is a web-based, 3-page, self-report questionnaire which includes demographic items, general health questions, physical symptoms, questions about environmental exposures and mental health items that may be deployment related (Milliken et al., 2007). When completed the PDHRA becomes part of the military member's medical record (Ozanian et al., 2008). Additionally, an electronic copy is integrated into the Defense Medical Surveillance System (DMSS) database (Milliken et al., 2007).

The Post-Deployment Health Reassessment (PDHRA) is a primary tool used by the military medical system to identify individuals who have physical or behavioral health concerns following a deployment. The PDHRA is also the last, in a series of formal screenings that are used by the military to identify service members who are experiencing distress after a deployment (Milliken, Auchterlonie, & Hoge, 2007). Consequently, the efficacy of the PDHRA in identifying distressed service members who may be at elevated risk for PTSD or depression is central to maintaining a healthy military population. If the PDHRA does not accurately identify individuals who are at-risk for PTSD or depression following a deployment, such individuals may not receive the supportive services they require. Conversely, if the PDHRA identifies a large number

of healthy individuals as at risk for PTSD or depression, valuable medical assets may be misallocated by providing follow-up services to a healthy segment of the population.

The PDHRA is structured in to two levels of triage. The first level of triage is conducted by the PDHRA manager. A positive PDHRA is defined as an endorsement of any question on page 2 or 3 of the PDHRA (see Appendix A). (Ozanian et al., 2008). Airmen with positive responses to these specific PDHRA questions are directed to the PDHRA manager. The PDHRA manager is responsible for triaging all positive PDHRAs at their military base. This contract with Airmen who had PDHRA responses which indicated concern may occur telephonically. In this case the PDHRA manager will call the military member to discuss the results of their PDHRA and explore the need for follow-up. On other bases an immediate referral to a medical provider will result from a positive PDHRA. Medical providers may then follow-up by phone or in person. An Airmen's primary care physician and the physician's support staff have access to the Airman's PDHRA results. These results provide clinically relevant information to the medical professionals who provide treatment. In addition to the primary questions on the PDHRA, Airmen who screen positively for behavioral health concerns may be offered the Alcohol Use Disorders Identification Test (AUDIT) which assesses alcohol misuse, the PTSD Checklist-Military Version (PCL-M) which assesses trauma symptoms and the Patient Health Questionaire (PHQ-9) which assesses depression while they are completing the PDHRA (Ozanian et al., 2008). The results of the AUDIT, PCL-M and PHQ-9 are also available to medical personnel.

III.2.2. The Alcohol Use Disorders Identification Test (AUDIT)

Subjects who screened positively for alcohol misuse were offered the opportunity to answer additional questions that helped the healthcare provider address their needs. If they agreed, they completed the Alcohol Use Disorders Identification Test (AUDIT) which was assessed by a health care provider upon referral (Ozanian et al., 2008).

The AUDIT was developed in a World Health Organization (WHO) collaborative project performed in primary health care facilities in Australia, Bulgaria, Kenya, Mexico, Norway, and the United States. Nearly 2000 patients were included in the sample (Allen, Litten, Fertig, & Babor, 1997).The AUDIT is a 10-item screening questionnaire with three questions on the amount and frequency of drinking, three questions on alcohol dependence, and four questions on problems caused by alcohol. Scores for each question range from 0 to 4, with the first response for each question (never=0), the second (less than monthly=1), the third (monthly=2), the fourth (weekly=3), and the last response (daily or almost daily=4). For questions 9 and 10, which only have 3 responses, the scoring is 0, 2, and 4 (from left to right). The psychometric properties of the AUDIT have been reported in many studies. A meta-analysis by Shields and Caruso (2003) reported that across 24 samples the median internal consistency reliability was 0.81 with a range of 0.59 to 0.91. An analysis by Gordon and colleagues (2001) of a primary care population estimated the sensitivity of the AUDIT for identifying hazardous drinkers was 76% using a cut point of 8 or higher with a specificity of 92%. The hazardous drinking criterion in the Gordon study was over 15 drinks weekly for men and over 11 drinks for women. Other studies on samples of the elderly, students, and subjects in a medical

setting have produced similar standards (Allen et al., 1997). A score of 8 or more is associated with harmful or hazardous drinking. A score of 13 or more in women, and 15 or more in men, is likely to indicate alcohol dependence (Saunders, Aasland, Babor, Fuente, & Grant, 1993).

III.2.3. PTSD Checklist-Military Version (PCL-M)

If members answered yes to any of the 4 response options on question 12, suggesting potential PTSD concerns, at the completion of the PDHRA were offered the opportunity to answer additional questions that helped the healthcare provider address their needs. If they agree, they completed the PCL-M which was assessed by a health care provider upon referral (Ozanian et al., 2008).

The PCL-17 has been used extensively in research on PTSD. It has been adapted for several specific groups including the military (Weathers & Ford, 1996). The PCL-M was initially developed and validated in samples of Vietnam and Persian Gulf Veterans (Weathers & Ford, 1996). It has also been validated among subsets of the military. The Department of Veterans' Affairs confirmed the validity of the PCL-M with female veterans with PTSD (N=2,545) (Dobie et al.). The civilian version of the PCL-m, the PCL-17 has also been used successfully to measure PTSD symptoms in mixed gender populations of civilian trauma patients, in survivors of cancer and in parents of pediatric cancer patients (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Dobie et al.).

The PCL-17 consists of 17 items. The questions on the PCL-17 fall into three subscales that directly correspond to the three symptom clusters specified in the DSM-IV criteria for PTSD; avoidance, arousal and re-experiencing (Blanchard et al., 1996). For

each item, respondents rate on a 5-point scale (1 = "not at all" to 5 = "extremely") the extent to which they have been bothered by the specified symptom in the past month (Tampke & Irwin, 1999). The PCL-17 produces a score for each of the three DSM-IV PTSD symptom clusters (Tampke & Irwin, 1999). A score of 50 or greater is considered a clinically significant level of trauma related symptoms (Weathers & Ford, 1996). The internal consistency of the three PCL-M subscales is high (Cronbach's alpha =.89 to .97). The concurrent and discriminant validity of the PCL have also been repeatedly demonstrated (Tampke & Irwin, 1999).

III.2.4. The Patient Health Questionnaire (PHQ-9)

Respondents, who answered “more than half the days” or “nearly every day” for PDHRA question 14a or b, were offered the opportunity to complete the Modified Patient Health Questionnare-9 (PHQ-9) which was assessed by the health care provider upon referral (Ozanian et al., 2008).

The PHQ-9 is a self-administered 4-point scale (0=not at all to 3=nearly every day), which measure the construct of depression. It scores each of the 9 diagnostic criteria for major depressive disorder from the DSM-IV. The complete PHQ-9 would be scored as follows: 0-4 None, 5-9 Mild, 10-14 Moderate, 15-19 Moderately Severe, 20-27 Severe (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 was developed to be used as a quick screening tool in primary care settings (Spitzer, Kroenke, Williams, & and the Patient Health Questionnaire Primary Care Study, 1999). The PHQ-9 has a high internal reliability (α=.89) (Kroenke et al., 2001). The convergent validity of the PHQ-9 has been established, but comparing it to the Beck Depression Inventory and the Structured

Clinical Interview for Depression (Adewuya, Ola, & Afolabi, 2006; Williams et al., 2005).

Many screening tools for depression are long and take a considerable amount of time to complete. The PHQ-9 is valuable because it can be completed quickly (Kroenke et al., 2001). The PHQ-9 also differs from many measures of depression because it was developed to assess not just for the presence of depression, but for the severity of depression (Kroenke et al., 2001). The PHQ-9 may help clinicians determine the appropriate course of treatment because it describes the level of depressive pathology (Hancock & Larner, 2009).

III.2.5. Primary Dependent Variables

The primary dependent variables for this study were ICD-9 codes for diagnostic depression and trauma related conditions. This data was drawn from the M-2 military public health database at Brooks Air Force Base, Texas. The M-2 data is a comprehensive database that includes all diagnostic data for all Air Force members. A data request was submitted for diagnostic data on all subjects.

The ICD-9 codes for post-traumatic stress disorder, 309.81 and acute stress disorder, 308.3. This data was used to create the endogenous variable "trauma diagnosis." For an Airman to receive an ICD-9 code of 309.81 or 308.81 they must have been evaluated by a physician, a licensed psychologist or a licensed clinical social worker who determines that the Airman meets the Diagnostic and Statistical Manuel (DSM) IV-TR criterion for PTSD or Acute Stress Disorder. This diagnosis was then be added to the

Airman's medical record and the ICD-9 code was entered in to the M-2 data base by the medical provider or their support staff.

The ICD-9 codes for dysthymic disorder, major depressive disorder, depressive episode, depression not otherwise specified were used to create the endogenous variable "depression diagnosis." For an Airman to receive an ICD-9 code of 311, 296.X or 300.4 they must have been evaluated by a physician, a licensed psychologist or a licensed clinical social worker who determines that the Airman meets the Diagnostic and Statistical Manuel (DSM) IV-TR criterion for Dysthymic Disorder, Major Depressive Disorder or Major Depressive Episode or Depressive Disorder Not Otherwise Specified. This diagnosis was then added to the Airman's medical record and the ICD-9 code was entered in to the M-2 data base by the medical provider or their support staff.

Figure 9. Complete Study Variable Key

Construct	Label	Variable	Measurement
Demographic	Total deployments	totdep	Continuous variable, sum of all deployments
Demographic	Pay Grade	Grade	E1=1 E2=2 E3=3 E4=4 E5=5 E6=6 E7=7 E8=8 E9=9 O1=10 O2=11 O3=12 O4=13 O5=14 O6=15 O7=16 O8=17
Demographic	Gender	gender	Male=0 Female=1
Alcohol Concerns	usemore	Q13a	"In the PAST Month, Did you use more alcohol than you meant to?" 1=yes 0=no
Alcohol Concerns	cutdown	Q13b	"In the PAST MONTH, have you felt that you wanted to or needed to cut down on your drinking?" 1=yes 0=no
Level of Alcohol Use	often	Q13c	"How often do you have a drink containing alcohol?" 4=4 or more times a week 3=2 to 4 times a week 2=2 to 4 times a month 1=monthly or less 0=never
Level of Alcohol Use	Howmany	Q13d	"How many drinks containing alcohol do you have on a typically day when you are drinking?" 4=10 or more 3=7 to 9 2=5 or 6 1=3 or 4

			0=1 or 2
Level of Alcohol Use	≥6	Q13e	"How often do you have 6 or more drinks on one occasion?" 4=Daily 3=Weekly 2=Monthly 1=Less than monthly 0=Never
Level of Alcohol Use	Audit Score	audittot	Sum of AUDIT questions 1-10 4=daily or almost daily 3=weekly 2=monthly 1= less than monthly 0=never the fourth (Questions 9 and 10, only have 3 responses, the scoring is 0, 2, and 4
Injury	hurt	Q7	"During your deployment, were you wounded, injured, assaulted or otherwise physically hurt?" 1=yes 0=no
Injury	hurtprob	Q7a	"If yes are you still having problems related to this assault, wound or injury?" 1=yes 0=no
Trauma	nitemare avoid onguard numb	Q12a Q12b Q12c Q12d	Have you ever had any experience that was so frightening, horrible or upsetting that in the past month you… a. Have had nightmares or thought about it when you did not want to? b. Tried hard not to think about it or went out of you way to avoid situations that remind you of it? c. Were constantly on guard, watchful or easily startled? d. Felt numb or detached from others, activities or your surroundings 1=yes 0=no
Trauma	PCL-M Score	pclmtot	Sum of PCL-M questions 1-17 1=Not at all 2=A little bit 3=Moderately 4=Quite a bit 5=Extremely
Depression	emoprob	Q4	"During the past 4 weeks, how difficult have emotional problems made it for you to do your work, take care of things at home or get along with other people?"

			0=Not at all 1=Somewhat difficult 2=Very difficult 3=Extremely difficult
Depression	interest feeldown	Q14a Q14b	"Over the past month have you been bothered by the following problems? a. Feeing little interest or pleasure in doing things. b. Feeling down depressed or hopeless" 0=Not at all 1=Few or several days 2=More than half the days 3=Nearly every day
Depression	PHQ-9	phq9tot	Sum of PHQ-9 questions 1-9 0=Not difficult at all 1=Somewhat Difficult 2=Very Difficult 3=Extremely Difficult
Depression/ Support Network Conflict	emoprob	Q4	"During the past 4 weeks, how difficult have emotional problems made it for you to do your work, take care of things at home or get along with other people?" 0=Not at all 1=Somewhat difficult 2=Very difficult 3=Extremely difficult
Support Network Conflict	conflict	Q11	Since return from your deployment, have you had serious conflicts with your spouse, family members, close friends or at work that cause you to worry or concern? 0=no 1=yes
Exposure Events	blast crash shot	Q9a1, Q9a2 Q9a3	"During this deployment did you experience any of the following events? (Mark all that apply) 1. Blast or explosion (IED, RPG, landmine, grenade, ect.) 2. Vehicular accident/crash (any vehicle including aircraft) 3. Fragment wound or bullet wound above your shoulders 0=no 1=yes
Exposure Symptoms	memlap dizzy	Q9d1 Q9d2	"In the past week have you had any of the symptoms you listed in 9c? (Mark all that apply)

	earsring photosense irritable insomnia	Q9d3 Q9d4 Q9d5 Q9d6 Q9d7	1. Memory problems or lapses 2. Balance problems or dizziness 3. Ringing in the ears 4. Sensitivity to bright light 5. Irritability 6. Headaches 7. Sleep problems” 0=no 1=yes

III.3. Data Analysis

III.3.1. Overview

The primary analysis in the current study employed Structural Equation Modeling; however, before models were completed, several data analytic strategies were conducted to assess the psychometric properties of the PDHRA, including assessing specificity, sensitivity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV). There are 4 ways to compare false positives, correct positives, false negatives and correct negatives, these are: sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) (Altman & Bland, 1994; Mayer, 2004; Nugent, 2009). To establish whether the PDHRA’s level of Type I error is high, I compared the levels of type I error found in this study to accepted levels described in the literature. Typically, type 1 error is indicated by specificity and type II error is indicated by sensitivity in the literature (Akobeng, 2007; Cummins & Hazinski, 2000). I also compared the PPV and NPV found in this study to standards established in the literature and discussed the issues related to computing PPV and NPV in samples with a low prevalence of a condition of interest (Akobeng, 2007; Altman & Bland, 1994), such as the low prevalence of PTSD and depression in the present study. Unfortunately, there are no generally

accepted levels of acceptable PPV or NPV because PPV and NPV depend much more on the prevalence of the phenomenon in the sample than the psychometric qualities of the test (Altman & Bland, 1994). For this study .85 will be considered a high level of sensitivity and specificity (Newman, 2010).

III.3.2. Sensitivity and Specificity

Specificity is a measure of how well a scale identifies subjects who do not have a condition of interest. A scale that correctly identifies all subjects who do not have the condition of interest would have a specificity of 1.0 (Altman & Bland, 1994). Specificity is an indicator of Type I error. The closer a scale's sensitivity is to 1.0 the lower the Type I error produced by the scale is. The farther the specificity is from 1.0 the higher the Type I error produced by the scale (Surhone, Timpledon, & Marseken, 2009). In the present study the specificity of the PDHRA for depression and PTSD were computed.

Sensitivity is commonly used to describe the psychometric properties of a scale (Akobeng, 2007; Romine et al., 2004). Sensitivity is computed using the formula:

$$\text{sensitivity} = \frac{\text{correct positives}}{\text{correct positives} + \text{false negatives}}$$

Sensitivity is an assessment of how often a scale identifies the portion of the sample that has the condition of interest. Sensitivity is the proportion of individuals with the condition of interest that are correctly identified by the test (Akobeng, 2007). Individuals who do not have a condition of interest are not included in a sensitivity analysis. A test that identifies all subjects with the condition of interest has a sensitivity of 1.0. The difference between 1.0 and the sensitivity of a test is the false negative rate or Type II error rate (Cummins & Hazinski, 2000). Only subjects who have the condition of

interest are included in the calculation of a scale's sensitivity. In the present study the sensitivity of the PDHRA for depression and PTSD were computed. Only individuals in the present sample who have depression were included in the calculation of the PDHRA's sensitivity for depression.

Specificity is a measure of how well a scale identifies subjects who do not have a condition of interest. Specificity is computed using the formula:

$$\text{specificity} = \frac{\text{correct negatives}}{\text{correct negatives} + \text{false positives}}$$

A scale that correctly identifies all subjects who do not have the condition of interest would have a specificity of 1.0. Specificity is an indicator of Type I error. The closer a scale's sensitivity is to 1.0 the lower the Type I error produced by the scale is. The farther the specificity is from 1.0 the higher the Type I error produced by the scale. In the present study the specificity of the PDHRA for depression and PTSD were computed.

Sensitivity is an assessment of how well a scale works for the portion of the sample that has the condition of interest. Sensitivity is the proportion of individuals with the condition of interest that are correctly identified by the test (Akobeng, 2007). Individuals who do not have a condition of interest are not included in a sensitivity analysis. A test that identifies every subject with the condition of interest has a sensitivity of 1.0. The difference between 1.0 and the sensitivity of a test is the false negative rate or Type II error rate (Cummins & Hazinski, 2000).

III.3.3. Positive Predictive Value and Negative Predictive Value Positive Predictive Value (PPV)

Positive Predictive Value (PPV) is the ratio of individuals with positive test results who have the condition of interest compared to individuals with positive test results who do not have the condition of interest (Gunnarsson & Lanke, 2002). PPV indicates the diagnostic value of a test (Altman & Bland, 1994). PPV compares correct positive to false positives.

Negative Predictive Value (NPV)

Negative Predictive Value (NPV) is the ratio of individuals with negative test results who do not have the condition of interest compared to individuals with negative test results who do have the condition of interest. NPV assesses the negative diagnostic value of a test (Altman & Bland, 1994).

III.3.4. Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a statistical technique that builds on factor analysis and ordinary least squares regression. SEM allows more complex modeling of variables and the inclusion of latent variables (Kline, 2005). SEM analysis provides feedback on the direct effects of variables, like in a regression equation, but it also describes the indirect, spurious and total effects that are present in a measurement model (Bollen & Lennox, 1991). This provides a more robust description of the dynamics present within the targeted phenomenon than can be achieved with less complex statistical approaches. Additionally, SEM allows analyses of the effects of variables over time (Compas, Hinden, & Gerhardt, 1995). This type of analysis is useful when evaluating the predictive validity of an instrument, as in this study.

SEM analyses vary in their complexity. A basic structural equation model examines the pathways between observed variables. This is known as path analysis. Path analysis can be conceptualized as a series of simultaneous regressions tied together by co-variances (Kline, 2005). This study employs latent variable SEM. Latent variables are unobserved variables which are derived from a theoretically related set of observed variables through the process of factor analysis (Bollen & Lennox, 1991). The use of latent variables can diminish the sensitivity of results because some data is lost during the creation of the new variable (DeVeaux, Velleman, & Bock, 2007). However, this limitation is offset by the benefit of including a theoretically derived variable that is a better proxy for the construct of interest than any of the individual observed variables that make up the factor. In this study latent variable SEM was used to assess the relationships between observed variables and several latent factors, including trauma, depression, alcohol abuse and exposure.

Once the model's parameters have been estimated, the resulting model implied covariance matrix can then be compared to an empirical or data-based covariance matrix (Kaplan & Wenger, 1993). If the two matrices are comparable, then the structural equation model can be considered a plausible explanation for relationships between the modeled variables (Kline, 2005). Unlike least squares regression, a significant *p* value is not sufficient to claim that a meaningful relationship exists between variables. A number of fit indices have been developed to describe the overall fit of a structural equation model. Significant relationships that exist within a model are only meaningful if the

overall model fit is good (Kline, 2005). For this study four fit indices were used to suggest goodness of model fit.

Modification and Fit Indices

The first step in analyzing the results of a structural equation model is assessing model fit. Assessment of fit is a basic task in SEM modeling and forms the basis for accepting or rejecting models (Kline, 2005). Assessment of fit essentially calculates how similar the predicted data are to matrices containing the relationships in the actual data (Muthen & Muthen, 2007). The output of the Mplus statistical program used in this study includes matrices of the estimated relationships between variables in the model. In poor fitting models, the statistical significance and effect size of individual relationships within the model should not be reported (Keith, 2006; Kline, 2005). Poor fitting models should be respecified before any conclusions are drawn about relationships within the model.

When model fit is poor, various method of modification can be employed. The Lagrange Multiplier (LM) Test is one that can be used to suggest additional paths that might improve the model's fit to the data. The LM Test is expressed as a chi-square statistic with a single degree of freedom and estimates the amount the overall model chi-square would decrease if an unconstrained path that was not originally estimated were added to the model (Kline, 2005, p. 148). The LM Test is calculated for all variables in a proposed model in Mplus by adding the MODINDICIES command to the OUTPUT instruction (Muthen & Muthen, 2007). Paths should only be added to poor fitting models

using the LM Test when they are theoretically supported to avoid capitalizing on chance (Kline, 2005).

Model fit can also be improved by using the Wald Chi-Square Test. Similar to the LM Test, the Wald Statistic is expressed as a chi-square statistic with one degree of freedom (Keith, 2006). Where the LM Test is used to add parameters to a model, the Wald Chi-Square Test is used to trim parameters from a model. The Wald Statistic approximates the amount that the overall chi-square statistic would increase if a freely estimated parameter were removed from the model (Kline, 2005). The Wald Statistic is computed by Mplus by entering a MODEL CONSTRAINT command under the MODEL instruction (Muthen & Muthen, 2007). When building a data driven model, the Wald Chi-Square Test should be used to determine the most parsimonious model (Kline, 2005, pp. 147-149).

In the current study LM Tests were only considered to improve poor fitting models that could be theoretically supported. As the models tested in this study were theoretically derived, the Wald Statistic was not used to trim parameters in poorly fitting models. In addition, removing theoretically supported relationships to improve model fit would have eliminated important data from the findings of this study. As it is important to know if relationships that have been identified in previous literature are applicable in the framework of this study, removing parameters might have eliminated important negative findings. Thus, neither of these modification strategies to improve model fit was utilized in this study.

SEM model tests are based on the assumption that the correct and complete relevant data have been modeled (Kline, 2005). In the SEM literature, discussion of fit has led to a variety of different recommendations on the precise application of the various fit indices and hypothesis tests (Bollen & Lennox, 1991; Dion, 2008). In this study four fit indices will be used to determine model fit and are discussed below.

Chi Square (X^2)

One fit test of model fit that will be used in this study is chi square (X^2). The X^2 test is the most used nonparametric statistical test (Keith, 2006). Chi Square is employed to test the difference between an actual sample and another hypothetical distribution such as that which may be expected due to chance or probability. In structural equation modeling an insignificant X^2 is desirable. An insignificant X^2 suggests that the model and the data are consistent with one another. This suggests that the model could produce a meaningful approximation of the phenomenon being studied (Keith, 2006).

Bentler's Comparative Fit Index (CFI)

The comparative fit index compares an experimental model of interest with a null model. The CFI compares the fit of a target model to the fit of a model in which the variables are assumed to be uncorrelated. Goodness of fit is determined by the degree of difference between the observed and predicted covariance matrices, as represented by the chi square index (Kline, 2005). In short, the CFI represents the ratio between the discrepancies of the experimental model to the null model. The CFI represents the extent to which the experimental model better explains the target phenomenon than the null model. In contrast to chi square, CFI is not very sensitive to sample size (Fan,

Thompson, & Wang, 1999). A model with values above .90 have traditionally been considered acceptable with recent researchers advocating closer to .95 as a desirable fit level (Hu & Bentler, 1999).

Tucker-Lewis Index (TLI)

TLI depends on the average size of the correlations in the data. If the average correlation between variables is not high, then the TLI will not be very high. TLI is relatively independent of sample size (Marsh, Balla, & McDonald, 1988). The TLI adjust for added parameters (Hu & Bentler, 1999). It can be used to compare different models or compare an experimental model to a null model. The TLI ranges between 0-1 and values greater than .90-.95 are considered acceptable (Hu & Bentler, 1999)

Root Mean-Square Error of Approximation (RMSEA)

RMSEA assesses the approximate fit of a model. This is in contrast to the X^2 statistic which describes the probability that a model fits perfectly in the population (Keith, 2006). RMSEA is particularly useful is positive and negative variates are used. RMSEA involves the approximation of a non-central chi-square distribution. REMSEA measures the degree of falseness of the null hypothesis. RMSEA increases as the degree of model misspecification increases (Kline, 2005). In SEM a RMSEA value below .05 suggests a good fitting model (Hu & Bentler, 1999).

Model Interpretation

In structural equation models significant relationships within the model cannot be meaningfully interpreted unless fit indices suggest a good fitting model. Therefore, path relationships in this study's models were only interpreted if they met the criteria for the

three fit indices described above. For good fitting models, *p-values*, path effect sizes and the r^2 for dependent variables are interpreted.

In statistical significance testing, the *p*-value is the probability that the results of a statistical model are the product of chance (DeVeaux, Velleman, & Bock, 2007; Schervish, 1996). A lower *p*-value indicates a decreased likelihood that results are the product of chance. A *p*-value of .05 corresponds to a 5% chance that statistical results were the product of chance (Schervish, 1996). Due to the large sample size included in this study, the *p*-value used to establish statistically significant relationships was .001. This corresponds to a .1% chance that modeled relationships were the product of chance.

Effect size is a measure of the strength of the relationship between two variables in a statistical sample (Hair et al., 2010). An effect size is a descriptive statistic that conveys the estimated magnitude of a relationship without making any statement about whether the apparent relationship in the data reflects a true relationship in the population (Kline, 2005). Therefore, effect sizes should only be reported in concert with *p*-values. Effect sizes for relationships that are not statistically significant should not be considered an accurate assessment of the relationship (Kelley, 2007). The standard criterion for effect sizes is: .1-.3 for a small effect. . >.3-.5 for a medium effect and >.5 for a large effect (Cohen, 1988; Kline, 2005, p. 122). Cohen (1988) does not use the term trivial, but all effect sizes <.1 in this paper were described as trivial.

Structural equation modeling (SEM) is a statistical technique that builds on least squares regression (Kline, 2005). Many of the techniques used to describe relationships in least squares regression are also used in SEM. R^2 is the square of the sample

correlation coefficient between the outcomes and their predicted values. R^2 represents the variance explained in a dependent variable by its covariates (Muthen & Muthen, 2007; Kline, 2005). The r^2 value from least squares regression serves the same function in SEM. R^2 values range from 0 to 1. An r^2 of 1 suggests that all of the variance in the dependent variable is explained by the contributions of the dependent variable's covariates (Hair, Black, Babin, & Anderson, 2010). In this study the $r^2$for each endogenous variable describes the amount of variance that is explained by all of the direct and indirect effects on that variable. For each model below the model r^2 for each endogenous variable was reported.

III.4. Specific Aims

III.4.1. Specific Aim 1: Research Questions and Analysis Strategy

Specific Aim 1: Describe the Sample

To understand the composition of Airmen included in these analyses, demographics and frequency of deployments are described. These factors are important to this study because each of them have been identified in previous literature as a risk or protective factor associated with development of PTSD and depression. The prevalence of behavioral health concerns as identified by the PDHRA is assessed. The means, standard deviations, and normality of the intervening risk factors for the study sample are described. The percentage of the sample that has diagnostic depression, diagnostic PTSD and co-morbid PTSD and depression is also described.

Research Question 1.1. *What are the characteristics of the study sample, regarding demographics and frequency of deployments and deployment experiences?*

Frequencies and descriptive statistics were used to describe sample demographics, the frequency of deployments and types of deployment experiences that were encountered by study participants.

Research Question 1.2. *What are the rates of diagnostic PTSD, diagnostic depression and co-morbid PTSD and depression within the sample?*

Frequencies and descriptive statistics were used to describe the prevalence of trauma and depressive disorders among participant Airmen.

Research Question 1.3. *Are there gender differences in pay grade, rate of deployment, alcohol use and rate of diagnostic depression and PTSD?*

Independent samples t-tests were used to compare genders across pay grades, deployment rate and mental health diagnoses.

III.4.2. Specific Aim 2: Research Questions and Analysis Strategy

Specific Aim 2: Examine the Internal Consistency of the Post-Deployment Health Reassessment (PDHRA) subscales for depression, alcohol use, and trauma. Describe the means, standard deviations and Cronbach's Alphas of the supplemental Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version (PCL-M) and the Patient Health Questionnaire (PHQ-9). Describe how these measures contribute to the factor structure of the Post-Deployment Health Reassessment (PDHRA).

To inform the clinical decisions made by providers who are using the PDHRA in post-deployment assessment, the reliability of the sub-scales within the PDHRA was examined. The Cronbach's α was computed for the PDHRA question sets that trigger the administration of the AUDIT, PCL-M and PHQ-9. The Cronbach's α was also computed for the AUDIT, the PCL-M and the PHQ-9. Additionally, confirmatory factor analysis was conducted on items within the PDHRA that were theoretically related to depression, trauma, alcohol consumption and traumatic exposure related symptoms. The goal of a confirmatory factor analysis is to fit a set of data by estimating its free parameters so that the predicted variances and co-variances of the observed variables are as close as possible to the corresponding observed values. Specifically, the inter-correlations among the variables are calculated and a confirmatory factor analysis is used to determine the extent to which each variable contributes to each factor and the total measurement instrument (Hu & Bentler, 1999). A CFA with good model if suggests that PDHRA items are measuring what they claim to measure, supporting the construct validity of the PDHRA.

A segment of the sample that screens positively for behavioral health concerns were offered the AUDIT, PCL-M and PHQ-9. The entire sample does not complete these supplemental measures; only subjects who screened positively for behavioral health concerns were offered these supplemental screening tools. Therefore, a second model factor analysis was conducted to assess if the inclusion of the measures alters the factor structure of the PDHRA.

<u>Research Question 2.1.</u> *What is the Cronbach's Alpha for PDHRA question sets used to identify subjects who were offered the AUDIT, PCL-M and PHQ-9?*

A Cronbach's α for PDHRA questions used to screen for the AUDIT was computed to assess the internal consistency of this question set.

Figure 10. PDHRA Screening Question Set for the AUDIT

13a. In the PAST MONTH, did you use more alcohol than you meant to?
13b. In the PAST MONTH, have you felt that you wanted to or needed to cut down on your drinking?
13c. How often do you have a drink containing alcohol?
13d. How many drinks containing alcohol do you have on a typical day when you are drinking?
13e. How often do you have six or more drinks on one occasion?

A Cronbach's α for PDHRA questions 12a, 12b, 12c and 12d was computed to assess the internal consistency of the question set used to indentify subjects who were offered the PCL-M.

Figure 11. PDHRA Screening Question Set for the PCL-M

12. Have you ever had an experience that was so frightening, horrible or upsetting that, IN THE PAST MONTH, you…
a. Have had nightmares about it or thought about it when you did not want to?
b. Tried hard not to think about it or went out of your way to avoid situations that remind you of it?
c. Were constantly on guard, watchful or easily startled?
d. Felt numb of detached from others, activities or your surroundings?

A Cronbach's α was computed for PDHRA questions 14a and 14b to assess the internal consistency of the question set used to identify subjects who were offered the PHQ-9.

Figure 12. PDHRA Screening Question Set for the PHQ-9

14. Over the PAST MONTH, have you been bothered by the following problems?
a. Little interest or pleasure in doing things
b. Feelings down, depressed or hopless

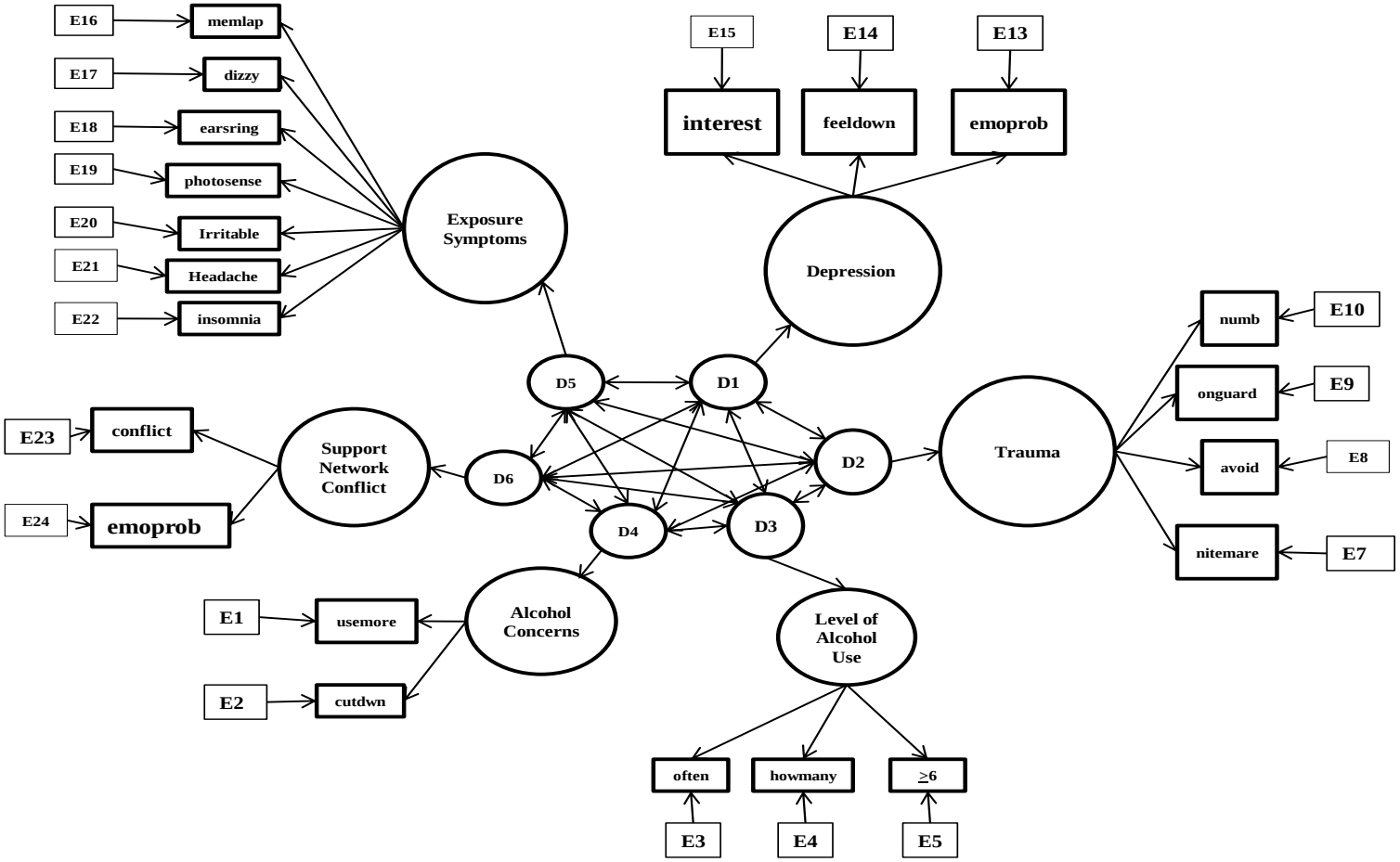
<u>Research Question 2.2</u> What are the means, standard deviations and Cronbach's α for the AUDIT, PCL-M and PHQ-9 for this sample?

The mean, standard deviation and Cronbach's α of the AUDIT, PCL-M and PHQ-9 for this sample were computed.

<u>Research Question 2.3.</u> Do PDHRA questions intended to measure depression, trauma, alcohol concerns, level of alcohol use, support network conflict and traumatic exposure related symptoms load on to unique factors? What is the model fit (X^2, CFL, TLI, RMSEA) of the confirmatory factor analysis model?

The purpose of the confirmatory factor analyses.were to determine if PDHRA items hypothesized to directly measure and indirectly relate to the latent constructs of depression and trauma are measuring these items (see Figure 17 and Figure 18).

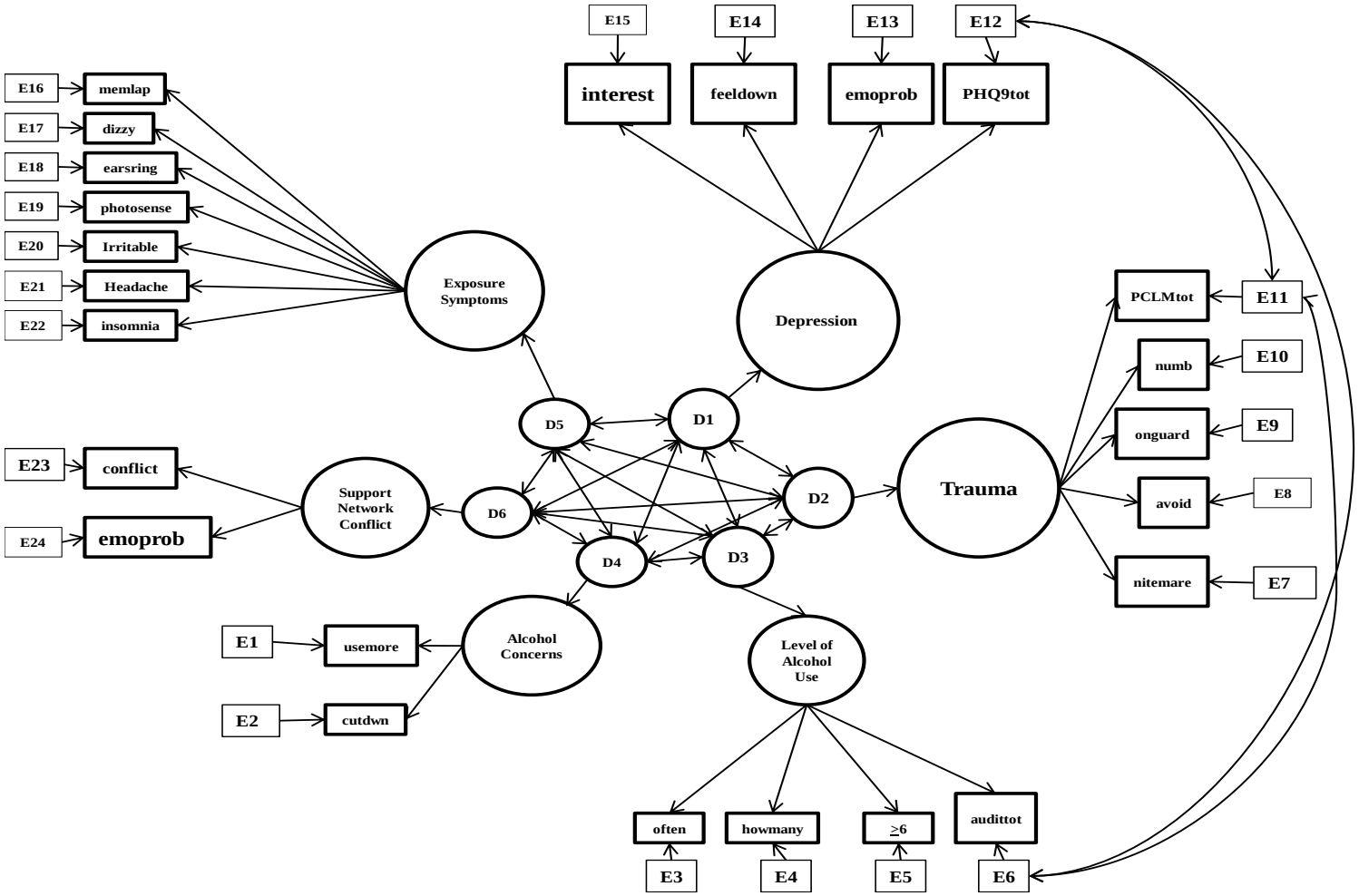
Figure 13. Post-Deployment Health Reassessment (PDHRA) Confirmatory Factor Analysis 1



Path coefficients are reported for all modeled relationships. Path coefficients are considered statistically significant at the *p<.001 level.* The overall fit of PDHRA Confirmatory Factor Analysis 1 is assessed using X^2, RMSEA, CFI and TLI.

<u>Research Question 2.4.</u> Do PDHRA items intended to measure level of alcohol use load onto a unique factor with the AUDIT? Do PDHRA questions intended to measure trauma load onto a unique factor with the PCL-M? Do PDHRA items intended to measure depression load onto a unique factor with the PHQ-9? What is the model fit (X^2, CFI, TLI and RMSEA) of the confirmatory factor analysis when the AUDIT, PCL-M and PHQ-9 variables are added?

Figure 14. Post-Deployment Health Reassessment (PDHRA) Confirmatory Factor Analysis 2



Path coefficients are reported for all modeled relationships. Path coefficients are considered statistically significant at the *p<.001 level.* The overall fit of PDHRA Confirmatory Factor Analysis 2 is assessed using X^2, RMSEA, CFI and TLI.

III.4.3. Specific Aim 3: Research Questions and Analysis Strategy

Specific Aim 3: How do PDHRA items designed to identify depression and trauma and items hypothesized to impact these conditions contribute to the overall identification of depression and trauma in this sample?

A measurement model was constructed using only PDHRA questions that were drawn from risk and resiliency theory and have been shown to have an influence on Airmen's development of trauma or depression. This model includes only items from the PDHRA. PDHRA items designed to identify physical concerns which are hypothesized to contribute to the constructs of *trauma* or *depression* were included in this model. The proposed model was a measurement model, not a causal model. PDHRA items related to *exposure symptoms, alcohol concerns, level of alcohol use, alcohol concerns* and *support network conflict* may load onto latent variables that are theoretically related to *trauma* and *depression*. The influence of these latent variables on depression and trauma was included in this model.

The variables gender, pay grade and total deployment can be treated in different ways depending on the theoretical orientation used.

1. A variety of theoretical perspectives could suggest moderating the overall measurement model with gender, pay grade or deployment frequency.

2. From a psychometric perspective these variables can be controlled for by removing them from the model

3. From a risk and resiliency theory perspective these variables can be included in the analysis to produce a regression coefficient that describes the nominal effect of the variable on the constructs of trauma and depression adjusted for the other variables included in the model.

Option 1.

Depending on the theoretical approach of the study, gender, pay grade and total deployments could be considered moderators of the measurement model. For instance, using a feminist paradigm may suggest that the authors of the PDHRA designed the measure from a male centric perspective; potentially creating inconsistent or inadequate measurement among female respondents. This conceptualization would suggest a multi-group analysis which would explain systematic differences in PDHRA completion between groups. If gender is used as a grouping variable, this would suggest that there are theoretical reasons to suspect that systematic differences in the ways that males and females complete the PDHRA are present. Because multi-group analysis requires categorical groups, grouping distinctions would have to be developed for the variables pay grade and total deployments for them to be used to moderate the measurement model. Such grouping would be guided by the hypothesized impact that group membership would have on the way group members complete the PDHRA. Therefore, the theoretical rationale for using these variables as moderators would have to be explained.

Running a multi-group analysis moderating for gender or pay grade, for instance, may result in the development of multiple models. If multiple models do not emerge, it would suggest that no systematic difference in PDHRA completion between groups. If multiple models emerge, it would suggest that respondents from different groups systematically differently. Fit indices can then be used to guide the development of better assessment tools for each group.

The basis for a mediated multi-group approach is the presence of theoretical support for believing that members of different groups would complete the Post Deployment Health Reassessment (PDHRA) differently. While there may be some gender, pay grade or total deployment related differences in survey completion, there is not a compelling theoretical basis for believing that the groups involved in this study will complete the PDHRA in systematically different ways. In fact, previous studies have not indentified important gender differences in the completion of measures that assess depression and anxiety (Crawford & Henry, 2003). A large cohort study (N=77,047) of military members did not find that survey completion was influenced by pay grade (Smith, Smith, Gray, & Ryan, 2007).

Option 2.

If the variables gender, pay grade and total deployments are viewed from a psycho-metric perspective however, they would be conceptualized as demographic or control variables. This approach would suggest that these variables were included in the PDHRA for reasons other than understanding the concepts that the PDHRA seeks to measure, trauma and depression. If gender, pay grade and total deployments are not

contributors to the measurement of trauma and depression they should be controlled for in the measurement model.

Removing observed variables measured by the PDHRA will eliminate their impact on model fit. This approach suggests that the variables that are excluded do not contribute to the explanation of variance in the measurement model, allowing variables that contribute directly to latent variables within the model to be assessed more specifically. Including variables within the measurement model will produce a path value and the statistical significance of the path value for each variable and may increase or decrease model fit indices. This strategy will describe the nominal effect of included variables on the factors of trauma and depression. Indentifying statistically significant effects within the measurement model will provide clinical information about the survey completer to clinicians who will use it as a triage tool.

Option 3.

From a risk and resiliency perspective these variables can be included in this analysis because of their hypothesized role as risk or protective factors for trauma and depression. For instance, research has consistently found that female combatants are at greater risk for developing PTSD than their male peers (Tolin & Foa, 2006). Similarly, a large cohort study (N=77,047) of military members from all branches found that elevated socio-economic status, as indicated by a higher pay-grade is protective against psychological vulnerability (Riddle, Smith, Smith, Corbeil, Engel & Wells, et al 2007). The number of times a service member has deployed can also be considered a risk factor for depression and PTSD because of the associated increase in family disruption and

exposure to traumatic events that may result from frequent deployments (Kline et al., 2010). When controlling for combat exposure, repeated combat-related traumatization has been found to increase rates of PTSD and depression in previous research (Koenen et al., 2002). Developing a measurement model for the PDHRA which includes gender, pay grade and total deployments implies that these variables were included in the PDHRA because they were relevant in measuring of the concepts of depression and trauma. The impact of these variables can be assessed by their direct effects on the latent variables, trauma and depression. Additionally, the indirect effects of gender, pay grade and number of deployments on the observed variables that contribute to the depression and trauma factors will also suggest the risk that each of these exogenous variables contributes. In this study only option three will be explored.

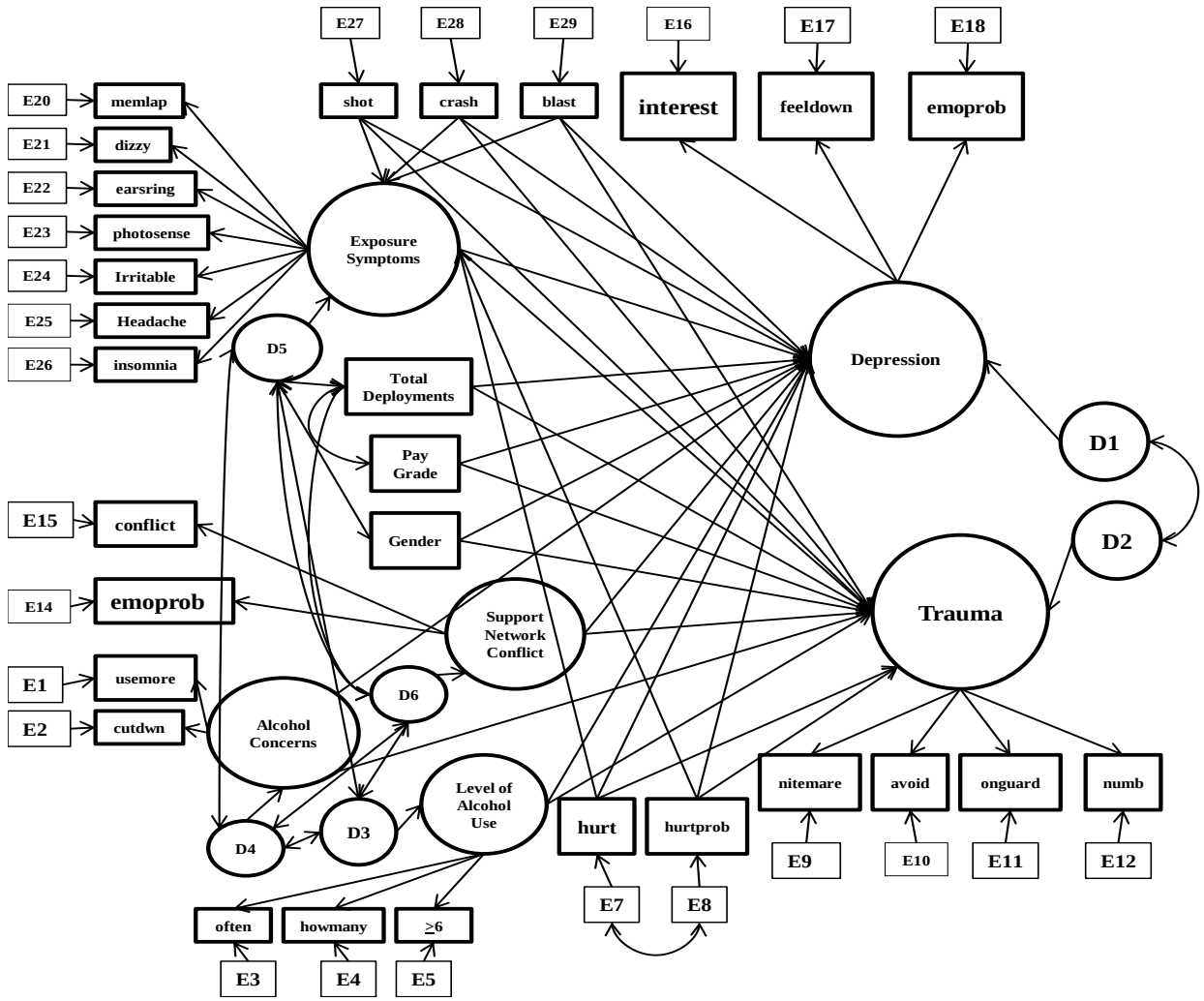
Risk and Resiliency Theory Derived Measurement Model

The purpose of this aim was to develop a measurement model using information on the PDHRA which provided clinicians with clinically useful information. Therefore all theoretically relevant variables were included in this model. The inclusion of gender, pay grade and total deployments were included to determine if they provide clinical utility for medical professionals who receive completed PDHRAs. For instance, if the proposed measurement model identifies a statistically significant effect associated with being female or being in a particular pay grade on depression, providers may be encouraged to increase screening for that particular condition with this group. Therefore, these variables were included in the measurement model. The proposed measurement

model for the PDHRA is below. Model fit will be assessed using CFI, TLI, X^2, and RMSEA.

> <u>Research Question 3.1.</u> *To what extent do the PDHRA questions that measure exposure symptoms, alcohol concerns, level of alcohol use, support network conflict, injury type (gunshot above the shoulders, vehicle crash, explosion/blast), total deployments, pay grade and gender effect the depression and trauma factors?* (See Figure 14.) *What is the model fit, X^2, CFI, TLI and RMSEA, of the measurement model?*

Figure 15. Post-Deployment Health Reassessment (PDHRA) Measurement Model 1.

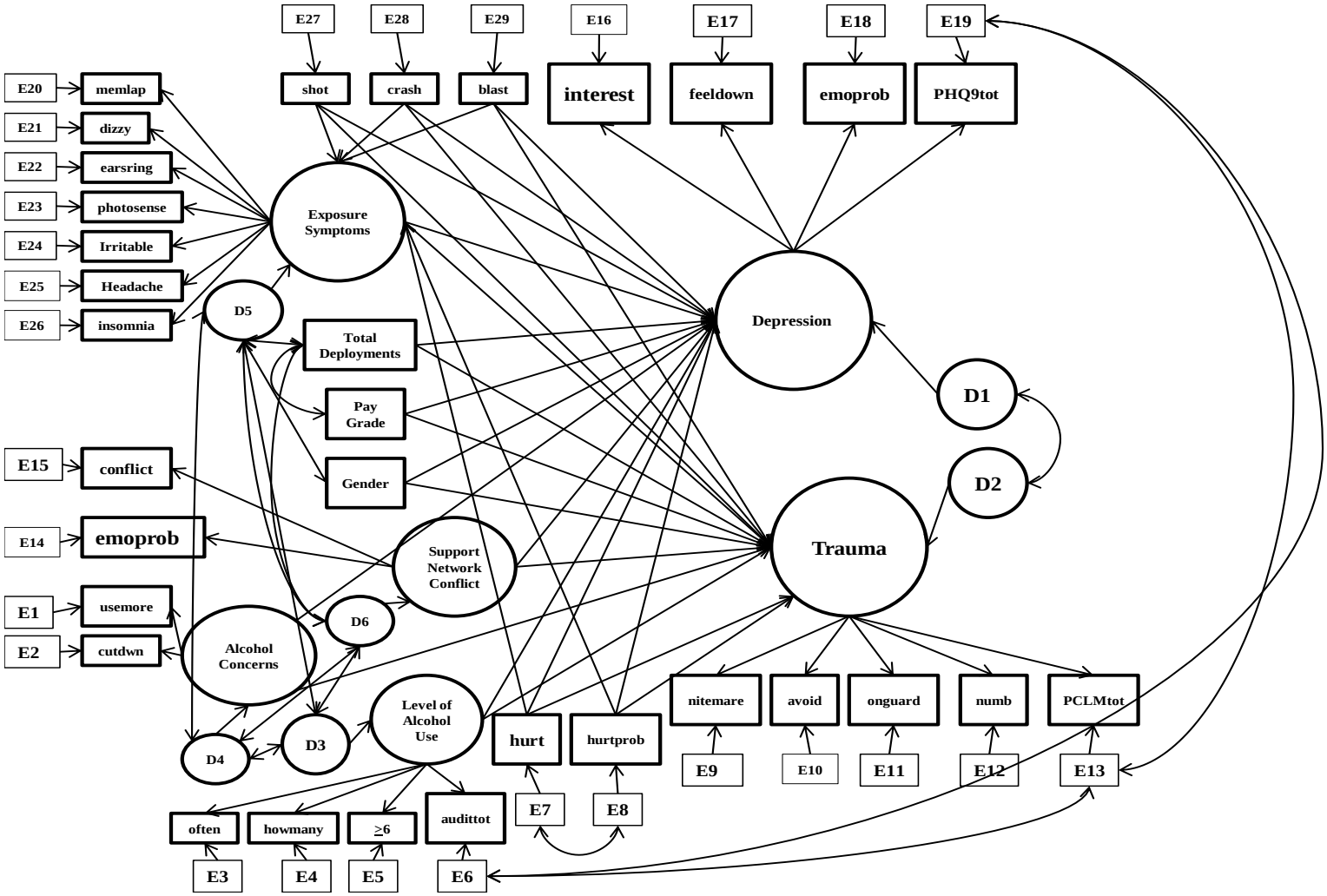


Path coefficients are reported for all modeled relationships. Path coefficients were considered statistically significant at the *p<.001 level.* The overall fit of PDHRA Measurement Model 1 was assessed using X^2, RMSEA, CFI and TLI.

The PDHRA offers the Alcohol Use Disorders Identification Test (AUDIT), PTSD Checklist-Military Version (PCL-M) and the 9-item Patient Health Questionnaire (PHQ-9) to respondents who screen positively for depression, trauma and alcohol concerns respectively, as described in RQ3.1. Subjects who do not screen positively on these items do not receive these supplemental measures. Therefore, a second measurement model is developed which will include subject's scores on the AUDIT, the PCL-M and the PHQ-9 (see Figure 16).

Research Question 3.2. To what extent do the PDHRA questions that measure exposure symptoms, alcohol concerns, level of alcohol use, support network conflict, injury type (gunshot above the shoulders, vehicle crash, explosion/blast), total deployments, pay grade and gender effect the depression and trauma factors when the AUDIT, PCL-M and PHQ-9 variables are added? What is the model fit, X^2*, CFI, TLI and RMSEA, of the measurement model?*

Figure 16. Post-Deployment Health Reassessment (PDHRA) Measurement Model 2.



Path coefficients are reported for all modeled relationships. Path coefficients are considered statistically significant at the *p<.001 level.* The overall fit of PDHRA Measurement Model 2 is assessed using X^2, RMSEA, CFI and TLI.

III.4.4. Specific Aim 4: Research Questions and Analysis Strategy

Specific Aim 4: Describe the psychometric properties and clinical value of the PDHRA for identifying individuals with a depressive or trauma-related diagnosis.

The fourth specific aim of this study builds on the third. This specific aim seeks to examine the psychometric qualities of the PDHRA and identify clinically relevant information that is present within the PDHRA assessment that can be used by medical providers to identify subjects with PTSD or depression. This aim examines the efficacy of the present PDHRA process for identifying behavioral health concerns. Four measures are commonly used to characterize the psychometric properties and clinical utility of a measure, these are: sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) (Akobeng, 2007).

Sensitivity and specificity are commonly used to describe the psychometric properties of a scale (Akobeng, 2007; Romine et al., 2004). Sensitivity is computed using the formula:

$$\text{sensitivity} = \frac{\text{correct positives}}{\text{correct positives} + \text{false negatives}}$$

Sensitivity is an assessment of how often a scale identifies the portion of the sample that has the condition of interest. Sensitivity is the proportion of individuals with the condition of interest that are correctly identified by the test (Akobeng, 2007). Individuals who do not have a condition of interest are not included in a sensitivity

analysis. A test that identifies all subjects with the condition of interest has a sensitivity of 1.0. The difference between 1.0 and the sensitivity of a test is the false negative rate or Type II error rate (Cummins & Hazinski, 2000). Only subjects who have the condition of interest are included in the calculation of a scale's sensitivity. In the present study the sensitivity of the PDHRA for depression and PTSD were computed. Only individuals in the present sample who have depression were included in the calculation of the PDHRA's sensitivity for depression.

Specificity is a measure of how well a scale identifies subjects who do not have a condition of interest. Specificity is computed using the formula:

$$\text{specificity} = \frac{\text{correct negatives}}{\text{correct negatives} + \text{false positives}}$$

A scale that correctly identifies all subjects who do not have the condition of interest would have a specificity of 1.0. Specificity is an indicator of Type I error. The closer a scale's sensitivity is to 1.0 the lower the Type I error produced by the scale is. The farther the specificity is from 1.0 the higher the Type I error produced by the scale. In the present study the specificity of the PDHRA for depression and PTSD were computed.

Positive Predictive Value (PPV) is the most important measure of diagnostic value of a scale as it reflects the probability the test accurately identifies the condition being measured. In this study, PPV reflects the proportion of Airmen who have PTSD or depression and are correctly identified. Standards for the computation of PPV vary; however, PPV depends largely on the prevalence of the disease/condition within the sample (Akobeng, 2007). Some suggest that the prevalence of the condition of interest

in the sample should match the prevalence of that condition in the general population (Altman & Bland, 1994). A large military cohort study found incidence of PTSD within the previous month at 4% and 2-week incidence of depression at 3.2% (Riddle et al., 2007). Other authors suggest that 50% of the sample should have the condition of interest when computing PPV (Altman & Bland, 1994).

The formula for PPV is:

$$\text{PPV} = \frac{\text{correct positives}}{\text{correct positives+false positives}}$$

A scale with high negative predictive value (NPV) accurately identifies individuals who do not have the condition of interest (Mayer, 2004). In this study, NPV reflects the proportion of Airmen identified by the PDHRA no behavioral health concerns who are not later diagnosed with these disorders. A scale with high NPV is a valuable tool to guide the allocation of medical resources, by screening out those who are not in need of care. In the context of the Post-Deployment Health Reassessment (PDHRA) negative predictive value may be beneficial to avoid pathologizing normal responses to post-deployment stress (Richard, 2003). Recent research has found that deficit focused interventions for normal responses to stress can increase negative outcomes (Ruzek, 2008).

The Formula for NPV is:

$$\text{NPV} = \frac{\text{correct negatives}}{\text{correct negatives} + \text{false negatives}}$$

After computing the sensitivity, specificity, PPV and NPV, the structural measurement models in Figure 19 and Figure 20 were supplemented with paths to

diagnostic depression and PTSD. Path values from the measurement models to the endogenous variables of diagnostic depression and PTSD are used to suggest the overall clinical utility of the PDHRA measurement model for identifying diagnostic depression and PTSD. The overall model fit of combined PDHRA measurement model and path model was assessed. Additionally, the variance explained in the endogenous variables, diagnostic categorizations, was described. Model fit indices,X^2, RMSEA, CFI and TLI are use to determine fit.

Research Question 4.1. Are depression diagnoses or PTSD diagnosis more common among individuals with a PDHRA that is positive for behavioral health concerns than among individuals with a PDHRA that is negative for behavioral health concerns?

A chi-square statistic will be calculated for positive behavioral health concerns on the PDHRA and depression and PTSD diagnoses.

Research Question 4.2. What are the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the PDHRA for a depressive diagnosis?

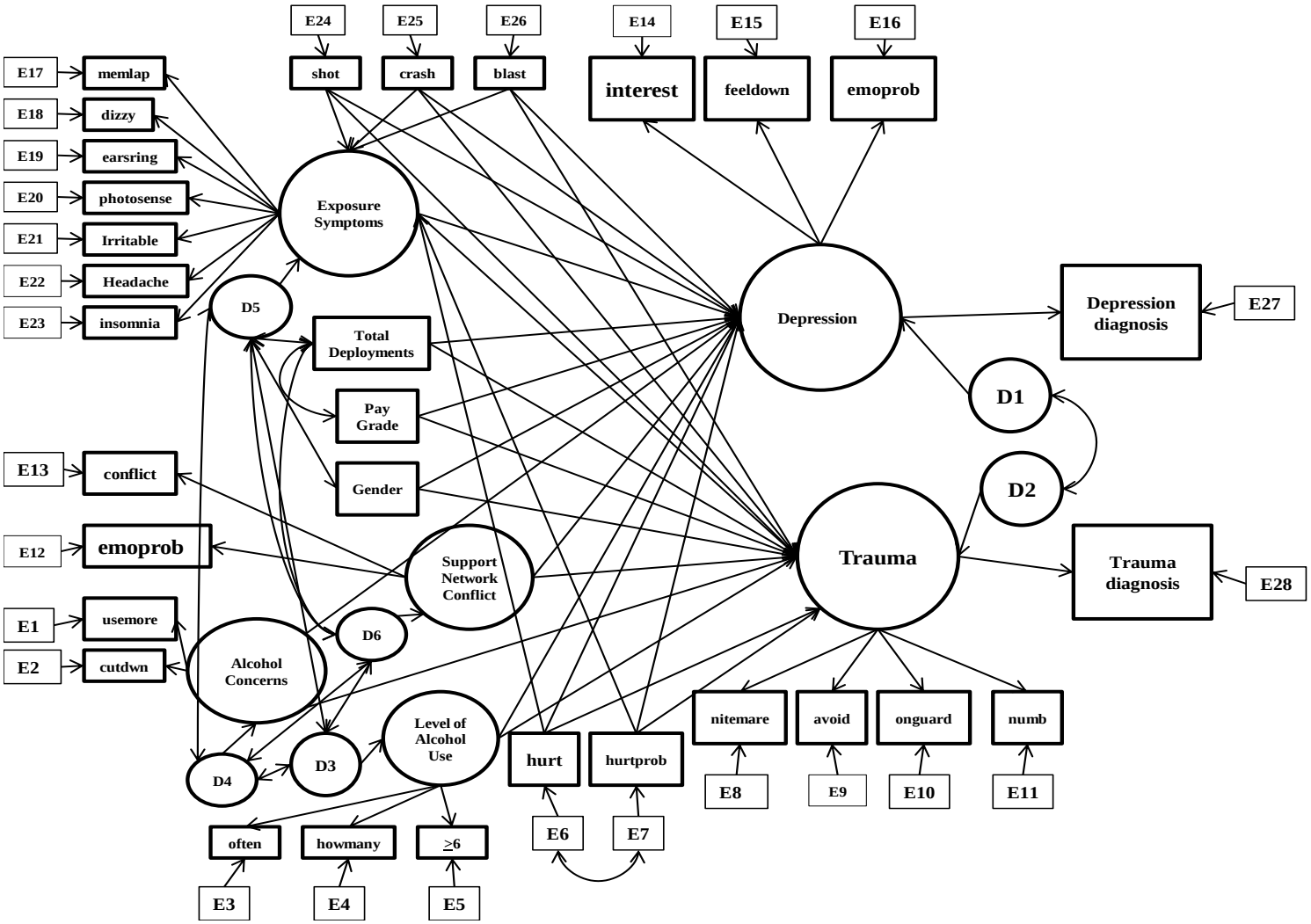
Research Question 4.3. What are the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the PDHRA for post-traumatic stress disorder?

The sensitivity, specificity, PPV and NPV of the PDHRA for depression and PTSD were calculated.

<u>Research Question 4.4.</u> What is model fit and variance explained for endogenous variables when adding paths to clinical diagnosis of PTSD and depression to the Post-Deployment Health Reassessment (PDHRA) Measurement Model 1? What is the model fit, X^2, CFI, TLI and RMSEA of the PDHRA Path Model 1? (See Figure 17.)

Path coefficients are reported for all modeled relationships. Path coefficients are considered statistically significant at the $p<.001$ *level.* The overall fit of PDHRA Path Model 1 is assessed using X^2, RMSEA, CFI and TLI.

Figure 17. Post-Deployment Health Reassessment (PDHRA) Path Model 1.

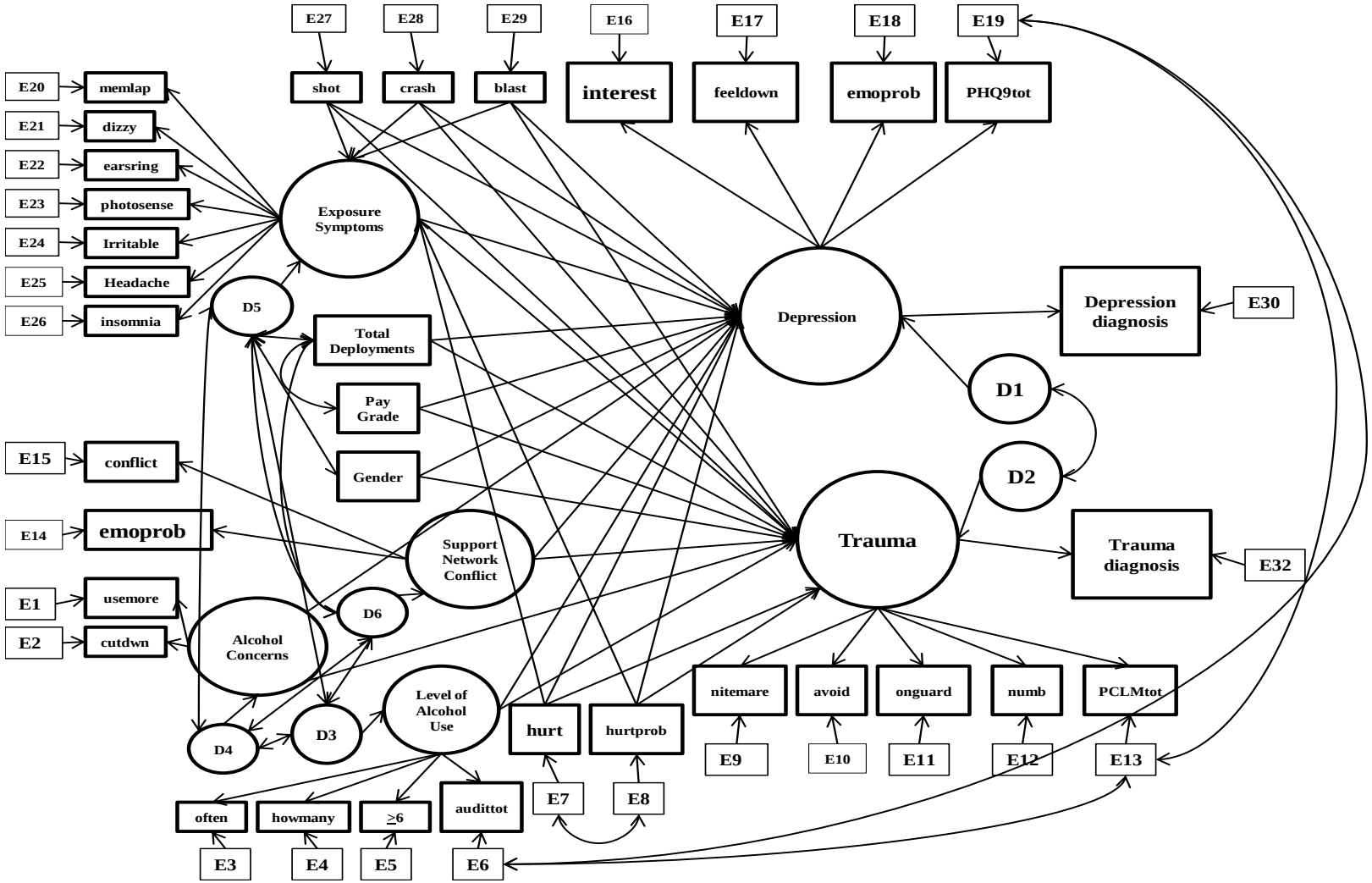


Research Question 4.5.

What is model fit and variance explained for endogenous variables when adding paths to clinical diagnosis of PTSD and depression to the PDHRA Measurement Model 2? What is the model fit, X^2, CFI, TLI and RMSEA, of PDHRA Path Model 2? (See Figure 18.)

The PDHRA offers the Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version (PCL-M) and the 9-item Patient Health Questionnaire (PHQ-9) to respondents who screen positively for alcohol concerns, trauma and depression respectively, as described in RQ3.1. Subjects who do not screen positively on these items do not receive these supplemental measures. Therefore, a second measurement model was developed which includes subject's scores on the AUDIT, the PCL-M and the PHQ-9. A second model was developed that can be used by medical providers to identify subjects with PTSD or depression. The structural measurement model, which includes the AUDIT, PCL-M and PHQ-9 was supplemented with a path model. Path values from the measurement model to the endogenous variables of diagnostic depression and PTSD were used to suggest the overall clinical utility of the PDHRA measurement model for identifying diagnostic depression and PTSD. The overall model fit of combined PDHRA measurement model and path model were assessed and the variance explained in the endogenous variables and diagnostic categories described. Model fit indices, X^2, RMSEA, CFI and TLI will be use to determine fit.

Figure 18. Post-Deployment Health Reassessment (PDHRA) Path Model 2



Path coefficients are reported for all modeled relationships. Path coefficients are considered statistically significant at the *p<.001 level.* The overall fit of PDHRA Path Model 2 is assessed using X^2, RMSEA, CFI and TLI.

IV. RESULTS

IV.1. Specific aim 1: Describe the sample.

Research Question 1.1. What are the characteristics of the study sample, regarding demographics and frequency of deployments and deployment experiences?

Pay grades ranged from Airman Basic (E-1) through Major General (0-8). A majority of the sample was enlisted (N=48,290). The officer corps made up about 17% of the sample (N=9,817). The largest group represented in this study were Staff Sergeants (E-5) (N=15,139). Males were over represented in this study. Males made up 85% of the sample (N=49,383). Females make up 19% of the total Air Force ("Military Demographics," 2010). In this study only 15% of the sample was represented by female respondents.

The average respondent in this study had deployed twice *(M= 1.98, SD=1.76).* A large part of the sample (17.8%) had not deployed to a combat zone, but was sent to more forward locations, like Germany to assist with combat operations. A considerable number of the subjects in this study were exposed to direct combat. A significant segment of the sample, 13.4% (N=7,823), endorsed exposure to an explosion or blast. A smaller portion of the sample, 3% (N=1,757), reported experiencing a vehicular crash during their deployment. Very few respondents (N=33) were wounded by a gunshot or fragmentary projectile. This may be due to a combination of battlefield tactics, such as the reliance on improvised explosive devices, and the lethality of such injuries.

Research Question 1.2. What are the rates of diagnostic PTSD, diagnostic depression and co-morbid PTSD and depression within the sample?

Over one-third (35.1%) of the sample were identified by the PDHRA for having behavioral health concerns. Although 16.5% of the sample endorsed one or more traumatic combat experiences, the sample had a very low prevalence of PTSD .3% (N=160) and depression .6% (N=338). PTSD and depression were significantly correlated in this sample *(r=.346, p<.001)*. In total .1% (N= 81) of subjects were diagnosed with co-morbid PTSD and depression.

Research Question 1.3. Are there gender differences in pay grade, rate of deployment, alcohol use and rate of diagnostic depression and PTSD?

Males (*M=2.01, SD=1.80)* were more likely to deploy than females (*M=1.50, SD=1.80)* from this sample *t(58.240)=25.64, p<.001*. The prevalence of PTSD was .5% among females and .2% among males. The prevalence of depression was 1.3% among females and .4% among males. Proportionately, females were significantly more likely to receive a diagnosis of PTSD, *t(58,240)= -4.997, p<.001*, and depression, *t(58,240)=-10.123, p<.001*, than their male counterparts . Females were also significantly closer to the clinical cut off for alcohol dependence than males t(12,295)=-1.79, *p*<.001. The clinical cutoff for females (*M=10*.57) on the AUDIT is a score of 12. The clinical cut off for males (*M=11*.99) on the AUDIT is 14. There was also statistically significant gender difference in pay grade *t(50,240)=4.21, p<.001*. While a statistical difference in pay grade existed, the importance of this difference is unclear. The mean difference in pay grade between males (*M=6.3)* and females *(M=6.2)* was very small.

Table 1. Sample Characteristics

Variable	Gender Male	Female	Total
Pay Grade			
Civilian	109	26	135
E-1	11	1	12
E-2	136	26	162
E-3	4,359	867	5,226
E-4	9,991	1,956	11,947
E-5	12,071	2,438	15,139
E-6	7,617	1,230	8,847
E-7	4,639	622	5,261
E-8	1,122	128	1,250
E-9	405	41	446
0-1	79	20	99
0-2	915	246	1,161
0-3	3,847	735	4582
0-4	1,890	337	2,227
0-5	1,358	166	1,524
0-6	195	20	215
0-7	5	0	5
0-8	4	0	4
PDHRA Behavioral Health Concerns	16,787	3,642	20,429
Depression Diagnosis	220	118	338
PTSD Diagnosis	113	47	160
Co-morbid PTSD and Depression	52	29	81
AUDIT Score	12.32 (SD=5.86)	10.57 (SD=6.01)	11.99 (5.93)
PCL-M Score	6.50 (SD=13.71)	8.71 (SD=15.46)	6.91 (14.08)
PHQ-9 Score	1.93 (SD=6.09)	2.82 (SD=7.45)	2.10 (6.37)

IV.2. Specific Aim 2: Examine the Internal Consistency of the Post-Deployment Health Reassessment (PDHRA) subscales for depression, alcohol use, and trauma. Describe the means, standard deviations and Cronbach's

Alphas of the supplemental Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version (PCL-M) and the Patient Health Questionnaire (PHQ-9). Describe how these measures contribute to the factor structure of the Post-Deployment Health Reassessment (PDHRA).

Research Question 2.1. *What is the Cronbach's Alpha for PDHRA question sets used to identify subjects who will be offered the PHQ-9, AUDIT and PCL-M?*

The Cronbach's alpha for the PDHRA question set used to screen for the AUDIT, is at the bottom or even below of the acceptable range for nomenthetic research (α=.60). The Cronbach's alpha for the PDHRA question set used to screen for the PCL-M is within the acceptable range for nomenthetic research (α=.76). The Cronbach's alpha for the question set used to screen for the PHQ-9, PDHRA questions 14a and 14b, was high enough to serve as a guide for clinical decision making (α=.83) (Abell, Springer, & Kamata, 2009; Bland & Altman, 1997; Hair, Black, Babin, & Anderson, 2010).

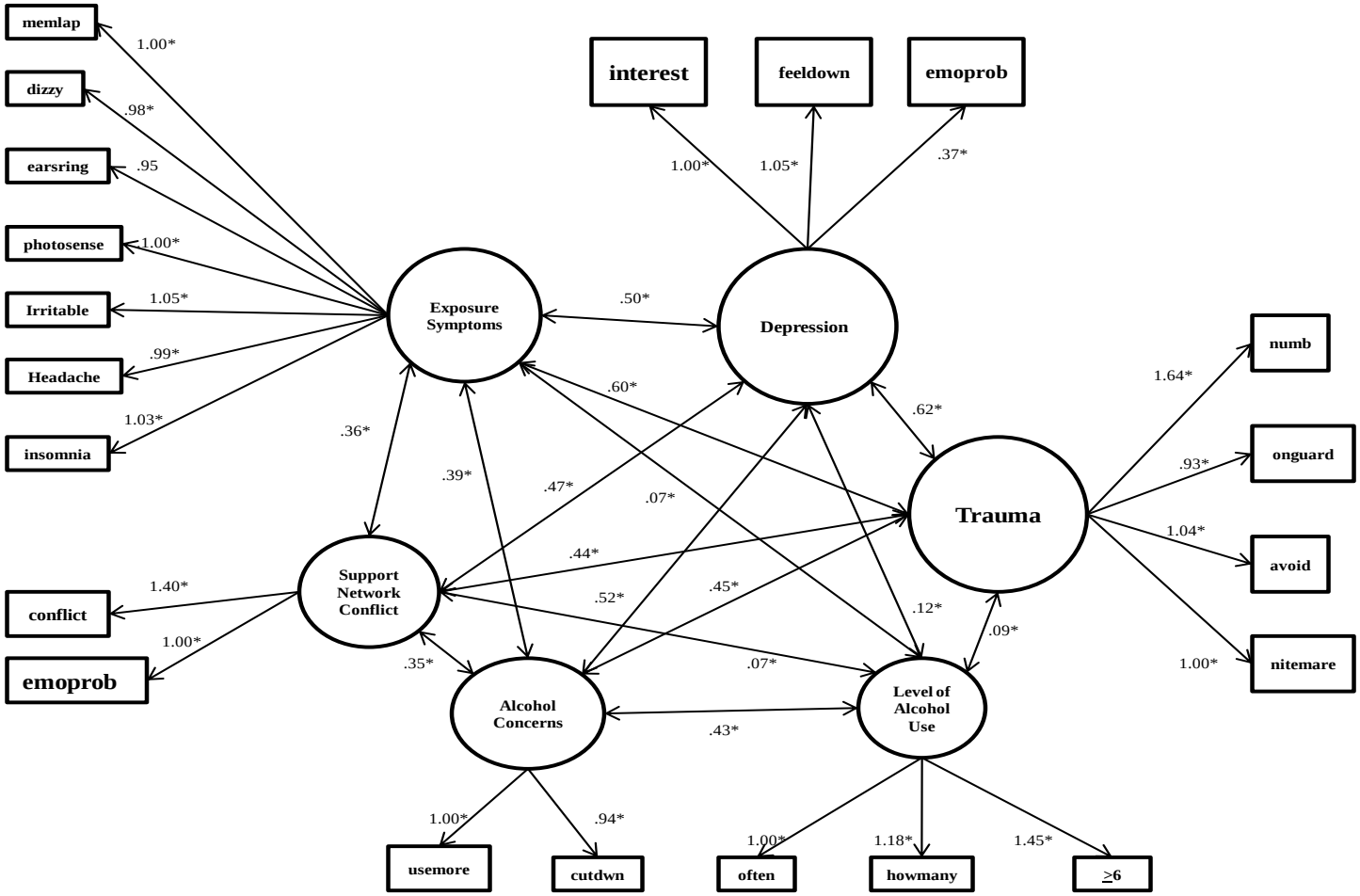
Research Question 2.2 *What are the means, standard deviations and Cronbach's α for the AUDIT, PCL-M and PHQ-9 for this sample?*

The internal consistency of the AUDIT when given within the PDHRA is excellent (α=.93). The mean of the sample *(M=11.99, SD=5.93)* was significantly above the clinical score of 8 which is indicative of problematic drinking and approaching the clinical cutoff of 13 for females and 15 for males which is likely to indicate alcohol dependence (Saunders, Aasland, Babor, Fuente, & Grant, 1993). Like the AUDIT and PCL-M the internal consistency of the PHQ-9 was excellent (α=.98). The mean score of subjects completing the PCL-M is more than three standard deviations below the PCL-

M's clinical cutoff level of 50 (*M=6.91, SD=14.08)* (Weathers & Ford, 1996). The internal consistency of the PHQ-9 was also excellent in this sample (α=.99). The mean of the PHQ-9 *(M=2.10, SD=9.37)* for this sample was within one standard deviation of the clinical concerns range of 5 for mild concerns and 10 for moderate concerns. A PHQ-9 score of 15 indicates moderate severe concerns and a score of 20 indicates severe concerns (Kroenke, Spitzer, & Williams, 2001).

> *<u>Research Question 2.3.</u> Do PDHRA questions intended to measure depression, trauma, alcohol concerns, level of alcohol use, support network conflict and traumatic exposure related symptoms load on to unique factors? What is the model fit (X^2, CFL, TLI, RMSEA) of the confirmatory factor analysis model?*

Figure 19. Post-Deployment Health Reassessment (PDHRA) Confirmatory Factor Analysis (CFA) 1 Results



IV.2.1. Confirmatory Factor Analysis (CFA) 1 Model Fit

A confirmatory factor analysis was conducted to determine the structural validity of six latent factors within the Post-Deployment Health Reassessment (PDHRA) (see Figure 19). These factors were *exposure symptoms, support network conflict, alcohol concerns, level of alcohol use, trauma* and *depression.* PDHRA CFA 1 did not include the supplemental assessment measures, the variables "audittot", "PCLMtot" or "PHQ9tot". Fit indices suggested that the proposed factor structure is a good fit to the data. The Chi-square test of model fit was significant, X^2(76, N=58,242)=1243.05, p=<.001. The significant chi-square value is likely the result of a large sample size (DeVeaux, Velleman, & Bock, 2007). Other fit indices suggested excellent fit: CFI=.99, TLI=1.00, RMESA=.02.

IV.2.2. Significant Relationships

Exposure Symptoms

The factor *exposure symptoms* consisted of 7 observed variables (see Figure 19). All 7 factor loadings made statistically significant contributions to the latent variable *exposure symptoms* (p=<.001). The variable "mamlap" was used as the reference variable in this analysis. The parameter value for the variable "memlap" was fixed at 1. The fixed parameter contributed 3% more to the latent variable *exposure symptoms* than the variable "dizzy." The variable "memlap" contributed 5% more to the factor than the variable "earsring." "memlap" contributed 1% more to the latent variable than the variable "photosense." The variable "irritable" made the largest contribution to the latent variable, *exposure symptoms*. "Irritable" contributed 5% more to the latent variable than

the fixed parameter. The variable "headache" contributed 1% less to the factor than the fixed parameter. "Insomnia" contributed 3% more to the latent variable than "memlap."

Support Network Conflict

Two observed variables contributed to the latent variable *support network conflict* (see Figure 19). Both factor loadings made statistically significant contributions to the latent variable *support network conflict* (p=<.001). "Emoprob" served as the reference variable for this factor, with a parameter value fixed at 1. "Conflict" contributed 40% more to the explanatory value of the latent variable than the fixed parameter.

Alcohol Concerns

The latent variable *alcohol concerns* had factor loadings from two observed variables (see Figure 19). Both factor loadings made statistically significant contributions to the latent variable *alcohol concerns* (p=<.001). The parameter value for "usemore" was fixed at 1. "Usemore" contribute 7% more to the latent variable than "cutdwn."

Level of Alcohol Use

Three observed variables contributed to the latent variable *level of alcohol use* (see Figure 19). Each factor loading made a statistically significant contribution to the latent variable (p=<.001). "Often" was the reference variable with a parameter value fixed at 1. "Howmany" contributed 18% more to the latent variable than the fixed parameter. "≥6" contributed 45% more to *level of alcohol use* than the fixed parameter.

Trauma

Four observed variables contributed to the latent factor *trauma* (see Figure 19). Each of these variables made statistically significant contributions to the factor (p=<.001). "Nitemare" was the reference variable for the factor *trauma.* The path value for "nitemare" was fixed at 1. "Avoid" contributed 4% more to the overall factor than the reference variable. "Onguard" contributed 6% less that the reference variable. "Numb" made the largest contribution to the factor, contributing 6% more than the reference variable.

Depression

Three observed variables contributed to the latent variable *depression* (see Figure 19). Each of the three factor loadings were statistically significant (p=<.001). "Interest" was used as the reference variable for this factor, with a path value fixed at 1. "Emoprob" contributed 61% less to the factor structure of *depression* than the reference variable. "Feeldown" made a 6% large contribution to the factor structure than the reference variable.

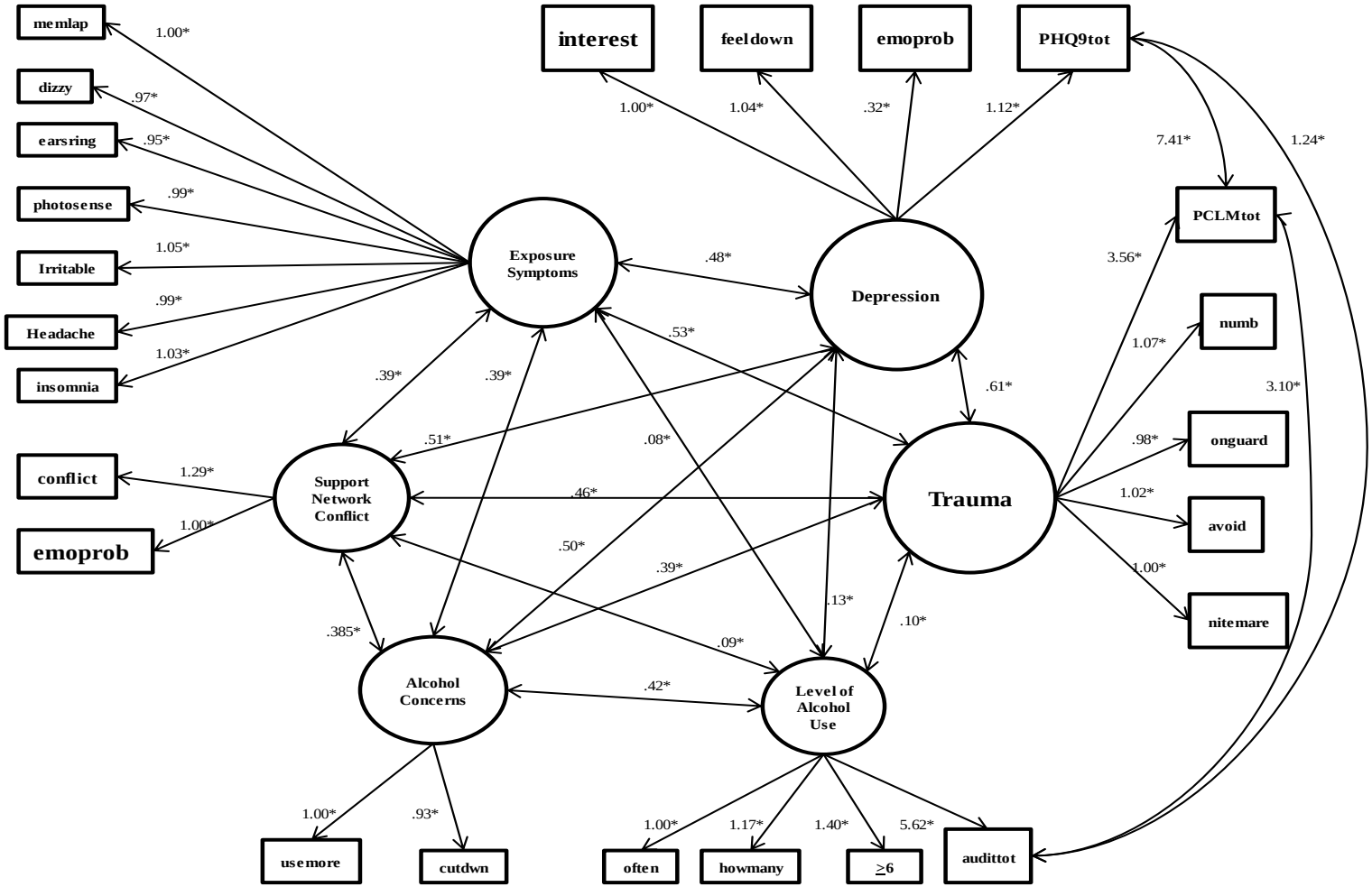
All of the co-variances that were modeled in Confirmatory Factor Analysis 1 were statistically significant (see Table 2).

Table 2. Co-variance Values for Confirmatory Factor Analysis 1

Covariances	Depression	Trauma	Exposure Symptoms	Alcohol Concerns	Level of Alcohol Use	Support Network Conflict
Depression	**1**					
Trauma	**.62***	**1**				
Exposure Symptoms	**.50***	**.60***	**1**			
Alcohol Concerns	**.52***	**.45***	**.39***	**1**		
Level of Alcohol Use	**.12***	**.09***	**.07***	**.43***	**1**	
Support Network Conflict	**.47***	**.44***	**.36***	**.35***	**.07***	**1**
***p<.001**						

<u>Research Question 2.4.</u> Do PDHRA items intended to measure level of alcohol use load on to a unique factor with the AUDIT? Do PDHRA questions intended to measure trauma load on to a unique factor with the PCL-M? Do PDHRA items intended to measure depression load on to a unique factor with the PHQ-9? What is the model fit (X^2, CFI, TLI and RMSEA) of the confirmatory factor analysis when the AUDIT, PCL-M and PHQ-9 variables are added?

Figure 20. Post-Deployment Health Reassessment (PDHRA) Confirmatory Factor Analysis (CFA) 2 Results



IV.2.3. Confirmatory Factor Analysis (CFA) 2 Model Fit

A confirmatory factor analysis was conducted to determine the structural validity of six latent factors within the Post-Deployment Health Reassessment (PDHRA) when the supplemental assessment variables the AUDIT "audittot", the PCL-M "PCLMtot" and the PHQ-9 "PHQ9tot" were included in the analysis (see Figure 20). These factors were *exposure symptoms, support network conflict, alcohol concerns, level of alcohol use, trauma* and *depression*. Using the Lagrange Multiplier Test co-variances were added between the "AUDITtot", "PCLMtot" and "PHQ9tot" variables. Fit indices suggested that the proposed factor structure is a good fit to the data. The Chi-square test of model fit was significant, X^2(92, N=58,242)=2747.34, p=<.001. The significant chi-square value is likely the result of a large sample size (DeVeaux et al., 2007). Other fit indices suggested excellent fit: CFI=.98, TLI=.99, RMESA=.02.

IV.2.4. Significant Relationships

Exposure Symptoms

The factor *exposure symptoms* consisted of the same 7 observed variables in CFA 2 as it did in CFA 1 (see Figures 19 & 20). All 7 factor loadings made statistically significant contributions to the latent variable *exposure symptoms* (p=<.001). The inclusion of the variables "audittot," "PCLMtot" and "PHQ9tot" in PDHRA CFA 2 did not change any of the factor loadings in the *exposure symptoms* variable from the results of CFA 1.

Support Network Conflict

Two observed variables contributed to the latent variable *support network conflict* (see Figure 20). Both factor loadings made statistically significant contributions to the

latent variable *support network conflict* (p=<.001). “Emoprob” served as the reference variable for this factor, with a parameter value fixed at 1. The inclusion of the variables “PHQ9tot”, “audittot” and “PCLMtot” in PDHRA CFA2 reduced the contribution of the variable “conflict” to the *support network conflict* factor. “Conflict” contributed 29% times more to the explanatory value of the latent variable than the fixed parameter.

Alcohol Concerns

The latent variable *alcohol concerns* had factor loadings from two observed variables (see Figure 20). Both factor loadings made statistically significant contributions to the latent variable *alcohol concerns* (p=<.001). The parameter value for “usemore” was fixed at 1. “Usemore” contribute 7% more to the latent variable than “cutdwn.” The factor loadings for *alcohol concerns* in CFA 2 are identical to the factor loadings in CFA 1.

Level of Alcohol Use

Four observed variables contributed to the latent variable *level of alcohol use* (see Figure 20). Each factor loading made a statistically significant contribution to the latent variable (p=<.001). “Often” was the reference variable with a parameter value fixed at 1. “Howmany” contributed 17% more to the latent variable than the fixed parameter. “≥6” contributed 40% more to *level of alcohol use* than the fixed parameter. The variable “audittot” made, by far the largest contribution to the latent variable *level of alcohol use*. “Audittot” contributed 562% more to the latent variable than the fixed parameter.

Trauma

Five observed variables contributed to the latent factor *trauma* (see Figure 20). Each of these variables made statistically significant contributions to the factor (p=<.001). "Nitemare" was the reference variable for the factor *trauma*. The path value for "nitemare" was fixed at 1. "Avoid" contributed 2% more to the overall factor than the reference variable. "Onguard" contributed 2% less that the reference variable. "Numb" contributed 7% more than the reference variable. "PCLMtot" contributed 356% more to the factor than the reference variable.

Depression

Four observed variables contributed to the latent variable *depression* (see Figue 20). Each of the four factor loadings were statistically significant (p=<.001). "Interest" was used as the reference variable for this factor, with a path value fixed at 1. "Emoprob" contributed 68% less to the factor structure of *depression* than the reference variable. "Feeldown" made a 4% large contribution to the factor structure than the reference variable. The variable "PHQ9tot" contributed 12% more to the factor structure than the reference variable.

All of the co-variances modeled in Confirmatory Factor Analysis 2 were statistically significant (see Table 3).

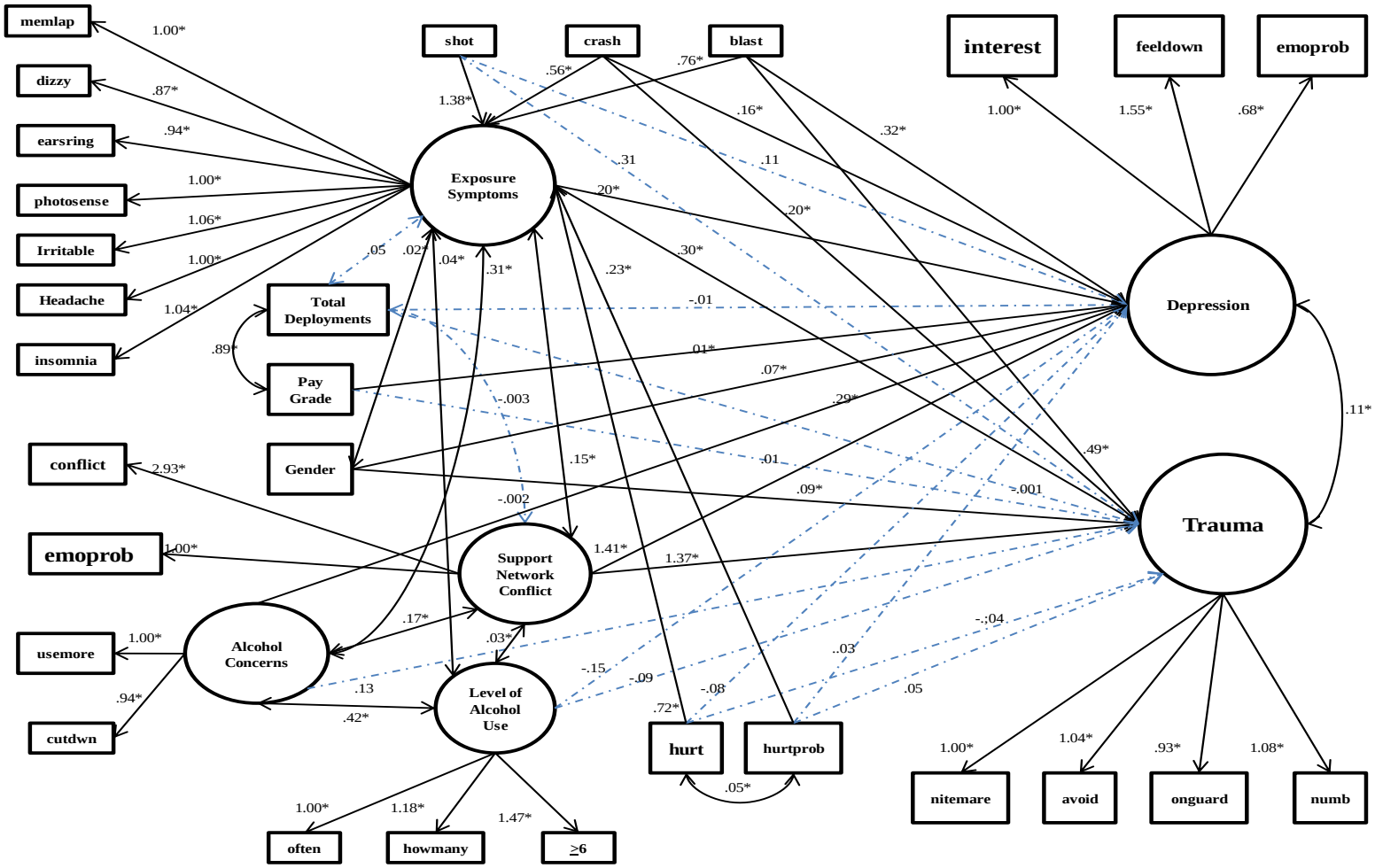
Table 3. Co-variance Values for Confirmatory Factor Analysis 2

Covariances	Depression	Trauma	Exposure Symptoms	Alcohol Concerns	Level of Alcohol Use	Support Network Conflict	PHQ9tot	PCLMtot	AUDITtot
Depression	1								
Trauma	.61*	1							
Exposure Symptoms	.48*	.53*	1						
Alcohol Concerns	.50*	.41*	.39*	1					
Level of Alcohol Use	.13*	.10*	.08*	.42*	1				
Support Network Conflict	.51*	.46*	.39*	.39*	.09*	1			
PHQ9tot							1		
PCLMtot							7.41*	1	
AUDITtot							1.24*	3.10*	1
*p<.001									

IV.3. Specific Aim 3: How do PDHRA items designed to identify depression and trauma and items hypothesized to impact these conditions contribute to the overall identification of depression and trauma in this sample?

<u>Research Question 3.1.</u> To what extent do the PDHRA questions that measure exposure symptoms, alcohol concerns, level of alcohol use, support network conflict, injury type (gunshot above the shoulders, vehicle crash, explosion/blast), total deployments, pay grade and gender effect the depression and trauma factors? What is the model fit, X^2, CFI, TLI and RMSEA, of the measurement model?

Figure 21. Post-Deployment Health Reassessment (PDHRA) Measurement Model 1 Results



IV.3.1. PDHRA Measurement Model 1

The results of the analysis of PDHRA Measurement Model 2 (see Figure 21) suggest a good fitting model. The Chi-square test of model fit was significant X^2(138, N=58,242)=6215.37, p=<.001. Other fit indices suggested a good to excellent fitting model: CFI=.94, TLI=.97, RMSEA=.03.

Post-Deployment Health Reassessment (PDHRA) Measurement Model 1 assesses the relationship between answers on the PDHRA and *depression* and *trauma.*

The largest direct effects in PDHRA Measurement Model 1 are produced by the latent variable *support network conflict. Support network conflict* produced a large, positive, statistically significant effect on *depression* (b=1.41, p=<.001) and *trauma* (b=1.37, p=<.001). All of the other of the direct effects on *depression* and *trauma* modeled in PDHRA Path Model 1 are small or insignificant.

Alcohol use variables accounted for little of the explained variance within PDHRA Measurement Model 1. A*lcohol concerns* had a small, positive effect on *depression* (b=.29, p=<.001); however, *alcohol concerns* did not have a statistically significant impact on *trauma* (b=.13, p=.008). *Level of alcohol use* did not produce a statistically significant effect on *depression* (b=-.15, p=.001) or *trauma* (b=-.09, p=.07). All relationships modeled in PDHRA Measurement Model 1 are displayed in Table 4.

Table 4. PDHRA Measurement Model 1

IV/DV	*b*	*S.E.*	*p*	*Effect Size*
Shot/ Exposure Symptoms	1.38*	.18	<.001	large
Crash/ Exposure Symptoms	.56*	.05	<.001	large
Blast/ Exposure Symptoms	.76*	.04	<.001	large
Hurt/ Exposure Symptoms	.72*	.04	<.001	large
Hurtprob/ Exposure Symptoms	.23*	.05	<.001	small
Exposure Symptoms/ Depression	.19*	.03	<.001	small
Exposure Symptoms/ Trauma	.30*	.03	<.001	moderate
Shot/ Depression	.11	.17	.506	small
Shot/ Trauma	.31	.15	.042	moderate
Crash/ Depression	.16*	.03	<.001	small
Crash/ Trauma	.19*	.03	<.001	small
Blast/ Depression	.32*	.03	<.001	moderate
Blast/ Trauma	.49*	.03	<.001	moderate
Hurt/ Depression	-.08	.03	.006	trivial
Hurt/ Trauma	-.04	.03	.122	trivial
Hurtprob/ Depression	.03	.03	.321	trivial
Hurtprob/ Trauma	.05	.03	.103	trivial
Total Deployments/ Depression	-.01	.005	.098	trivial
Total Deployments/ Trauma	-.001	.01	.818	trivial
Pay Grade/ Depression	.01*	.002	<.001	trivial
Pay Grade/ Trauma	.01	.003	.035	trivial
Gender/ Depression	.07*	.02	<.001	trivial
Gender/ Trauma	.09*	.02	<.001	trivial
Support Network Conflict/ Depression	1.41*	.08	<.001	large
Support Network Conflict/ Trauma	1.37*	.09	<.001	large
Alcohol Concerns/ Depression	.29*	.04	<.001	small
Alcohol Concerns/ Trauma	.13	.05	.008	small
Level of Alcohol Use/ Depression	-.15	.04	.001	trivial
Level of Alcohol Use/ Trauma	-.09	.05	.071	trivial
*p<.001				

All co-variances modeled in Measurement Model 1 are described in Table 5.

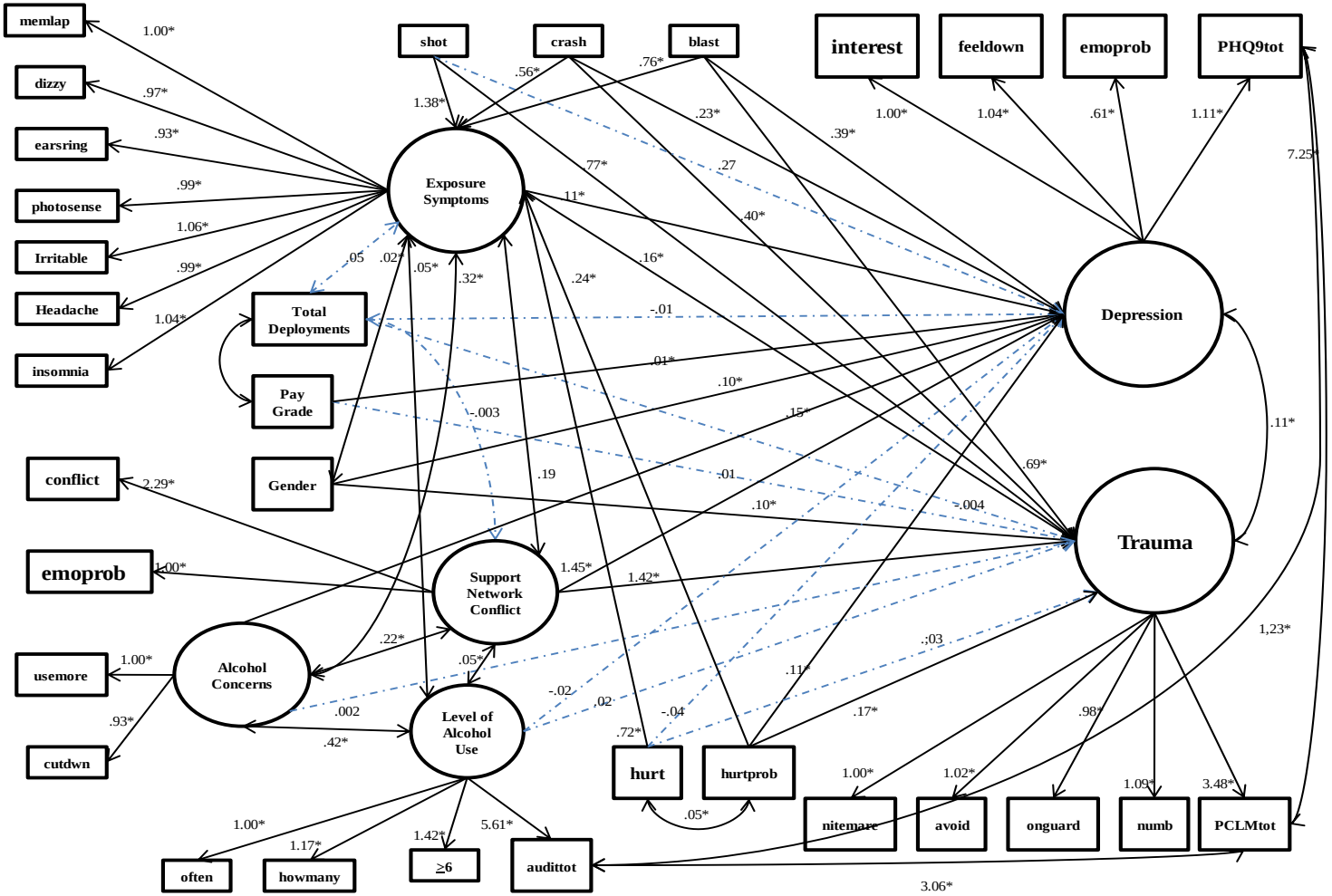
Table 5. Co-variances Modeled in PDHRA Measurement Model 1

Variables	*b*	*S.E.*	*p*
Exposure Symptoms/ Total Deployments	.05	.03	.09
Exposure Symptoms/ Gender	.02	.01	.001
Exposure Symptoms/ Level of Alcohol Use	.04	.01	.001
Exposure Symptoms, Alcohol Concerns	.31	.03	<.001
Exposure Symptoms/ Support Network Conflict	.15	.01	<.001
Total Deployments/ Pay Grade	.89	.02	<.001
Total Deployments/ Support Network Conflict	-.002	.01	.75
Support Network Conflict/ Level of Alcohol Use	.03	.003	<.001
Support Network Conflict/ Alcohol Concerns	.17	.01	<.001
Alcohol Concerns/ Level of Alcohol Use	.42	.01	<.001
Hurt/ hurtprob	.05	.002	<.001
Depression/ Trauma	.11	.01	<.001
*p<.001			

<u>Research Question 3.2.</u> To what extent do the PDHRA questions that measure exposure symptoms, alcohol concerns, level of alcohol use, support network conflict, injury type (gunshot above the shoulders, vehicle crash, explosion/blast), total deployments, pay grade and gender effect the depression and trauma factors

when the AUDIT, PCL-M and PHQ-9 variables are added? What is the model fit, X^2, CFI, TLI and RMSEA, of the measurement model?

Figure 22. Post-Deployment Health Reassessment (PDHRA) Measurement Model 2 Results



IV.3.2. PDHRA Measurement Model 2

The results of the analysis of PDHRA Measurement Model 2 (see Figure 22) suggest a good fitting model. The Chi-square test of model fit was significant X^2(150, N=58,242)=7224.54, *p*=<.001. Other fit indices suggested a good to excellent fitting model: CFI=.93, TLI=.97, RMSEA=.03.

Post-Deployment Health Reassessment (PDHRA) Measurement Model 2 assesses the relationship between answers on the PDHRA and *depression* and *trauma.*

Most of the direct effects on *depression* and *trauma* in PDHRA Measurement Model 2 are small or insignificant. The largest direct effects in PDHRA Measurement Model 2 are produced by the latent variable *support network conflict. Support network conflict* produced a large, positive, statistically significant effect on *depression* (*b*=1.45, *p*=<.001) and *trauma* (*b*=1.42, *p*=<.001). Several other variables produced statistically significant direct effects on *depression* and *trauma.* Being "shot" (*b*=.77, *p*=<.001) and being exposed to a "blast" (*b*=.69, *p*=<.001) had a large, positive direct effect on *trauma*. Being involved in a vehicle "crash" has a moderate, positive effect on *depression (*b=.39, *p*=<.001). Being exposed to a "blast" also had a moderate, positive effect *depression* (*b*=.39, *p*=<.001).

Alcohol use variables accounted for little of the explained variance within PDHRA Measurement Model 2. A*lcohol concerns* had a small, positive effect on *depression* (*b*=.15, *p*=<.001); however, *alcohol concerns* did not have a statistically significant impact on *trauma* (*b*=.002, *p*=.996). *Level of alcohol use* did not produce a statistically significant effect on *depression* (*b*=-.02, *p*=.491) or *trauma* (*b*=.02, *p*=.64).

Overall the relationships in PDHRA Measurement Model 2 were very similar to the relationships modeled in PDHRA Measurement Model 1. All relationships modeled in PDHRA Measurement Model 2 are displayed in Table 6.

Variance Explained in Diagnostic and Latent Dependent Variables

PDHRA Path Measurement 2 accounts for 64.2% (r^2=.642) of the variance in the latent variable *depression*, 60.8% (r^2=.608) of the variance in the latent variable *trauma* and 16.6% (r^2=.166) of the variance in the latent variable *exposure symptoms.*

Table 6. PDHRA Measurement Model 2

IV/DV	*b*	*S.E.*	*p*	*Effect Size*
Shot/ Exposure Symptoms	1.38*	.18	<.001	large
Crash/ Exposure Symptoms	.56*	.05	<.001	large
Blast/ Exposure Symptoms	.76*	.04	<.001	large
Hurt/ Exposure Symptoms	.72*	.04	<.001	large
Hurtprob/ Exposure Symptoms	.24*	.05	<.001	small
Exposure Symptoms/ Depression	.11*	.03	<.001	small
Exposure Symptoms/ Trauma	.16*	.02	<.001	small
Shot/ Depression	.27	.17	.125	small
Shot/ Trauma	.77*	.13	<.001	large
Crash/ Depression	.23*	.03	<.001	small
Crash/ Trauma	.40*	.03	<.001	moderate
Blast/ Depression	.39*	.03	<.001	moderate
Blast/ Trauma	.69*	.02	<.001	large
Hurt/ Depression	-.04	.03	.133	trivial
Hurt/ Trauma	.03	.03	.218	trivial
Hurtprob/ Depression	.11*	.03	<.001	small
Hurtprob/ Trauma	.17*	.03	<.001	small
Total Deployments/ Depression	-.01	.004	.017	trivial
Total Deployments/ Trauma	-.004	.01	.464	trivial
Pay Grade/ Depression	.01*	.002	<.001	trivial
Pay Grade/ Trauma	.01	.003	.052	trivial
Gender/ Depression	.10*	.02	<.001	small
Gender/ Trauma	.10*	.02	<.001	small
Support Network Conflict/ Depression	1.45*	.07	<.001	large
Support Network Conflict/ Trauma	1.42*	.08	<.001	large
Alcohol Concerns/ Depression	.15*	.04	<.001	small
Alcohol Concerns/ Trauma	.002	.04	.966	trivial
Level of Alcohol Use/ Depression	-.02	.04	.491	trivial
Level of Alcohol Use/ Trauma	.02	.04	.695	trivial
*p<.001				

All co-variances modeled in Measurement Model 2 are described in Table 7.

Table 7. Co-variances Modeled in PDHRA Measurement Model 2

Variables	*b*	*S.E.*	*p*
Exposure Symptoms/ Total Deployments	.05	.03	.08
Exposure Symptoms/ Gender	.02	.01	.001
Exposure Symptoms/ Level of Alcohol Use	.05*	.01	<.001
Exposure Symptoms, Alcohol Concerns	.32*	.03	<.001
Exposure Symptoms/ Support Network Conflict	.19*	.01	<.001
Total Deployments/ Pay Grade	.89*	.02	<.001
Total Deployments/ Support Network Conflict	-.003	.01	.68
Support Network Conflict/ Level of Alcohol Use	.05*	.004	<.001
Support Network Conflict/ Alcohol Concerns	.22*	.01	<.001
Alcohol Concerns/ Level of Alcohol Use	.42*	.01	<.001
Hurt/ hurtprob	.05*	.002	<.001
Depression/ Trauma	.11*	.01	<.001
PCLMtot/ PHQ9tot	7.25*	.04	<.001
PCLMtot/ audittot	3.06*	.07	<.001
audittot/ PHQ9tot	1.23*	.04	<.001
*p<.001			

IV.4. Specific Aim 4: Describe the psychometric properties and clinical value of the PDHRA for identifying individuals with a depressive or trauma-related diagnosis.

Research Question 4.1. Are depression diagnoses or PTSD diagnosis more common among individuals with a PDHRA that is positive for behavioral health concerns than among individuals with a PDHRA that is negative for behavioral health concerns?

In this sample, depression diagnoses are significantly more common among individuals who have a PDHRA that is positive for behavioral health concerns than among individuals who have a PDHRA that is negative for behavioral health concerns, x^2(1, N=58,242)=186.43, *p*=<.001. Among individuals with a positive PDHRA, 1 out of 85 eventually received a diagnosis of depression, while only 1 out of 378 individuals who had a negative PDHRA received a depressive diagnosis. This translates to Airmen with a positive PDHRA being more than 4 times more likely to be diagnosed with depression than Airmen who have a PDHRA that does not indicate behavioral health concerns.

Post-traumatic Stress Disorder (PTSD) was also significantly more common among individuals with a PDHRA that was positive for behavioral health concerns than those with a PDHRA that was negative for behavioral health concerns, x^2=(1, N=58,242)=108.81, *p*=<.001. Among Airmen with a positive PDHRA, 1 of 171 eventually received a diagnosis of PTSD, while only 1 of 922 individuals with a negative PDHRA received a diagnosis of PTSD. Thus, Airmen with a positive PDHRA were

more than 5 times more likely to be diagnosed with PTSD than Airmen who had a PDHRA that did not indicate behavioral health concerns.

Research Question 4.2. What are the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the PDHRA for a depressive diagnosis?

PDHRA Sensitivity for Depression Diagnoses

In this study, those who were diagnosed with depression had a positive PDHRA for behavioral health concerns 70.4% (N=238) of the time (see Table 8). The sensitivity of the PDHRA for depression was below the .85 threshold used in this study to establish a high level of sensitivity.

$$\text{sensitivity} = \frac{\text{correct positives}}{\text{correct positives+false negatives}} \quad \text{sensitivity} = \frac{238}{238+100} \quad \text{sensitivity=.704}$$

Thus, the PDHRA has a sensitivity of .704 for depression. The Type II error rate (1-sensitivity or 1-.704) of the PDHRA for depression is .296 or 29.6%.

PDHRA Specificity for Depression Diagnoses

Specificity is an assessment of how well a scale works for the portion of the sample that do not have the condition of interest; specificity reflects the proportion of individuals without the condition of interest that are correctly identified by the test. A test that correctly identifies every subject that is negative for a condition of interest has a specificity of 1.0. The difference between 1.0 and test specificity is the false positive rate or Type I error rate (Cummins & Hazinski, 2000; Surhone, Timpledon, & Marseken, 2009). In this study, those not diagnosed with depression had a PDHRA that was negative for behavioral health concerns 65.1% (N=37,713) of the time (see Table 8). The

specificity of the PDHRA for depression was below the .85 threshold used to establish a high level of specificity in this study.

$$\text{specificity} = \frac{\text{correct negatives}}{\text{correct negatives+false positives}} \quad \text{specificity}= \frac{37{,}713}{37{,}713+20{,}191} \quad \text{specificity}=.651$$

Thus, the PDHRA has a specificity of .651 for depression. The Type I error rate (1-specificity or 1-.651) of the PDHRA for depression is .349 or 34.9%.

Table 8. Sensitivity and Specificity of PDHRA for Depression

		Depression Diagnosis		
		No (Sensitivity)	Yes (Specificity)	Total
PDHRA Behavioral Health Concerns	No	37713 **(65.1%)**	100 (29.6%)	37813 (64.9%)
	Yes	20191 (34.9%)	238 **(70.4%)**	20429 (35.1%)
Total		57904 (100%)	338 (100%)	58242 (100%)

PDHRA Positive Predictive Value (PPV) for Depression Diagnoses

In this study, 1.2% (N=238) of individuals who had behavioral health concerns on their PDHRA had no diagnosis of depression (see Table 9).

$$\text{PPV} = \frac{\text{correct positives}}{\text{correct positives+false positives}} \quad \text{PPV}= \frac{238}{2238+20{,}191} \quad \text{PPV}= .012$$

PDHRA Negative Predictive Value (NPV) for Depression Diagnoses

In this study 99.7% (N=37,713) of individuals who had no behavioral health concerns on their PDHRA had no diagnosis of depression (see Table 9).

$$\text{NPV}\frac{\text{correct negatives}}{\text{correct negatives+false negatives}} \quad \text{NPV}=\frac{37{,}713}{37{,}713+100} \quad \text{NPV}= .997$$

Table 9. Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of the PDHRA for Depression

		PDHRA Behavioral Health Concerns		
		No (NPV)	Yes (PPV)	Total
Depression Diagnosis	No	37713 (**99.7%)**	20191 (98.8%)	57904 (99.4%)
	Yes	100 (.3%)	238 **(1.2%)**	338 (.6%)
Total		37813 (100%)	20429 (100%)	58242 (100%)

<u>Research Question 4.3.</u> What are the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the PDHRA for post-traumatic stress disorder?

PDHRA Sensitivity for PTSD Diagnosis

In this study, those who were diagnosed with PTSD had a PDHRA that was positive for behavioral health concerns 74.4% (N=119) of the time (see Table 10). The

Type II error rate (1-sensitivity or 1-.744) of the PDHRA for PTSD is .256 or 25.6%. The sensitivity of the PDHRA for PTSD was below the .85 threshold used in this study to establish a high level of sensitivity.

$$\text{sensitivity} = \frac{\text{correct positives}}{\text{correct positives+false negatives}} \quad \text{sensitivity}= \frac{119}{119+41} \quad \text{sensitivity}=.744$$

PDHRA Specificity for PTSD Diagnosis

In this study, those who were not diagnosed with PTSD had a PDHRA that was negative for behavioral health concerns 65.0% (N=37,772) of the time (see Table 10). The Type I error rate (1-specificity or 1-.65) of the PDHRA for PTSD is .350 or 35%. The specificity of the PDHRA for PTSD was below the .85 threshold used in this study to establish a high level of specificity.

$$\text{specificity} = \frac{\text{correct negatives}}{\text{correct negatives+false positives}} \quad \text{specificity}= \frac{37772}{37{,}772+20{,}310} \quad \text{specificity}=.650$$

Table 10. Sensitivity and Specificity of PDHRA for PTSD

		PTSD Diagnosis		
		No (Specificity)	Yes (Sensitivity)	Total
PDHRA Behavioral Health Concerns	No	37772 (**65.0%)**	41 (25.6%)	37813 (64.9%)
	Yes	20310 (35.0%)	119 (**74.4%)**	20429 (35.1)
Total		58082 (100%)	160 (100%)	58242 (100%)

PDHRA Positive Predictive Value (PPV) for PTSD Diagnosis

In this study .6% (N=119) of individuals who had behavioral health concerns on their PDHRA were diagnosed with PTSD (see Table 11).

$$\text{PPV} = \frac{\text{correct positives}}{\text{correct positives+false positives}} \quad \text{PPV}= \frac{119}{20{,}310+119} \quad \text{PPV}= .006$$

PDHRA Negative Predictive Value (NPV) for PTSD Diagnosis

In this study 99.9% (N=37,713) of individuals who had no behavioral health concerns on their PDHRA were not diagnosed with PTSD (see Table 11).

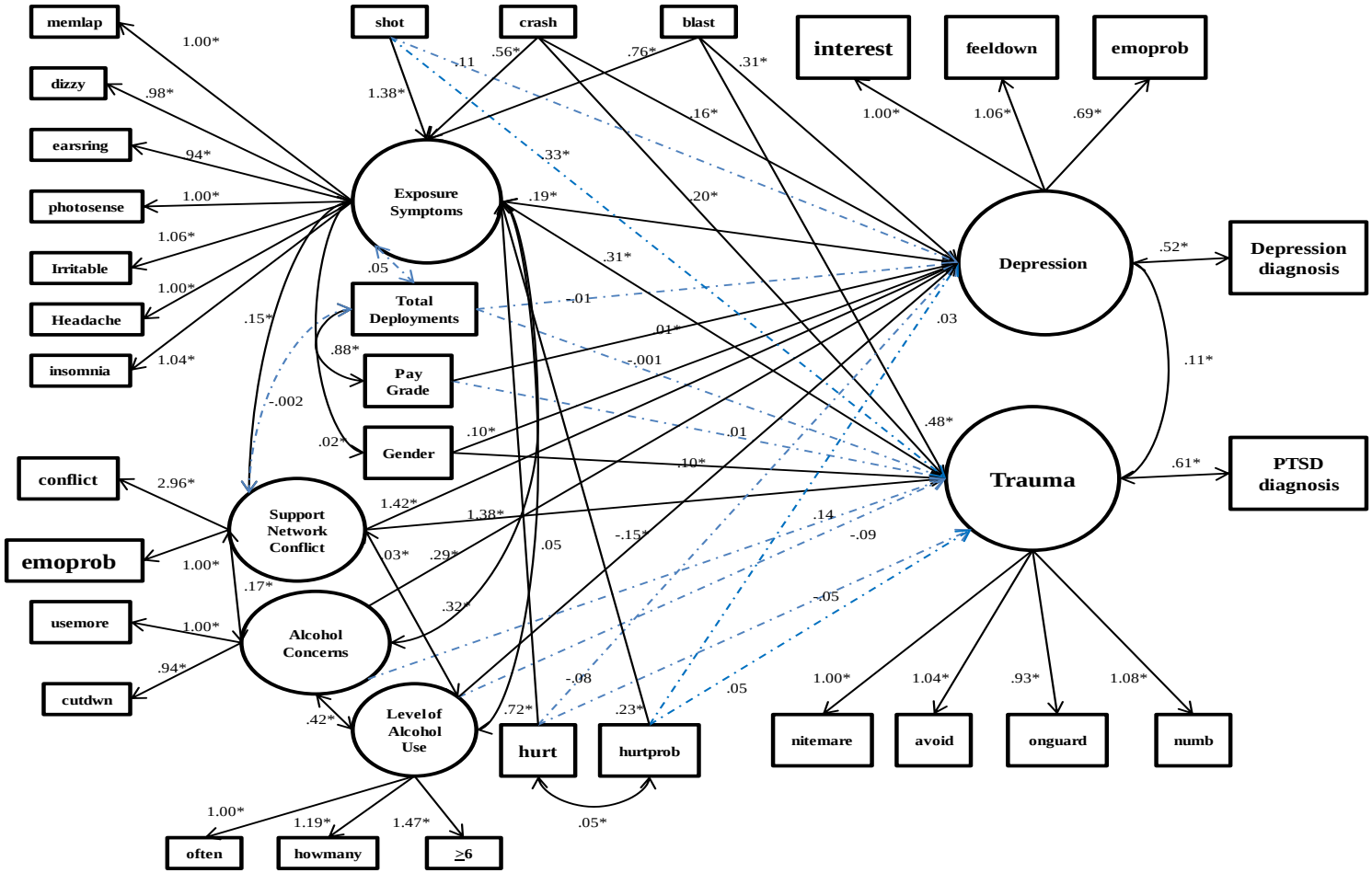
$$\text{NPV} = \frac{\text{correct negatives}}{\text{correct negatives+false negatives}} \quad \text{NPV}= \frac{37{,}772}{37{,}772+41} \quad \text{NPV}= .999$$

Table 11. Positive and Negative Predictive Value of PDHRA for PTSD

		PDHRA Behavioral Health Concerns		
		No (NPV)	Yes (PPV)	Total
PTSD Diagnosis	No	37772 **(99.9%)**	20310 (99.4%)	58082 (99.7)
	Yes	41 (.1%)	119 **(.6%)**	160 (.3%)
Total		37813 (100.0%)	20429 (100.0%)	58242 (100.0%)

<u>Research Question 4.4.</u> *What is model fit and variance explained for endogenous variables when adding paths to clinical diagnosis of PTSD and depression to the Post-Deployment Health Reassessment (PDHRA) Measurement Model 1? What is the model fit, X^2, CFI, TLI and RMSEA of the PDHRA Path Model 1?*

Figure 23. Post-Deployment Health Reassessment (PDHRA) Path Model 1 Results



IV.4.1. PDHRA Path Model 1

The results of the analysis of PDHRA Path Model 1 (see Figure 23) suggest an excellent model fit. The Chi-square test of model fit was significant X^2(160, N=58,242)=5451.05, p=<.001. Other fit indices suggested an excellent fitting model: CFI=.95, TLI=.98, RMSEA=.03.

Post-Deployment Health Reassessment (PDHRA) Path Model 1 assesses the relationship between answers on the PDHRA and the later development of a "depression diagnosis" or a "trauma diagnosis." The latent variable *depression* produced a large, positive direct effect (b=.52, p=<.001) on the variable "depression diagnosis" and the latent variable *trauma* produced a large direct effect (b=.61, p=<.001) on the variable "trauma diagnosis."

Most of the direct effects on *depression* and *trauma* in PDHRA Path Model 1 are small or insignificant. The largest direct effects in PDHRA Path Model 1 are produced by the latent variable *support network conflict*. *Support network conflict* produced a large, positive, statistically significant effect on *depression* (b=1.42, p=<.001) and *trauma* (b=1.39, p=<.001). Several other variables produced statistically significant direct effects on *depression* and *trauma*. *Exposure symptoms* produced a moderate, positive direct effect on *trauma* (b=.31, p=<.001). Being exposed to a "blast" had a moderate, positive direct effect on *depression* (b=.31, p=<.001) and *trauma* (b=.48, p=<.001).

Alcohol use variables accounted for little of the explained variance within PDHRA Path Model 1. A*lcohol concerns* had a small, positive effect on *depression*

(b=.29, p=<.001); however, *alcohol concerns* did not have a statistically significant impact on *trauma* (b=.14, p=.005). *Level of alcohol use* produce a small, negative effect on *depression* (b=-.15, p=<.001), but did not produce a statistically significant effect on *trauma* (b=-.09, p=.05). All of the relationships modeled in PDHRA Path Model 1 are displayed in Table 12.

Variance Explained in Diagnostic and Latent Dependent Variables

PDHRA Path Model 1 accounts for 22.8% (r^2=.228) of the variance in "depression diagnosis" and 31.1% (r^2=.311) of the variance in "trauma diagnosis" in this sample. PDHRA Path Model 1 accounted for 65.5% (r^2=.655) of the variance in the latent variable *depression*, 66.6% (r^2=.666) of the variance in the latent variable *trauma* and 16.6% (r^2=.166) of the variance in the latent variable *exposure symptoms.*

Table 12. PDHRA Path Model 1

IV/DV	*b*	*S.E.*	*p*	*Effect Size*
Shot/ Exposure Symptoms	1.38*	.18	<.001	large
Crash/ Exposure Symptoms	.56*	.05	<.001	large
Blast/ Exposure Symptoms	.76*	.04	<.001	large
Hurt/ Exposure Symptoms	.72*	.04	<.001	large
Hurtprob/ Exposure Symptoms	.23*	.05	<.001	small
Exposure Symptoms/ Depression	.19*	.03	<.001	small
Exposure Symptoms/ Trauma	.31*	.03	<.001	small
Shot/ Depression	.11	.30	.719	small
Shot/ Trauma	.33	.15	.033	moderate
Crash/ Depression	.16*	.03	<.001	small
Crash/ Trauma	.20*	.03	<.001	moderate
Blast/ Depression	.31*	.03	<.001	moderate
Blast/ Trauma	.48*	.03	<.001	moderate
Hurt/ Depression	-.08	.03	.003	trivial
Hurt/ Trauma	-.05	.03	.097	trivial
Hurtprob/ Depression	.03	.03	.281	trivial
Hurtprob/ Trauma	.05	.03	.088	trivial
Total Deployments/ Depression	-.01	.01	.105	trivial
Total Deployments/ Trauma	-.001	.01	.859	trivial
Pay Grade/ Depression	.10*	.002	<.001	small
Pay Grade/ Trauma	.01	.003	.053	trivial
Gender/ Depression	.10*	.02	<.001	small
Gender/ Trauma	.10*	.02	<.001	small
Support Network Conflict/ Depression	1.42*	.09	<.001	large
Support Network Conflict/ Trauma	1.45*	.08	<.001	large
Alcohol Concerns/ Depression	.29*	.04	<.001	moderate
Alcohol Concerns/ Trauma	.14	.05	.005	small
Level of Alcohol Use/ Depression	-.15*	.04	<.001	small
Level of Alcohol Use/ Trauma	-.09	.05	.054	trivial
Depression/ Depression Diagnosis	.52*	.02	<.001	large
Trauma/ Trauma Diagnosis	.61*	.04	<.001	large
*p<.001				

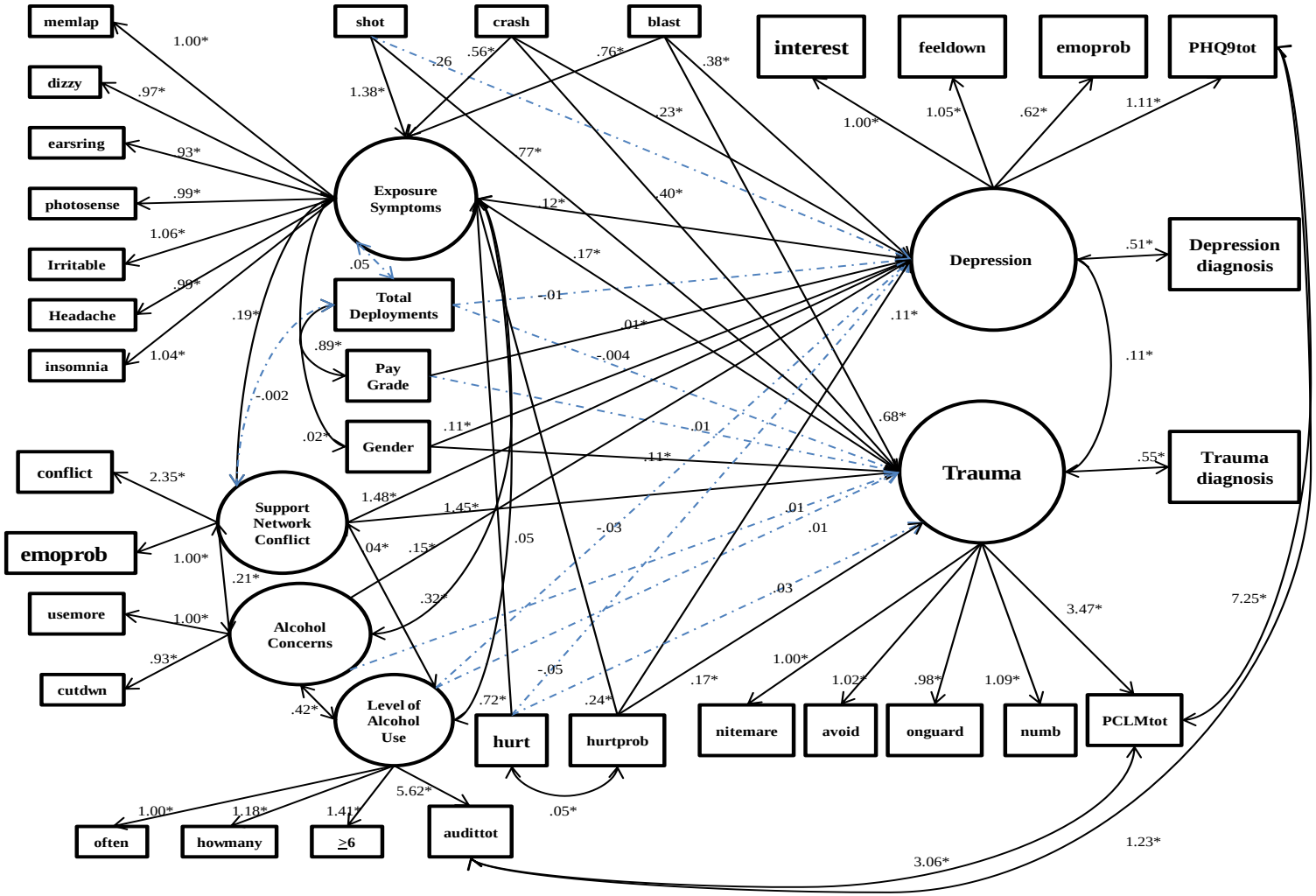
All co-variances modeled in Path Model 1 are described in Table 13.

Table 13. Co-variances Modeled in PDHRA Path Model 1

Variables	*b*	*S.E.*	*p*
Exposure Symptoms/ Total Deployments	.05	.03	.08
Exposure Symptoms/ Gender	.02	.01	.001
Exposure Symptoms/ Level of Alcohol Use	.04	.01	.001
Exposure Symptoms, Alcohol Concerns	.31*	.03	<.001
Exposure Symptoms/ Support Network Conflict	.15*	.01	<.001
Total Deployments/ Pay Grade	.89*	.02	<.001
Total Deployments/ Support Network Conflict	-.002	.01	.78
Support Network Conflict/ Level of Alcohol Use	.03*	.003	<.001
Support Network Conflict/ Alcohol Concerns	.17*	.01	<.001
Alcohol Concerns/ Level of Alcohol Use	.42*	.01	<.001
Hurt/ hurtprob	.05*	.002	<.001
Depression/ Trauma	.11*	.01	<.001
*p<.001			

<u>Research Question 4.5.</u> What is model fit and variance explained for endogenous variables when adding paths to clinical diagnosis of PTSD and depression to the PDHRA Measurement Model 2? What is the model fit, X^2, CFI, TLI and RMSEA, of PDHRA Path Model 2?

Figure 24. Post-Deployment Health Reassessment (PDHRA) Path Model 2 Results



IV.4.2. PDHRA Path Model 2

The results of the analysis of PDHRA Path Model 2 (see Figure 24) suggest a good fitting model. The Chi-square test of model fit was significant X^2(160, N=58,242)=6530.03, p=<.001. Other fit indices suggested a good to excellent fitting model: CFI=.94, TLI=.97, RMSEA=.03.

Post-Deployment Health Reassessment (PDHRA) Path Model 2 assesses the relationship between answers on the PDHRA and the later development of a "depression diagnosis" or a "trauma diagnosis." The latent variable *depression* produced a large, positive direct effect (b=.51, p=<.001) on the variable "depression diagnosis" and the latent variable *trauma* produced a large direct effect (b=.55, p=<.001) on the variable "trauma diagnosis."

Most of the direct effects on *depression* and *trauma* in PDHRA Path Model 2 are small or insignificant. The largest direct effects in PDHRA Path Model 2 are produced by the latent variable *support network conflict*. *Support network conflict* produced a large, positive, statistically significant effect on *depression* (b=1.48, p=<.001) and *trauma* (b=1.45, p=<.001). Several other variables produced statistically significant direct effects on *depression* and *trauma*. Being "shot" (b=.77, p=<.001) and being exposed to a "blast" (b=.68, p=<.001) had a large, positive direct effect on *trauma*. Being involved in a vehicle "crash" also had a moderate, positive effect on *trauma* (b=.40, p=<.001) and *depression* (b=.38, p=<.001).

Alcohol use variables accounted for little of the explained variance within PDHRA Path Model 2. A*lcohol concerns* had a small, positive effect on *depression* (b=.15, p=<.001); however, *alcohol concerns* did not have a statistically significant

impact on *trauma* (b=.01, p=.89). *Level of alcohol use* did not produce a statistically significant effect on *depression* (b=-.03, p=.46) or *trauma* (b=.01, p=.70). Overall the relationships in PDHRA Path Model 2 were very similar to the relationships modeled in PDHRA Path Model 1. All relationships modeled in PDHRA Path Model 2 are displayed in Table 14.

Variance Explained in Diagnostic and Latent Dependent Variables

PDHRA Path Model 2 accounts for 22.2% (r^2=.222) of the variance in "depression diagnosis" and 26.2% (r^2=.262) of the variance in "trauma diagnosis" in this sample. PDHRA Path Model 2 accounted for 64.5% (r^2=.645) of the variance in the latent variable *depression*, 61.3% (r^2=.613) of the variance in the latent variable *trauma* and 16.6% (r^2=.166) of the variance in the latent variable *exposure symptoms.*

Table 14. PDHRA Path Model 2

IV/DV	*b*	*S.E.*	*p*	*Effect Size*
Shot/ Exposure Symptoms	1.38*	.18	<.001	large
Crash/ Exposure Symptoms	.56*	.05	<.001	large
Blast/ Exposure Symptoms	.76*	.04	<.001	large
Hurt/ Exposure Symptoms	.72*	.04	<.001	large
Hurtprob/ Exposure Symptoms	.24*	.05	<.001	small
Exposure Symptoms/ Depression	.12*	.03	<.001	small
Exposure Symptoms/ Trauma	.17*	.02	<.001	small
Shot/ Depression	.26	.24	.282	small
Shot/ Trauma	.77*	.13	<.001	large
Crash/ Depression	.23*	.03	<.001	small
Crash/ Trauma	.40*	.03	<.001	moderate
Blast/ Depression	.38*	.03	<.001	moderate
Blast/ Trauma	.68*	.02	<.001	large
Hurt/ Depression	-.05	.03	.085	trivial
Hurt/ Trauma	.03	.03	.267	trivial
Hurtprob/ Depression	.11*	.03	<.001	small
Hurtprob/ Trauma	.17*	.03	<.001	small
Total Deployments/ Depression	-.01	.004	.017	trivial
Total Deployments/ Trauma	-.004	.01	.479	trivial
Pay Grade/ Depression	.01*	.002	<.001	trivial
Pay Grade/ Trauma	.01	.003	.072	trivial
Gender/ Depression	.11*	.02	<.001	small
Gender/ Trauma	.11*	.02	<.001	small
Support Network Conflict/ Depression	1.48*	.08	<.001	large
Support Network Conflict/ Trauma	1.45*	.08	<.001	large
Alcohol Concerns/ Depression	.15*	.04	<.001	small
Alcohol Concerns/ Trauma	.01	.04	.891	trivial
Level of Alcohol Use/ Depression	-.03	.04	.464	trivial
Level of Alcohol Use/ Trauma	.01	.04	.698	trivial
Depression/ Depression Diagnosis	.51*	.02	<.001	large
Trauma/ Trauma Diagnosis	.55*	.03	<.001	large
*p<.001				

All co-variances modeled in Measurement Path Model 2 are described in Table 15.

Table 15. Co-variances Modeled in PDHRA Path Model 2

Variables	*b*	*S.E.*	*p*
Exposure Symptoms/ Total Deployments	.05	.03	.08
Exposure Symptoms/ Gender	.02	.01	.001
Exposure Symptoms/ Level of Alcohol Use	.05*	.01	<.001
Exposure Symptoms, Alcohol Concerns	.32*	.03	<.001
Exposure Symptoms/ Support Network Conflict	.19*	.01	<.001
Total Deployments/ Pay Grade	.89*	.02	<.001
Total Deployments/ Support Network Conflict	-.002	.01	.72
Support Network Conflict/ Level of Alcohol Use	.04*	.004	<.001
Support Network Conflict/ Alcohol Concerns	.21*	.01	<.001
Alcohol Concerns/ Level of Alcohol Use	.42*	.01	<.001
Hurt/ hurtprob	.05*	.002	<.001
Depression/ Trauma	.11*	.01	<.001
PHQ9tot/ PCLMtot	7.25*	.04	<.001
PHQ9tot/ audittot	1.23*	.04	<.001
PCLMtot/ audittot	3.06*	.07	<.001
*p<.001			

V. DISCUSSION AND CONCLUSION

The primary purpose of the current study was to evaluate the psychometric properties and clinical utility of the Air Force Post-Deployment Health Reassessment (PDHRA). The findings of this study suggest that the subscales within the PDHRA have good internal validity. Following the logic of known-instruments validity and known-groups validity, the findings of this study suggest that the construct validity of the PDHRA is good. The PDHRA seems to be an effective clinical tool for the identification of Airmen at risk for the development of *trauma, depression* following a deployment. While the PDHRA is a useful tool for suggesting an Airman's risk for depression or PTSD diagnoses the low positive predictive value of the PDHRA suggests that the PDHRA is a poor diagnostic tool for depression and PTSD.

The Discussion chapter will begin with an interpretation of the major findings of this study and this interpretation will be organized around the 4 specific aims that guided this study. The strengths and limitations of these findings will be discussed. Finally, recommendations will be made for future research and modifications to the PDHRA.

V.1. Specific Aim 1. Describe the Sample

The first research aim of this study was to describe the demographic and mental health related characteristics of the sample. This section will include a discussion of the makeup of the sample used in this study including the demographic variables; "pay grade", "gender", "total deployments" and behavioral health concerns and the diagnostic conditions, PTSD and depression.

Pay Grade

The inclusion of the variable, “pay grade”, in this analysis served multiple purposes. From a classical measurement theory perspective, “pay grade” is an important demographic component of a sample. The distribution of “pay grade” in the sample compared to the overall distribution of “pay grades” in the Air Force can be used to assess the representativeness of the current sample. From a risk and resiliency theory perspective, “pay grade” was included in the analysis as a proxy for socio-economic status. Lower socio-economic status, as represented by lower “pay grade”, was hypothesized to be a risk factor for mental health disorders. In the sections below, lower “pay grade” will be discussed as a risk factor for *trauma* and *depression*.

The “pay grade” distribution for enlisted personnel under-represented lower ranking enlisted members compared to the overall “pay grade” makeup of the Air Force ("Military Demographics," 2010). This may be due to professional military training that younger Airmen must complete before they are qualified to deploy; thus, lower ranking Airmen are under-represented among those completing the PDHRA after returning from a deployment. Typically, a new military enlisted member is sent to prolonged job training, following the completion of basic training (Jordan, Taylor, & Mazarr, 1999). Many enlisted members may be promoted to the next “pay grade” during or shortly after the completion of this training. This process may have resulted in the lowest “pay grades” in the current study being under-represented among those completing the PDHRA. The distribution of officer “pay grades” in this sample was similar to the overall distribution of officer “pay grades” in the Air Force.

The generalizability of these findings to lower ranking enlisted members may be limited because this group was inadequately represented in this study. Unique characteristics of lower ranking Airmen related to *trauma* and *depression* may not have been accurately modeled in the current study. Future study which compares the "pay grade" makeup of the current sample with the "pay grade" makeup of Airmen deployed throughout the Air Force would clarify the overall representativeness of the sample used in this study.

Gender

The role of "gender" in this study varied depending on the theoretical perspective that was applied. From a classical measurement perspective "gender" is an important demographic variable. The "gender" distribution within the current sample is an important indicator of the representativeness of the sample and the generalizability of the findings of this research. Concurrently, risk and resiliency theory was used to select variables to include in the analysis of the efficacy of the PDHRA at identifying *trauma* and *depression*. Because being female has been associated with increased risk for developing PTSD and depression in previous research (Angst et al., 2002; Tolin & Foa, 2006), "gender" was included in this analysis. In this section, the impact of "gender" on sample representativeness and study generalizability will be discussed. In sections below the risk associated with "gender" for mental health disorders will be discussed.

Females were under-represented in this sample. Females account for about 20% of Air Force personnel, but only about 15% of this sample were female ("Military Demographics," 2010). Thus, female representation among Airmen who completed the

PDHRA is 25% lower than female representation across the Air Force. The reason for this is unclear. One possible explanation might be that females who are pregnant are exempt from deployment (Roadman, 1998), which may contribute to the reduced number of females completing the PDHRA. However, pregnancy is probably not an adequate explanation for female under-representation in this sample. It is doubtful that 25% of female Airmen were pregnant at the time of a deployment. Another possible explanation is that females may be under-represented in military career fields that deploy frequently.

An analysis of the effect of career field on the gender-specific rate of deployment was not possible in this study because of the PDHRA does not record respondents military occupational code. However, further study might assess the rate of pregnancy and "gender" distribution across career fields to determine if these factors resulted in females being deployed less frequently than males.

Because females were significantly under-represented in this study, the findings of this research may not be generalizable to all females in the Air Force. Females in this study may have differed from the total female population in the Air Force in ways that would affect the clinical utility of the PDHRA as a screening tool for *trauma* and *depression* in female Airmen. However, if it is determined that across the Air Force females typically account for 15% of deployed forces rather than 20%, the sample used in this study may be considered relatively representative of the gender of Air Force PDHRA completers. In this case findings of this study may be more generalizable to females across the Air Force.

V.1.1. Behavioral Health Concerns on the Post-Deployment Health Reassessment (PDHRA), PTSD and Depression

Risk and resiliency theory suggests that military members who encounter traumatic experiences during a deployment are at elevated risk for psychological disorders like depression and PTSD. A large minority (35%) of Airmen who completed the Post-Deployment Health Reassessment (PDHRA) were classified as having behavioral health concerns. This level of psychological concerns is consistent with recent research on returning Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) veterans (Hoge, Auchterlonie, & Milliken, 2006; Hoge et al., 2008). This finding suggests that many Airmen experience some level of distress during their reintegration following their deployment. However, a very small percentage, less than 1% of Airmen in this study were diagnosed with PTSD or depression in the 12 to 27 months following their deployment (see Table 6).

A comprehensive literature review did not identify any other studies that compared PDHRA results with diagnostic PTSD and depression. The findings of this study suggest that previous studies, which have used the PDHRA to suggest the prevalence of mental health problems among post-deployed military members (Hoge, Auchterlonie, & Milliken, 2006; Milliken, Auchterlonie, & Hoge, 2007), may have over-stated the prevalence and severity of mental health problems among military members following a deployment. Comparing the prevalence of PDHRA identified behavioral health concerns with the rate of diagnostic depression and PTSD in additional military

samples may clarify the usefulness of the PDHRA for describing the pervasiveness of mental health disorders among post-deployed military members.

V.1.2. Diagnostic Depression and Post-Traumatic Stress Disorder (PTSD) among Airmen Who Completed the Post-Deployment Health Reassessment (PDHRA)

Diagnostic depression was nearly twice as common in this sample as PTSD (see Table 6). This is consistent with the prevalence of diagnostic depression and PTSD in the general population (APA, 2000). There is a significant amount of overlap in the risk and protective factors that influence the development of PTSD and depression (Campbell et al., 2007). However, among military samples operational stressors may be more closely associated with deployment-related diagnostic depression than PTSD (Brown, Fielding, & Grover, 1999). In its present form the PDHRA focuses largely on combat-related stress. While direct combat exposure contributes to the development of depression (Cabrera, Hoge, Bliese, Castro, & Messer, 2007; Hoge et al., 2008), the stress of being separated from family and being required to work long hours in austere conditions has been shown to contribute to depression among military members as well (Bridger, Kilminster, & Slaven, 2007). Since diagnostic depression is a more common phenomenon than PTSD among Airmen following a deployment, it may be useful to include questions on the PDHRA that focus on specific operational stress risk factors for depression. Content related to family separation or difficult experiences related to environmental or job conditions in the deployment location may increase the clinical utility of the PDHRA, particularly in identifying Airmen at risk for depression.

V.1.3. Bi-variate Findings for Airmen Who Completed the Post-Deployment Health Reassessment (PDHRA)

This section will discuss gender differences within the sample. The bi-variate analysis assessed gender differences in “pay grade”, alcohol use and diagnostic depression and Post-Traumatic Stress Disorder (PTSD). The implications of these results will be discussed.

Gender Differences in Pay Grade

There were statistically significant “gender" differences in “pay grade” found in this sample. On average males were slightly higher ranking than females in this sample (see Table 1). This may be the result of females leaving military service at a higher rate than males. Prior research has found that females leave military service at a 30% higher rate than their male counterparts (Caulfield, Wolfe, Turner, Newton, Melia, Martin et al., 2005). Researchers have hypothesized that the higher rate of attrition among females may be due to parenting obligations, job dissatisfaction or a paternalistic culture within the military (Carreiras, 2008; Vernez & Zellman, 1987).

Higher rates of attrition would account for female under-representation in higher ranks. Females who leave the service are not available to be promoted to higher “pay grades”. Military members become eligible for promotion following a pre-specified length of time in a given “pay grade”. Military members are required to complete specific professional education programs and tests during their time in a given “pay grade” (Dorn, 1996). Females who separate from the military will not meet the time requirements to be promoted to the next grade. Additionally, service members who

believe they will separate from the military may not complete the requisite professional education to achieve promotion.

The data available for this study did not allow for an evaluation of "pay grade" distribution by "gender" in the general Air Force population. "Gender" differences in "pay grade" in this sample may reflect the representativeness of the sample used in this study. If "gender" differences in "pay grade" across the Air Force are not consistent with the "gender" differences in "pay grade" observed in this sample the representativeness of the sample may be inadequate, limiting the generalizability of this study to the larger Air Force.

Gender Differences in Rate of Alcohol Use

Females scored significantly closer to the clinical cutoff level on the Alcohol Use Disorders Identification Test (AUDIT), indicating alcohol dependence, than males. This is counter to previous literature that has consistently found higher levels of alcohol dependence among males in the general population (Brady, Grice, Dustan, & Randall, 1993; Nolen-Hoeksema & Hilt, 2006). Researchers have suggested that biological factors and different social norms related to alcohol use are the primary explanations for the differences in male and female alcohol use (Nolen-Hoeksema & Hilt, 2006). However, studies conducted with military cohorts have found that problematic alcohol use by females exceeded problematic alcohol use by males (Lande, Marin, Chang, & Lande, 2007).

Possible explanations for this finding may center on social norms for female alcohol use that differ in the military than in the general population. Previous research

suggests that alcohol use patterns are shaped largely by the social setting that a majority of the alcohol use occurs in (Lederman & Steward, 2005). In an effort to integrate in to a male dominated culture, females may attempt to keep up with the alcohol use of their overwhelmingly male counterparts. Females are known to encounter alcohol-related problems, including dependence, at lower use rates than males (Brown, Bray, & Hartzell). Thus, females emulating the alcohol use patterns of a male majority would be expected to develop higher rates of alcohol-related problems.

Additionally, females in the military may experience stressors that females in the general population may not experience (Caulfield et al., 2005). Females are significantly under-represented in the military. Until recently females were prohibited from fulfilling many roles in the military (Jordan, Taylor, & Mazarr, 1999). As recently as 1973, less than 3% of military members were female (Dobie et al., 2002). This history has excluded females from policy making positions with the military for most of its history. Thus, females may encounter difficulties integrating within the military culture (Carreiras, 2008). Female military members may rely on alcohol to help cope with the stress of military service in a way that females in the general population do not. This, in part, may explain differences in patterns of alcohol use between military females and females in the general population.

Gender Differences in Rate of Diagnostic Depression and PTSD

This study used risk and resiliency theory to guide the selection of exogenous variables based on the risk or protective influence these variables had on the constructs of *trauma* and *depression*. Multiple studies have found a higher prevalence of both PTSD

and Depression among females when compared to males (Piccinelli & Wilkinson, 2000; Tolin & Foa, 2006). Thus, "gender" was included in the current study because of the increased risk of females to develop PTSD and depression. Gender patterns related to PTSD and depression in the current study were congruent with prior research. Females in this study were significantly more likely to be diagnosed with depression and PTSD than males.

Authors have offered a number of explanations for "gender" differences in the rate of PTSD and depression. Biological differences are frequently hypothesized to contribute to "gender" differences in the prevalence of PTSD and depression (Breslau, Davis, Andreski, Peterson, & Schultz, 1997; Piccinelli & Wilkinson, 2000). Researchers have also cited higher rates of violent victimization among women to explain disparities in the prevalence of PTSD and depression between males and females (Angst et al., 2002; Tolin & Foa, 2006). While the reasons for "gender" differences in rates of PTSD and depression continue to be debated, the pattern of higher rates of these disorders among females was replicated in this sample.

Risk and resiliency theory suggests that as the number of risks an individual encounters increases the likelihood of emotional dysfunction increases (Greene, Galambos, & Youjung, 2003; Schumm, Briggs-Phillips, & Hobfoll, 2006). The findings of this study suggest that females may face significantly more risks, such as biological vulnerability and maladaptive alcohol use, related to military deployment than males. This may result in increased mal-adaptive alcohol use among females than males in the Air Force following a deployment. Prior studies have consistently identified an increased

risk for depression and PTSD associated with maladaptive alcohol use (Brown, Bray, & Hartzell; Fergusson, Boden, & Horwood, 2009). Higher rates of PTSD and depression among females compared to males in this sample may reflect diminished resilience among females due to elevated risks. These finding suggest that resources to support female Airmen in the combat zone and following re-deployment are essential to maintaining mission readiness. Military medical and mental health providers may benefit by taking "gender" in to account during post-deployment screenings.

V.2. Specific Aim 2: Examine the Internal Consistency of the Post-Deployment Health Reassessment (PDHRA) subscales for depression, alcohol use, and trauma. Describe the means, standard deviations and Cronbach's Alphas of the supplemental Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version (PCL-M) and the Patient Health Questionnaire (PHQ-9). Describe how these measures contribute to the factor structure of the Post-Deployment Health Reassessment (PDHRA).

There are three question sets in the PDHRA which are used to identify Airmen who will complete supplemental assessments (AUDIT, PCL-M and PHQ-9) during their completion of the PDHRA (see Figures 10, 11 &12). The internal consistency of these three question sets will be discussed in this section. Classical measurement theory suggests that subjects have a true score on a construct of interest (Crocker & Algina, 1986; Nitko & Brookhart, 2007). In this section the constructs of interest are alcohol abuse, trauma and depression. The internal consistency of the scales used to measure these constructs suggests how closely related individual measurement items are. Scales

with individual measurement items that are highly inter-related may diminish variance between the observed score and the true score (Cronbach, Gleser, Harinder, & Rajaratnam, 1972; Netemeyer, Bearden, & Sharma, 2003). The clinical implications of these findings will be discussed.

Because of the seriousness of the conditions that are measured by the AUDIT, PCL-M and PHQ-9, (alcohol abuse, PTSD and depression) it is desirable that the screening question sets minimize false negative screenings. PDHRA respondents who have an alcohol-related diagnosis, diagnostic depression, or post-traumatic stress disorder (PTSD) who are classified in a no behavioral health concerns condition on the PDHRA (false negative) may be less likely to receive mental health care for these conditions. Ideally, the screening question sets will identify a pool of Airmen to take the AUDIT, PCL-M or PHQ-9, who on average, score slightly below clinical levels. This may result in some false positive screenings for alcohol abuse, PTSD and depression, but should minimize false negatives (Rubin & Babbie, 2008).

AUDIT Screening Question Set

The screening questions used for the AUDIT (see Figure 14) had a Cronbach's alpha of .60. This is below the level of internal consistency recommended for nomonthetic or clinical research (Abell et al., 2009). This suggests that the clinical utility of these questions for identifying alcohol-related problems may be questionable. The low level of internal consistency suggests that the question set may be measuring concepts other than alcohol problems (Netemeyer, Bearden, & Sharma, 2003). Further research is warranted to improve the internal consistency of the AUDIT screening question set.

Developing an effective question set for alcohol-related problems is a multi-step process. First scale developers need to define the construct of alcohol-related problems. The definition should focus on the effects of alcohol-problems rather than factors involved in the formation of alcohol-problems (Netemeyer, Bearden, & Sharma, 2003). The poor internal consistency of the present AUDIT screening question set suggests that each question is not measuring the same construct. This may be the result of poor construct definition (Netemeyer, Bearden, & Sharma, 2003).

The next step in developing an improved AUDIT screening question set involves scale developers generating a large question set that is theoretically related to the operationalized definition of alcohol-related problems. These questions would then be administered to several samples of post-deployed military members who have recently returned from deployment and the psychometric properties of the questions are assessed. Each item would need to be analyzed via exploratory factor analysis. Through this process, poorly constructed questions are eliminated. Finally a confirmatory factor analysis is used to assess the internal consistency of the new scale (Netemeyer et al., 2003; Springer, 1997).

In their present form, the AUDIT screening question set produced two distinct factors, the *level of alcohol* use and *alcohol concerns* factors. A question set which more consistently measured the desired characteristics of military members' alcohol use may provide greater clinical utility to helping professionals who provide for the alcohol-related needs of post-deployed military member's (Netemeyer et al., 2003).

The findings of the current study also suggest that the AUDIT screening questions may have limited clinical utility. The mean AUDIT score of respondents was well above the "problem drinking" range and within 1 standard deviation of the "alcohol dependence" range for both males and females (Saunders et al., 1993). This suggests that the screening question set used to identify Airmen who will take the AUDIT is not sensitive enough. The present mean AUDIT score is not suggestive of screening questions that are minimizing false negative screening for alcohol abuse. The fact that the mean AUDIT score is above the clinical range suggests that some Airmen who have problematic drinking patterns may not presently being identified by the PDHRA.

Previous research suggests that early intervention related to alcohol misuse can help to prevent the development of alcohol-related problems (Babor, Ritson, & Hodgson, 1986; Room, Babor, & Rehm, 2005). Screening, brief counseling and psycho-education have been shown to be the most efficacious and cost effective strategies for preventing alcohol related-problems (Solberg, Maciosek, & Edwards, 2008). Developing more sensitive screening questions may facilitate identifying at-risk Airmen prior to the development of significant, alcohol-related dysfunction.

PCL-M Screening Question Set

The question set used to screen for the PCL-M (see Figure 15) has an internal consistency (α=.76) that falls in the acceptable range of internal consistency for nomenthetic research, but is not adequate for clinical decision making (Abell et al., 2009). Since the PDHRA may be used to guide clinical decisions this question set may warrant further refinement. In contrast to AUDIT screening questions, the questions used

to identify Airmen who will be offered the PCL-M may be too sensitive to be of significant clinical value. The mean PCL-M score for this sample was more than three standard deviations below the clinical cut off which indicates trauma-related concerns. This suggests that the vast majority of Airmen who are being selected to complete the PCL-M are reporting very low levels of trauma-related distress. This over-sensitivity may limit the clinical utility of the question set used to screen for the PCL-M, because nearly all of the subjects identified by the PCL-M screening question set demonstrated little or no trauma-related dysfunction on the PCL-M.

While there may be value in an overly sensitive screening device for trauma-related disorders, the present set of PCL-M screening questions requires many Airmen who are not experiencing significant stress-related concerns to complete the PCL-M. This is of concern because the potential for random error and error caused by respondent fatigue or disinterest on an assessment may increase with additional questions (Nitko & Brookhart, 2007). This may result in less accurate responses on the PDHRA and diminish the ability of the PDHRA to accurately identify Airmen who are at elevated risk for *trauma* or *depression* (Netemeyer et al., 2003).

Of additional concern is the fact that over-sensitivity on the PDHRA may excessively tax the medical resources tasked to respond to questionnaires that indicate concerns. Excessive demands on military medical and mental health providers may result in truly at-risk Airmen receiving an inadequate level of care (Fowler, 2008; Schroeder, 1987), because so many are having to be seen who are not experiencing trauma-related distress. Studies have shown that over-utilization of medical services are

associated with decreased productivity and quality of care among medical providers (Wittchen, 2002). Additionally, over-utilization has been shown to dramatically increase the cost of medical care (Fowler, 2008). This burden on military medical budgets may result in fewer funds being available to hire the medical personnel needed to meet the post-deployment medical and mental health needs of military members.

PHQ-9 Screening Questions

The two items used to screen for the PHQ-9 (see Figure 16) had the best internal consistency of the three sets of screening questions (α=.83). This level of internal consistency suggests that these questions are useful in guiding clinical decisions regarding an individual's level of *depression* (Abell et al., 2009). The question set used to screen for the PHQ-9 also seems to have a desirable level of sensitivity. Airmen who completed the PHQ-9, typically were less than one standard deviation below the "mild" clinical concerns level. The mean scores on the PHQ-9 in this sample suggest that the PHQ-9 screening question set is identifying a group of individuals who are experiencing depressive symptoms or are at risk for developing depressive symptoms. A group of subjects who have slightly sub-clinical PHQ-9 scores suggests that false negative screenings for depression are being minimized by the PHQ-9 screening question set. The population health of the Air Force may be enhanced by early interventions with at-risk Airmen to minimize the development of severe depressive symptoms (Rutz, Knorring, & Wålinder, 1992).

V.2.1. Psychometric Properties of the Alcohol Use Disorders Identification Test (AUDIT), PTSD Checklist-Military Version (PCL-M) and Patient Health Questionnaire (PHQ-9)

The psychometric properties of the three PDHRA supplemental scales, the AUDIT, PCL-M and PHQ-9, will be discussed in this section. In the current study the mean, standard deviation and internal consistency as measured by Chronbach's alpha of the AUDIT, PCL-M and PHQ-9 were computed. The clinical implications of these results will also be discussed in this section. According to classical measurement theory, measures that have high levels of internal consistency may minimize the variance between a subject's observed score and a subject's true score on a measure (Netemeyer et al., 2003). High levels of internal consistency on the AUDIT, PCL-M and PHQ-9 are suggestive of an accurate representation of alcohol abuse, trauma and depression within the PDHRA.

The Alcohol Use Disorders Identification Test (AUDIT)

The internal consistency of the Alcohol Use Disorders Identification Test (AUDIT) (α=.93) was extremely high in this sample. This is not surprising given that the AUDIT has been extensively validated in prior research (Allen, Litten, Fertig, & Babor, 1997; Saunders et al., 1993). Still, most previous research has not found that the internal consistency of the AUDIT was as high as it was in this study. Previous studies have placed the internal consistency of the AUDIT in the .80s (Allen et al., 1997). The AUDIT has demonstrated a high level of sensitivity and specificity in previous studies with large heterogeneous samples (Shields & Caruso, 2003).

The fact that the internal consistency of the AUDIT, when given within the PDHRA, had excellent internal consistency in this sample and the extensive body of research supporting the validity of the AUDIT suggests that the AUDIT is a valuable clinical tool for Air Force medical providers. The PDHRA embedded AUDIT likely provides an accurate description of the level of harmful alcohol use an individual engages in following deployment (Shields & Caruso, 2003).

Having a correct appraisal of an Airman's level of harmful alcohol use may allow medical and mental health professionals to provide an appropriate level of intervention. Research suggests that medical providers under-diagnose alcohol abuse compared to alcohol dependence, particularly in the primary care setting where the PDHRA is used (Cheeta et al., 2008). Consequently, many individuals with alcohol-related problems do not receive treatment until their problems with alcohol have become advanced. Early and accurate identification of alcohol-related problems among post-deployed Airmen may prevent harmful consequences for at-risk drinkers and facilitate recovery for those with alcohol-related disorders. A meta-analysis of 54 studies on alcohol related treatment found that early intervention and brief treatment were associated with the best recovery trajectories (Moyer, Finney, Swearingen, & Vergun, 2002).

The PTSD Checklist-Military Version (PCL-M)

The internal consistency of the PTSD Checklist-Military Version (PCL-M) (α=.99) was excellent in this sample. In fact, responses on the PCL-M demonstrated a higher level of inter-relatedness than has been found in other research. The internal consistency of the PCL-M has ranged from .78 to .92 in previous studies (de Vries et al.,

1999; Weathers & Ford, 1996). The PCL-M has demonstrated a high level of sensitivity and specificity as a tool for identifying diagnostic PTSD (Dobie et al., 2002; Weathers & Ford, 1996). This means that the PCL-M has been found to accurately identify the presence and describe the severity of *trauma* among military members. The excellent internal consistency of the PCL-M, when given within the PDHRA, and the extensive body of research supporting the validity of the PCL-M suggests that it may a valuable tool for screening Airmen for *trauma* following a deployment.

A significant number of effective, evidence-based practices for the treatment of trauma-related symptoms exist (Bradley, Greene, Russ, Dutra, & Westen, 2005). If military members with trauma or trauma-specific diagnosis like acute stress disorder and post-traumatic stress disorder are identified quickly and accurately following a deployment, they can receive care from trained medical professionals. Timely, evidence-based care may significantly enhance the resilience of traumatized military members following deployment (Nemeroff et al., 2006).

The Patient Health Questionnaire (PHQ-9)

The internal consistency of the Patient Health Questionnaire (PHQ-9) (α=.98) in the current study was excellent. Like the AUDIT and the PCL-M, the internal consistency of the PHQ-9 in the current study was higher than it was in previous research which placed the internal consistency of the PHQ-9 between .80 and .90 (Adewuya, Ola, & Afolabi, 2006; Williams et al., 2005). The PHQ-9 has a high sensitivity and specificity for major depressive disorder (Kroenke et al., 2001). In addition to providing diagnostic feedback regarding the depressive symptoms, the PHQ-9 is also a reliable and valid

measure of *depression* severity (Hancock & Larner, 2009). The robust description of the presence and level of *depression* provided by the PHQ-9 suggests that it is a clinically valuable tool for helping professionals seeking to meet the mental health needs of post-deployed Airmen. Additionally, the brevity of the PHQ-9 makes it an ideal supplement to the PDHRA (Hancock & Larner, 2009).

Discussion Regarding Inclusion of Additional Supplemental Assessments

In the confirmatory factor analysis conducted in this study, the path values of paths between the AUDIT, PCL-M and PHQ-9 and their respective factors suggest that the AUDIT, PCL-M and PHQ-9 suggested that these supplemental scales increased the information present in the individual factors they contributed to. However, when the AUDIT, PCL-M and PHQ-9 were included in the confirmatory factor analysis, the overall model fit of the data marginally decreased. This suggests that a significant amount of the information contributed by the AUDIT, PCL-M and PHQ-9 may have been redundant. The decrease in degrees of freedom within the confirmatory factor model was not offset by the additional information contributed by the AUDIT, PCL-M and PHQ-9. A more parsimonious approach to this model would suggest that these supplemental scales be excluded (Kline, 2005; Netemeyer et al., 2003).

While the inclusion of supplemental measures did not improve model fit, the internal consistencies of the AUDIT, PCL-M and PHQ-9 in this study suggest that the inclusion of standardized measures within the PDHRA may be advisable. The internal consistency of these supplemental measures suggests that military members respond consistently on standardized psychological assessments that are embedded in the PDHRA

(Netemeyer, Bearden, & Sharma, 2003). Future iterations of the PDHRA may benefit from the inclusion of standardized measures to assess other constructs of interest. For instance, the large effect sizes produced by the latent variable *support network conflict*, on *depression* and *trauma* (*1.37-1.48, p=<.001* respectively) suggest that the PDHRA could be improved by the inclusion of standardized measures specific to this construct. Presently, the factor *support network conflict* in the PDHRA encompasses social support, family functioning and work place dynamics. A standardized assessment for each of these components of *support network conflict* may provide important clinical information about the functioning and role of support structures available to post-deployed Airmen.

The inclusion of a more robust description of support network dynamics is supported by previous research. For instance, social support has been shown to enhance resilience in post-deployed military members (Pietrzak et al., 2009). Similarly, supportive martial relationships have been found to be protective against post-deployment psychopathology among military members (Renshaw, Rodrigues, & Jones, 2009). Other studies also suggest that a supportive occupational environment enhances resilience among military members following a deployment (Murphy & Fogarty, 2009). The behavior of the factor *support network conflict* in the models discussed above (see Figures 29 & 31) and the findings of previous research suggest that the PDHRA could be improved by the inclusion of a standardized measure of support network functioning.

Excluding theoretically relevant paths based on strictly empirical considerations can increase the chance of Type II error (Kline, 2005). It may be that the AUDIT, PCL-M and PHQ-9 did not increase model fit due to characteristics of the particular sample

used in this study. Considering theory in model specification can serve as a buffer against the problem of sample-specific results (Kline, 2005, p. 147). Additionally, the findings of this study suggest that the internal consistency of the AUDIT, PCL-M and PHQ-9, when given as part of the PDHRA, is extremely high. A significant amount of research supports the reliability, validity and clinical utility of the AUDIT, PCL-M and PHQ-9 (Allen, Litten, Fertig, & Babor, 1997; Kroenke, Spitzer, & Williams, 2001; Weathers, Keane, & Davidson, 2001).

The models developed for this study were based on theoretical concepts thought to be related to PTSD and depression diagnosis, not on empirical findings of this sample. If models had been developed empirically, without using the existing PDHRA and without significant empirical support for risk and protective factors associated with PTSD and depression, the principles of empirical model specification would indicate that the supplemental scales should be removed from the models in this study (Kline, 2005). Based on one purpose of this study, to examine the psychometric properties of the PDHRA, removing the AUDIT, PCL-M and PHQ-9 could have eliminated important information. For instance it was hypothesized that as participants total number of deployments increased their risk for *depression* and *trauma* would increase. The finding that there was not a relationship between total deployments and *depression* and *trauma* is important for understanding the phenomena of *depression* and *trauma* in Airmen following a deployment. These measures are currently included in the PDHRA for respondents who are positive for behavioral health concerns. It may be useful for the authors and users of the PDHRA to be aware of the limited impact these measures had on

the models in this study. Based on these issues, the AUDIT, PHQ-9 and PCL-M were included in the models developed in this study.

The continued use of supplemental measures in the PDHRA is another concern illustrated in this study. The path and measurement models in this study suggest that supplemental measures do not add a significant amount of additional information about *depression* and *trauma* in PDHRA completers. However the AUDIT, PHQ-9 and PCL-M are reliable, validated and widely used instruments (Allen, Litten, Fertig, & Babor, 1997; Hancock & Larner, 2009; Kroenke, Spitzer, & Williams, 2001; Shields & Caruso, 2003; Weathers & Ford, 1996). These scales had a very high level of internal consistency with Airmen in this sample. The reliability and validity of these measures combined with the familiarity of health care providers with them may cause health care providers to be more comfortable using them to assess post-deployed Airmen than using PDHRA questions alone.

Another important consideration is how clinicians use the AUDIT, PCL-M and PHQ-9 after an Airman is identified as at-risk. The PDHRA is a triage tool. Positive respondents receive additional medical screening for areas of concern. The AUDIT, PCL-M and PHQ-9 are frequently used instruments that provide clinicians with a concise picture of a respondents alcohol use, trauma-related concerns and depressive issues respectively. These tools may improve the ability of clinicians to assess individuals who are identified by the PDHRA. In this study the AUDIT, PCL-M and PHQ-9 do not seem to significantly improve the ability of the PDHRA to identify at-risk Airmen. However, the supplemental scales may improve the quality of care that Airmen receive from

medical providers after completing a PDHRA that is positive for behavioral health concerns. Additional research on how military medical providers use PDHRA results may help clarify the value of including the AUDIT, PCL-M and PHQ-9 in the PDHRA.

In summary, there are dynamics present in the PDHRA confirmatory analysis models that are supportive of the inclusion of the AUDIT, PCL-M and PHQ-9 and other indicators that suggest these supplemental scales be excluded. The strong factor loading of the scales, their high internal consistency, the risk of Type II error involved with removing the scales and the potential clinical benefit of providing these scales to medical professionals are all factors that suggest that the AUDIT, PCL-M and PHQ-9 should be included in the PDHRA. The decrease in model fit that was found in this study when supplemental scales were included and the consequences of respondent fatigue due to longer assessments are factors that suggest that the AUDIT, PCL-M and PHQ-9 should be removed from the PDHRA.

V.2.2. Factor Structure of the Post-Deployment Health Reassessment (PDHRA)

Two confirmatory factor analyses were developed for the current study (see Figures 10 & 11). The purpose of these confirmatory factor analyses was to assess the extent to which various PDHRA questions described constructs of interest in the current study. The factor structures of the PDHRA that were tested fit the data of this study very well. This suggests that the individual items that were used to measure the constructs targeted in this study: *exposure symptoms, support network conflict, alcohol concerns, level of alcohol use, depression* and *trauma*; are contributing to an accurate

approximation of these mental health concerns among PDHRA respondents. Factors which accurately describe *exposure symptoms, support network conflict, alcohol concerns, level of alcohol use, depression* and *trauma* may be of value to medical providers who will make clinical determinations about the level and type of care to provide based on the results of the PDHRA. The findings of this study suggest that the PDHRA may describe the mental health status of a post-deployed Airman accurately enough to be a useful triage tool.

The Factor Structure of the PDHRA with Supplemental Assessment Tools

The primary difference between PDHRA confirmatory factor analysis 1 and PDHRA confirmatory factor analysis 2 was the inclusion of the three supplemental scales, Alcohol Use Disorders Identification Test (AUDIT), the PTSD Checklist-Military Version (PCL-M) and the Patient Health Questionnaire (PHQ-9) in the second CFA model. These supplemental scales did not significantly improve the overall factor structure of the PDHRA in this study. However, each of the supplemental scales contributed a significant amount of information to the individual factor structure of the factor on to which they load. Two of the supplemental scales, the AUDIT and PCL-M, contributed significantly more to the factors structure than other factor loadings. This suggests that *the level of alcohol use* and *trauma* factors provide a considerably more accurate description of alcohol use and trauma when the supplemental scales are included. The PHQ-9 contributed a comparable amount to the *depression* factor as other factor loadings. This further supports the idea that the screening questions for the PHQ-9 are well constructed. In addition to identifying Airmen who scored at a desirable mean

on the PHQ-9, the variables “interest” and “feeldown” contribute to the depression factor at nearly the same level as a highly validated, standardized measure of depression. This suggests that PDHRA questions 14a and 14b may be comparably effective at screening for depression as PHQ-9.

Known-Instruments Validity

The findings suggest concurrent known-instruments validity of the PDHRA. Findings suggest that PDHRA questions designed to identify alcohol-related concerns, trauma and depression load cohesively onto factors with the supplemental instruments (AUDIT, PCL-M and PHQ-9). These measures are known to effectively measure these constructs, which supports the concurrent known-instruments validity of the PDHRA. Establishing known instruments validity is one way to determine the concurrent validity of a measure. Known-instruments validity involves identifying a validated instrument that measures the target construct. The degree that the experimental scale correlates with the known scale establishes the level of known-instrument validity (Shultz & Whitney, 2005). Based on the logic of known-groups validity, the findings of this study suggest that criterion validity of the PDHRA is good.

Convergent Validity

If an experimental measure is highly correlated with other scales that measure the same construct, convergent validity is suggested (Springer, 1997; Crocker & Algina, 1986). In this study the three questions on the PDHRA which are used to identify depression were highly correlated with the supplemental measure, the PHQ-9. This significant correlation suggests the convergent validity of the PDHRA as a measure of

depression. The four questions that are used to identify post-traumatic stress symptoms were also highly correlated with the supplemental measure, the PCL-M. Similar to depression, this finding supports the convergent validity of the PDHRA as a measure of PTSD. Confirmatory factor analysis was also calculated and results showed a two factor solution for alcohol-related items on the PDHRA. This finding suggests that PDHRA questions related to alcohol misuse are not measuring a single construct (Creamer, Bell, & Failla, 2003). On the other hand, the AUDIT, another supplemental measure, was highly correlated with the *Level of Alcohol Use* factor and the three items that contribute to making up this factor. This suggests that a more parsimonious approach to measuring alcohol misuse may improve the convergent validity of PDHRA alcohol-related items.

V.3. Specific Aim 3: How do PDHRA items designed to identify depression and trauma and items hypothesized to impact these conditions contribute to the overall identification of depression and trauma in this sample?

Two measurement models were developed to assess the degree to which the PDHRA identified *trauma* and *depression* in the current study (see Figures 15& 16). These models were developed using the factor structures that were validated in PDHRA confirmatory analysis 1 and 2. Theoretically derived relationships were modeled to assess the level of measurement of trauma and depression within the PDHRA. The primary difference between two measurement models that were developed was the inclusion of the AUDIT, PCL-M and PHQ-9 in PDHRA measurement model 2.

The two PDHRA measurement models that were proposed in this study both fit the data very well. A majority of the relationships between variables were very similar

between measurement model 1 and measurement model 2. The inclusion of the AUDIT, PCL-M and PHQ-9 in measurement model 2 did not substantially change the fit of the model. As was the case in the confirmatory factor models, from a classical measurement perspective, the most parsimonious model structure would suggest that the supplemental scales should not be included in the PDHRA. However, within the PDHRA measurement models two variables did behave significantly different when supplemental assessments, the AUDIT, the PCL-M and the PHQ-9, were included in the analysis. These variables were "shot" and "hurtprob". The differences in these two variables between measurement model 1 and measurement model 2 are discussed in the following section.

The Variable "Shot"

The variable "shot", which comes from PDHRA question 9a3, asks individuals if they have been shot or received a fragment wound above the shoulders during their deployment. "Shot" was not significantly related to trauma or depression in measurement model 1. When supplemental assessments were included in measurement model 2, the variable "shot" produced a moderate, significant, direct effect on the latent factor *trauma.*

This difference may have been caused by the inclusion of the PCL-M as a component of the latent variable *trauma.* The experience of trauma may be more robustly described when the PCL-M contributes to the *trauma* factor. The more complete *trauma* factor, which included the PCL-M, interacted with the variable "shot" differently than the *trauma* factor which excluded the PCL-M. The hypothesized relationship

between being shot above the shoulders and experiencing higher levels of trauma gained statistical significance within the measurement model when the PCL-M was included. This finding may suggest that medical providers who are treating a service member who has been shot above the shoulders will have inadequate clinical information about the mental health status of the service member if the PCL-M is not completed by that service member. This finding may also be supportive of the clinical value of the PCL-M in identifying at-risk Airmen following a traumatic deployment.

It should also be noted that differences in the variable "shot" between measurement model 1 and measurement model 2 may only be a statistical artifact. The number of individuals who accounted for this variable is extremely low (N=33) especially when compared to the overall sample size (N=58,242). Additionally, only 36% of the Airmen who reported being wounded above the shoulders by a bullet or explosive fragment were screened into the PCL-M. Replication of these findings with a significantly larger sample size would be necessary to reach any meaningful conclusions about the relationship of the variable "shot" to *trauma* and the importance of PDHRA supplemental scales to the measurement of that relationship.

The Variable "Hurtprob"

The variable "hurtprob", which asks Airmen if they are still experiencing problems with a wound, assault or injury did not produce a significant effect on *depression* or *trauma* in PDHRA measurement model 1. In PDHRA measurement model 2 "hurtprob" produced small, but significant, direct effects on both *depression* and *trauma*. The differences between measurement model 1 and measurement model 2 may

be related to the inclusion of the PCL-M and PHQ-9 which may have improved the measurement of *trauma* and *depression.*

When the supplemental assessments are included in PDHRA measurement model 2, findings suggest that persistent problems related to a wound, assault or other physically injury are risk factors associated with higher levels of depression and trauma. This finding is consistent with previous research. For example, among military members who were not exhibiting significant *trauma* or *depression* related symptoms one month after a combat experience, those with physical problems were significantly more likely to experience diagnostic levels of *trauma* or *depression* in the following months than physically healthy military members (Grieger et al., 2006). Similarly, military members with persistent somatic complaints, like headaches and dizziness caused by a head injury were more prone to developing *depression* or *trauma*-related problems in the year following a deployment (Schneiderman, Braver, & Kang, 2008). These findings may suggest that the inclusion on of the PCL-M in the *trauma* factor and the PHQ-9 in the *depression* factor were of clinical value in understanding the vulnerability of service members who are experiencing persistent distress related to a traumatic injury that occurred during their deployment.

Noteworthy Relationships

While most variables behaved consistently between measurement model 1 and measurement model 2, a number of variables did not interact as hypothesized within either model. The section below will discuss unexpected and noteworthy relationships and offer possible explanations for the relationships modeled by these data.

Total Deployments and Mental Health

An Airman's number of deployments was hypothesized to have a direct effect on *trauma* and *depression*. It was assumed that as deployments increase Airmen would be more likely to encounter traumatic events, potentially multiple traumatic events. Previous literature suggested that multiple deployments would increase the potential for *trauma* and *depression* among military members (Kline et al., 2010). This relation was not supported by the data within this sample.

There are a number of potential explanations for this finding. Airmen who have very negative deployment experiences which result in their being traumatized or depressed may opt to leave the service at a higher rate than those who have positive deployment experiences (Hoge, Auchterlonie, & Milliken, 2006). Thus, a segment of the population which might have modeled the hypothesized relationship between "total deployments" and *trauma* or *depression* was not represented in this sample because they had separated from the military and did not complete the PDHRA. Additionally, service members who develop PTSD or a diagnosis of depression during a deployment may be prevented from deploying by military medical personnel (Chu, 2006). This process would result in fewer deployments for those who develop a mental health disorder compared to those who do not.

Occupation and Mental Health

Another consideration that was not evaluated in this study was an Airman's job or occupation. Different military occupations deploy at different rates and for different lengths of time. It may be that occupations which are intrinsically more dangerous

deploy at a lower rate or for a different length of time than jobs which present less risk of traumatic exposures. There are considerable differences in the danger associated with various military occupational specialties. Some Air Force occupational specialties, like military police and explosive ordinance disposal personnel have high levels of exposure to direct combat. Other specialties like lawyers and medical personnel have significantly less exposure to direct combat. Previous research has found that military members whose jobs involve direct combat exposure are at significantly higher risk for *depression* and *trauma* than military members who serve in a combat support role (Fear et al., 2010).

It may be useful to include the military member's occupational code on the PDHRA to assess how different jobs impact a service member's mental health status. To date little, if any, research concerning the role of military occupational specialty as a risk or protective factor has been conducted. It may also be of benefit to compare the total number of days an Airman has deployed to the number of times an Airman has deployed in future analysis of the PDHRA. Some Air Force occupational specialties, like pilots, may deploy often, but for shorter periods of time. Other Air Force occupations, like civil engineers and military police, may deploy less often, but for longer periods. Comparing the total number of days deployed with the total number of deployments may indicate differences in the risks presented by different deployment patterns within the Air Force. Risk and resiliency theory suggests that the vulnerability of Airmen can best be understood by considering as many risk and protective factors as possible. Thus, the PDHRA may be a better measure of *trauma* and *depression* if other variables that are theoretically hypothesized to be risks or protective factors are included.

Total Deployments and Support Network Conflict

Previous research with Army subjects has suggested that prolonged or frequent separations associated with deployments, place strain on family and social networks (Hoge et al., 2006). A large body of literature has suggested the protective role of support networks during and after adversity (Brugha et al., 2009; Galea, Tracy, Norris, & Coffey, 2008; Lowery & Stokes, 2005). Applying a risk and resiliency theory framework to research on the relationship between support networks and emotional disorders resulted in the hypothesis that conflict within support networks may increase with higher numbers of deployment. This hypothesis was examined in the current study; however, no relationship between the number of deployments and *support network conflict* found within data of this sample. This may be reflective of differences between Army and Air Force deployments. Typically, the Army deploys soldiers for much longer periods than the Air Force deploys Airmen (Esmond, 1999; Harvey & Schoomaker, 2005). Previous research has demonstrated that longer deployments have a more deleterious effect on relationships and mental health status than shorter deployments (Shen, Arkes, & Pilgrim, 2009). As risk and resiliency theory might suggest concerning protective factors, the Air Force's model of shorter deployment durations may create less disruption in support networks, thereby enhancing protective support structures.

In addition to the differences in duration of deployments between military branches, the nature of deployments varies by military branch as well. Air Force members may be less likely to participate in close or prolonged direct combat compared to military members from other branches (Harvey & Schoomaker, 2005; Moseley, 2005).

This may diminish the presence of trauma-related symptoms and their impact on Airmen's support networks. Lower levels of trauma within the community may serve as a protective factor for Air Force support networks when compared to the Army (Harvey, 2005).

The two questions on the PDHRA that assess support networks focus on the Airman's perception of conflict within support networks. This approach, which takes a risk factor perspective rather than a more protective, resilience focused approach. Important aspects of support networks functioning which may be protective are not included in the PDHRA. The PDHRA does not include any direct assessment of support network functioning following a deployment. In fact, the entire post-deployment process focuses on the symptoms of the military member. A more holistic view of the post-deployment experience, which assesses the positive dynamics within support networks, may enhance our understanding of risk and protective factors military members encounter following a deployment (Schumm, Briggs-Phillips, & Hobfoll, 2006; Tuerk, Grubaugh, Hamner, & Foa, 2009).

Alcohol-Related Factors

Previous research suggests that the *level of alcohol use* an individual engages in is often related to their risk for *trauma* and *depression* (Fergusson, Boden, & Horwood, 2009; Grant & Harford, 1995; Jacobsen, Southwick, & Kosten, 2001). Guided by the findings of previous research, higher levels of alcohol use were conceptualized as risk factors for *trauma* and *depression* in the current study. However, the hypothesis that higher levels of alcohol use was a risk factor for *trauma* or *depression* was not supported

by the data. The lack of positive relationships between alcohol-related variables and *trauma* and *depression* in this study was surprising.

A possible explanation may be that during the present conflicts in Iraq and Afghanistan alcohol use is restricted or forbidden in most deployed locations (*Mental Health Advisory Team (MHAT), Operation Iraqi Freedom 06-08: Iraq, Operation Enduring Freedom 8: Afghanistan*, 2008). The fact that Airmen are not able to rely on alcohol as a coping mechanism in the deployed environment may force them to turn to more adaptive coping strategies, such as exercise or talking to friends, family members or helping professionals (Biro, Novovi, & Gavrilov, 1997; Cicchetti & Rogosch, 2009). Additionally, the absence of alcohol in the immediate aftermath of a traumatic experience may allow for a more thorough and healing emotional processing of the event (McFarlane, 1998). These factors may help explain why higher levels of alcohol use did not impact *trauma* and *depression* as hypothesized in this study.

An individual's alcohol concerns were not related to *trauma* in this study, but *alcohol concerns* did produce a small, direct effect on *depression*. From a risk and resiliency perspective, this dynamic may be related to the vulnerabilities in an individual's cognitive-emotional process. Negative cognitions about drinking may negatively impact one's sense of self (Whitfield & Davidson, 2007). Airmen who perceive a lack of control regarding their alcohol use may experience a depressive emotional reaction. The factor, *alcohol concerns*, may reflect a cognitive process regarding alcohol use more than it does the harmful consequences associated with that alcohol use. It is possible for an individual to use alcohol in a way that is not

maladaptive and still experience negative cognitions about their use. Some research has suggested that depression is more closely associated with alcohol problems than alcohol use (Camatta & Nagoshi, 1995). Airmen who perceive that their alcohol use is a problem may be prone to depressive feelings. This may explain why *alcohol concerns* affected Airmen's experience of *depression* in this study. Additional, individual item analysis of the PDHRA questions which contribute to the *alcohol concerns* factor is necessary to clarify if these items are measuring an individual's perception of alcohol use rather than alcohol misuse.

The Variable "Pay Grade"

The increased risk associated with lower socio-economic status (SES) for *depression* and *trauma,* described in previous research suggested the need for a variable that would reflect this issues. Given the limitations of the questions on the PDHRA and the absence of a direct measure of Airmen's income or other measure of SES, the variable "pay grade" Was included as a proxy. Like *alcohol concerns*, the variable "pay grade" produced a direct effect on *depression,* but not *trauma.* It is unclear why "pay grade" effects *depression* and not *trauma* in this sample. One possible explanation is that the variable "pay grade" is an inadequate proxy for SES. Socioeconomic status is a complex construct, with considerable variance in the operational definition of SES between studies. Some studies include educational level, job type and access to resources as characteristics of SES (Dohrenwend et al., 1992), while other studies define SES strictly on the basis of income (DiGrande et al., 2008; Frankenberg et al., 2008; Hobfoll et al., 2009). Classical measurement theory suggests that inconsistency in the operational

definition a variable may diminish the validity of findings related to that variable (Netemeyer, Bearden, & Sharma, 2003). Therefore, the body of research which suggests a relationship between of SES and *trauma* and *depression* may not be applicable to the current study.

Future research on the relationship between "pay grade" and *depression* and *trauma* should consider the impact of occupation on this relationship. In the military there are a large number of career fields and jobs within military branches. Some career fields and specific jobs are more commonly exposed to traumatic stimuli, while others rarely experience these exposures. For instance, Air Force para-rescue members routinely parachute in to hostile environments, under enemy fire to extract severely wounded or deceased military members. On the other hand, Air Force cooks typically never leave the relative safety of the military installation. Thus a high ranking cook is much less likely to encounter a traumatic, combat-related event than a lower ranking para-rescue Airman. It is possible that the relationship between "pay grade" and trauma that was not significant in this study is due to confounding effects associated with members' type of job and ultimately their exposure to traumatic events. Future research that examines the relationship between pay grade, as an estimate of socio-economic status, and *depression* and *trauma* while controlling for job type would improve the understanding of this relationship.

Another possible explanation for the lack of a relationship between "pay grade" and trauma is that the relationship between socio-economic status (SES) and *trauma* may not exist among certain groups or under certain circumstances. While an abundance of

previous research suggests that lower levels of SES diminish resilience after a traumatic event, this relationship has not been consistently replicated (Frankenberg et al., 2008; Olofsson, Bunketorp, & Andersson, 2009). It may be that studies which have found a relationship between SES and *trauma* were inadequate of their description of this relationship and do not generalize to military members. The findings of this study suggest that socioeconomic factors may not be adequately represented in the PDHRA. A more robust assessment of Airmen's socioeconomic status may increase the sensitivity with which the PDHRA is able to identify Airmen at risk for *trauma* (Hobfoll et al., 2009).

While "pay grade" may not adequately represent SES within the PDHRA, the finding that a lower "pay grade" increases *depression* is noteworthy. Prior research with military subjects has found that depression is more common among the younger, less educated, unmarried and those with shorter time in service (Riddle et al., 2007). Each of these characteristics is more common among lower "pay grades". Perhaps the strain of having fewer financial resources and a less stable family structure increases the degree to which military members experience depression (Brown, 2000; Butterworth, Rodgers, & Windsor, 2009). Additional research which helps explain the relationship between "pay grade" and mental health status may be of value to those who provide medical and mental health services to military members.

In addition, a service member's occupation may be more relevant to traumatic exposures than pay grade. As discussed above, there are considerable differences in the danger associated with various military occupational specialties. Previous research

suggests that military members who work in high-risk career fields are at greater risk for PTSD and depression across pay-grades (Fear et al., 2010). It may be of value to assess the effect of the variable "pay grade" on *trauma* while controlling for occupation. This would allow for a comparison of the effect of "pay grade" among a sample with similar types of exposure. An analysis of the occupational influence a potential relationship between "pay grade" and *trauma* is not possible in the current study because of the absence of an occupational code on the Post-Deployment Health Reassessment (PDHRA). A comprehensive literature review found no studies which examined the role of military occupation and mental health problems controlling for "pay grade."

Suggestions for Modifying the Measurement Model of the Post-Deployment Heath Reassessment (PDHRA)

"Gender", *support network conflict* and *exposure symptoms* were each significantly related to *trauma* and *depression* in PDHRA measurement models 1 and 2. This study highlighted several concerns related to the measurement of these variables. This section will include recommendations for improving the measurement of these variables to improve the identification of *depression* and *trauma* on the PDHRA.

Gender

Previous research has identified a higher prevalence of depression and PTSD among females (Godin et al., 2009; Tolin & Foa, 2006). In this study being female was conceptualized as a risk for *depression* and *trauma.* The hypothesized relationship between being female and higher levels of *trauma* and *depression* was supported by the data in this study. Being female was associated with marginally higher levels of *trauma*

and *depression*. It may be of value for military health care providers to be aware of the additional risk female Airmen face during and following a deployment. Modifications to the PDHRA may help clarify gender-related risks associated with *trauma* and *depression*.

In its present form the PDHRA does not include "gender" as a behavioral health risk factor (Ozanian et al., 2008). Including "gender" as a behavioral health risk factor by itself is not indicated by the findings of this research. However, developing gender specific thresholds for various behavioral health items on the PDHRA may improve the sensitivity of the assessment. The authors of the PDHRA did create gender specific cutoffs for alcohol-related problems on the PDHRA (Ozanian et al., 2008). Expanding the use of this approach to other constructs may be of value. In its present form screening questions for both *depression* and *trauma* produce a binary categorization. Airmen who answer "yes" to any *depression* or *trauma* screening question are identified as having behavioral health concerns. Developing gender specific clinical thresholds for *depression* and *trauma* screening questions may improve the sensitivity of the PDHRA. Below are suggestions for gender specific modifications that may improve the PDHRA.

The relationships modeled in the PDHRA measurement and path models of this paper suggest that the relationship between "gender" and *trauma* and "gender" and *depression* may be partially mediated by *exposure symptoms*. This relationship is suggested by the path tracing rules for recursive path models. Recursive path tracing rules assert that "the model-implied correlation is the sum of all the causal and non-causal associations from all valid tracings between two variables in a recursive path model" (Kline, 2005, p. 130). In the PDHRA measurement models and path models developed in

the current study (see Figures 24, 26, 29 & 31) the mediating role of *exposure symptoms* is suggested through the covariance between "gender" and *exposure symptoms* and the direct path from *exposure symptoms* to *depression* and *trauma*. Previous research suggests that gender specific patterns of *exposure symptoms* emerge following a traumatic event (Norris, Perilla, & Ibanez, 2001). Several studies suggest that somatic and emotional symptoms that occur following a traumatic experience follow gender-specific trajectories (Norris, Perilla, & Ibanez, 2001; Pratchett, Pelcovitz, & Yehuda, 2010). If this relationship is present in military samples, it may suggest that including gender specific assessments of *exposure symptoms* could improve the clinical usefulness of the PDHRA. Future research which assessed gender differences in response patterns to the *exposure symptoms* items on the PDHRA may help clarify if there is a need to develop a gender-specific *exposure symptoms* measure on the PDHRA.

The factor *support network conflict* may also be a candidate for gender specific clinical thresholds. Within the PDHRA measurement models and path models of the current study, recursive path tracing suggests that *support network conflict* may also mediate the impact of "gender" on *trauma* and *depression*. The mediating effect of *support network conflict* can be traced from "gender" through *exposure symptoms* through *support network conflict* to *trauma* and *depression* (see Figures 24, 26, 29 & 31). Additionally, previous research suggests that the impact of support networks on the risk of developing a mental health disorder is significant (Pietrzak, Johnson, Goldstein, Malley, & Southwick, 2009). To date, research suggests that support networks are equally important to the psychological resilience of males and females (Brugha et al.,

2009). However, previous research has also described significant gender differences in the structure and role of support networks (Plaisier et al., 2007). These differences may produce statistical differences within the measurement structure of the PDHRA. Future research that examines the relationship between "gender" and *support network conflict* items on the PDHRA may improve the understanding of how these variables contribute to *depression* and *trauma* as measured by the PDHRA.

Support Network Conflict

Support network conflict produced the largest effects on both *depression* and *trauma* in both PDHRA measurement models. The importance of support networks in enhancing resilience following traumatic exposures in combat veterans is well established in the literature (Boscarino, 1995; Bozo, Anahar, Ates, & Etel, 2010). *Support Network Conflict* on the PDHRA encompasses family, social and occupational support networks. Social support, family functioning and occupational satisfaction are each important components of a support network. Combat veterans who enjoy high levels of social support are less at risk for *depression* and *trauma*-related problems following a combat experience than peers who have inadequate social resources (Boscarino, 1995). Closeness to family members also enhances resilience in military members after traumatic combat-related experiences (Dikel, Engdahl, & Eberly, 2005). Previous research has also demonstrated that higher levels of occupational strain increase emotional risk among military members (Bridger et al., 2007). The PDHRA measures these three separate aspects of a support network with only two variables, "conflict" and "emoprob".

The role of support networks seems to have been under-valued by the authors of the PDHRA. No standardized supplemental assessment of support networks was included in the PDHRA, as it was for alcohol use, depression and PTSD. The inclusion of a more robust assessment of support network functioning may provide critical clinical information about the presence or lack of the resiliency enhancing systems available to military members following a deployment. The inclusion of a small set of screening questions for each of the constructs of social support, family functioning and occupational satisfaction could be included in the PDHRA with minimal impact on the length of the assessment. These screening questions could then be supplemented with standardized measures of these constructs in a similar fashion to the use of the AUDIT, PCL-M and PHQ-9. The addition of a question that directly asks if the respondent had an important relationship end or change significantly during or since their deployment may be of value.

Exposure Symptoms

Exposure symptoms produce significant effects on both *trauma* and *depression* in both PDHRA measurement models. When supplemental assessments were included in measurement model 2 the path coefficient of *exposure symptoms* to *depression* and *trauma* was significantly reduced. This may be because the PHQ-9 and PCL-M explained a significant portion of the variance in *trauma* and *depression* that was being explained by *exposure symptoms* in PDHRA measurement model 1. However, there may be differences between the Airmen who completed the PCL-M and PHQ-9 and those who did not. Airmen who do not answer affirmatively to PCL-M and PHQ-9 screening

questions may have had experiences or personality characteristics that influence their level of *depression* and *trauma* that are not explained by exposure-related factors. Non PCL-M/PHQ-9 completers may not have these characteristics, elevating the influence of exposure symptoms on their experience of *depression* and *trauma.* A pilot study which examines the influence of *exposure symptoms* on *depression* and *trauma* in a sample with universal PCL-M and PHQ-9 completion may help to determine if sampling bias caused the effect size differences in *exposure symptoms*.

An important consideration regarding *exposure symptoms* is that they are not presently used in this PDHRA to identify behavioral health concerns. The variables that make up the *exposure symptoms* factor are used to identify traumatic brain injury (TBI) and indicate physical concerns on the PDHRA. It is important for medical providers to be informed about the fact that *exposure symptoms* may be indicative of both physical concerns and behavioral health concerns.

Because the *exposure symptoms* question set was designed to assess TBI, there is no question which asks respondents if they were shot below the shoulders. While a gunshot wound below the shoulders presents little risk of causing a traumatic brain injury, it may present a significant risk of causing psychic damage (MacGregor, Corson, Larson & et al., 2009). The addition of a question which directly asks if respondent suffered a gunshot or fragmentary wound below the neck may add valuable information about an Airman's risk for *trauma* and *depression.*

V.4. Specific Aim 4: Describe the clinical value of the PDHRA for identifying individuals with a depressive or trauma-related diagnosis.

Sensitivity and Specificity

The Post-Deployment Health Reassessment (PDHRA) was found to be a moderately effective clinical triage tool with this sample of Airmen. Individuals who were positive for behavioral health concerns on the PDHRA were significantly more likely to develop a diagnosis of PTSD or depression than individuals who had a PDHRA that did not indicate behavioral health concerns. The PDHRA was designed to be an overly inclusive screening tool (Ozanian, 2010); therefore, it was not surprising that the specificity of the PDHRA was not high. Findings demonstrated that a large number of individuals who had behavioral health concerns on their PDHRA did not develop PTSD or depression. This suggests that the PDHRA has extremely little diagnostic value.

The sensitivity of the PDHRA for both depression and PTSD did not reach the .85 threshold set forth in this study, (depression = .71, PTSD = .74) (Newman, 2010). This was surprising given that it was designed to be overly inclusive of behavioral health concerns. As 30% of Airmen who were diagnosed with depression or PTSD were not identified by the PDHRA as having behavioral health concerns, it suggests that these individuals may not have been directed or referred to services to address their mental health issues. This may also suggest that these Airmen did not have diagnostic depression or PTSD at the time they completed their PDHRA. The lower than expected sensitivity of the PDHRA (less than .85) in this study may be partially due to poor controls during the weeks or months between the time an Airman completed their

PDHRA and when they were diagnosed with depression or PTSD. For instance, some individuals who were diagnosed with depression or PTSD after completing the PDHRA which did not indicate behavioral health concerns may have developed depression or PTSD due to factors that occurred after their PDHRA screening which may have had little connection to their deployed experiences.

More than 100 Airmen in this study who screened negatively for behavioral health concerns on the PDHRA were later diagnosed with of depression or PTSD. Given that no psychometric measure is perfect, it is likely that some of these Airmen were incorrectly identified by the PDHRA as not having a BH concern (Nunnally & Bernstein, 1994). Depression and PTSD can be chronic and debilitating conditions in post-deployed military members (Grieger et al., 2006). Future research which controls for relevant variables that occur following the completion of the PDHRA might clarify how these factors impacted the sensitivity of the PDHRA in this study. If the sensitivity of the PDHRA remained below .85 in research that controlled for post-PDHRA factors steps should be taken to adjust the PDHRA to minimize false negative screening rates..

Future cluster analysis research which assesses the response patterns of Airmen who are diagnosed with PTSD or depression following deployment, but are not classified by the PDHRA as having behavioral health concerns, may identify unique response patterns among this group. This could be accomplished through a factorial analysis of PDHRA responses that identifies patterns of responses that are associated with the future development of depression or PTSD. Additionally, qualitative analysis of Airmen's perceptions about the PDHRA and the consequences of PDHRA responses may also

improve methods to make the post-deployment screening process more sensitive to the needs of at-risk Airmen.

Positive and Negative Predictive Value

Positive Predictive Value (PPV) is the most important measure of diagnostic value of a scale as it reflects the probability the test accurately identifies the condition being measured. In this study, PPV reflects the proportion of Airmen who have PTSD or depression and are correctly identified. Standards for the computation of PPV vary; however, PPV depends largely on the prevalence of the disease/condition within the sample (Akobeng, 2007). Some suggest that the prevalence of the condition of interest in the sample should match the prevalence of that condition in the general population (Altman & Bland, 1994). A large military cohort study found incidence of PTSD within the previous month at 4% and 2-week incidence of depression at 3.2% (Riddle et al., 2007). Other authors suggest that 50% of the sample should have the condition of interest when computing PPV (Altman & Bland, 1994). Among the current study's sample of Airmen, The PPV of the Post-Deployment Health reassessment (PDHRA) was very low (PPV for Depression=.012, PPV for PTSD=.006). Thus, neither of these standards for prevalence was met and no conclusions should be drawn about the positive predictive value of the PDHRA.

The principles of classical measurement theory suggest that a valid and reliable instrument should produce consistent results for different samples (Shultz & Whitney, 2005). Therefore, problems associated with computing the PPV for a sample with very low prevalence can be illustrated by considering how a highly reliable and valid measure

should perform with the sample used in the current study. The Beck Depression Inventory (BDI) is widely considered a "gold standard" measure of depression (Leentjens, Verhey, Luijckx, & Troost, 2000). The specificity and sensitivity of the Beck are commonly reported in the .85 range (Beck, Guth, Steer, & Ball, 1997; Homaifar et al., 2009; Leentjens et al., 2000). The positive predictive value of a measure can easily be extrapolated for a measure from the measure's sensitivity and specificity. The formula for PPV is:

$$\text{PPV} = \frac{\text{correct positives}}{\text{correct positives+false positives}}$$

The percentage of correct positives a measure produces is its sensitivity. Thus, the Beck Depression Inventory typically identifies 85% of individuals with depression correctly. False positives are indicated by subtracting the specificity from 1.0 (Homaifar et al., 2009). The BDI typically has a sensitivity of .85. Therefore, the BDI typically classifies 15% (1.0-.85) of non-depression subjects in the depression category. Said another way, the BDI usually has a 15% false positive rate. In the current study there were 57,825 individuals who did not have a depression diagnosis out of 58,242 total subjects. Given the specificity of the Beck Depression Inventory (BDI), 15% (N=8,674) of individuals in the present sample who did not have a diagnosis of depression would be expected to have a false positives on the BDI. In this study 338 individuals had a diagnosis of depression. Therefore, the Beck Depression Inventory (BDI) would be expected to correctly identify 287 (338 x .85) of the depressed participants correctly.

Now that we have the expected correct positive number (287) and the expected false positive number (8,674) for the BDI, the expected positive predictive value for the BDI in the current study can be computed.

$$\text{PPV} = \frac{\text{correct positives}}{\text{correct positives+false positives}} = \text{PPV} = \frac{287}{287+8{,}674} = \text{PPV} = .032$$

This analysis suggests that if the Beck Depression Inventory (BDI) were given to the sample in this study instead of the Post-Deployment Health Reassessment (PDHRA), the PPV of the BDI would be very poor (PPV= .03). This suggests that the diagnostic utility of the BDI would be poor for this sample; however, it would be incorrect to conclude that the BDI is not a useful tool to identify diagnostic depression in this sample because the poor PPV was a function of prevalence not the instrument. Thus, the low PPV of the PDHRA for depression and PTSD, given the extremely low prevalence of these conditions in this sample, is not meaningful. Future research using samples with more appropriate prevalence rates of PTSD and depression may produce more meaningful results related to the PDHRA's positive predictive value.

Another consideration regarding the Positive Predictive Value (PPV) of the Post-Deployment Health Reassessment (PDHRA) relates to the purpose for which this measure is given to military members. As the PDHRA was developed to assist in identifying military members who are experiencing behavioral health concerns as a result of deployment-related stress, it is not a diagnostic tool (Ozanian et al., 2008). While many military members will experience some stress related to a deployment, most will not develop difficulties to the level that reaches a psychiatric diagnosis (Milliken, Auchterlonie, & Hoge, 2007). The poor predictive value of the PDHRA may be

reflective of the number of individuals who experience only sub-diagnostic levels of stress. Each individual with a PDHRA that was positive for behavioral health concerns was offered a variety of additional supports (see Figure 8), which may have obviated the need for further mental health treatment and diagnosis. This early identification and support may have reduced the prevalence of PTSD and depressive diagnoses in this sample (Roberts, Kitchiner, Kenardy, & Bisson, 2009), resulting in reduced PPV of the PDHRA.

While the poor predicative value of the PDHRA suggests that it is not an effective diagnostic tool, the findings of this study suggest that a PDHRA which indicates behavioral health concerns is a valuable tool for identifying Airmen who are at increased risk for developing diagnostic PTSD or depression (Akobeng, 2007). Triage is the process of sorting people based on their need for immediate medical treatment as compared to their chance of benefiting from such care (Baker, 2007). Airmen with PDHRAs which were positive for behavioral health concerns had significantly greater odds of receiving a diagnosis of PTSD or depression in this study than Airmen with a PDHRA that did not indicate behavioral health concerns.

A scale with high negative predictive value (NPV) accurately identifies individuals who do not have the condition of interest (Mayer, 2004). In this study, NPV reflects the proportion of Airmen identified by the PDHRA with no PTSD or depression who are not later diagnosed with these disorders. A scale with high NPV is a valuable tool to guide the allocation of medical resources, by screening out those who are not in need of care. In the context of the Post-Deployment Health Reassessment (PDHRA)

negative predictive value may be beneficial to avoid pathologizing normal responses to post-deployment stress (Richard, 2003). Recent research has found that deficit focused interventions for normal responses to stress can increase negative outcomes (Ruzek, 2008). This suggests that the extremely high NPV of the PDHRA (depression= .997, PTSD=.999) or over-identifying those with behavioral health concerns may enhance the health of Airmen post-deployment. However, the high negative predictive value of the PDHRA cannot be considered an indication that the PDHRA identifies individuals without PTSD and depression at extremely high rates because the high NPV is a product of the low prevalence of PTSD and depression in this sample (Liu et al., 2008). If the percentage of Airmen in this sample that had diagnostic depression or PTSD were higher the NPV would have been lower. The exact impact a different prevalence would have on NPV of the PDHRA can be calculated using the sensitivity and specificity reported above. This phenomenon is the opposite of the impact of prevalence on PPV described above. In fact, if a measure is given to a sample with no subjects who have the condition of interest the NPV would be 1.0 because there could not be a false negative (Altman & Bland, 1994). Therefore, it should not be concluded that the PDHRA is an effective diagnostic tool for identifying individuals who do not have a diagnosis of depression or PTSD. Future research using a sample with more appropriate prevalence levels is necessary to draw any conclusions about the usefulness of the PDHRA as a negative diagnostic tool.

Known-Instruments Validity

Airmen who complete the PDHRA are categorized as having behavioral health concerns or not having behavioral concerns. There was a moderate rate of correspondence between having behavioral health concerns on the PDHRA developing diagnostic PTSD or depression following a deployment. There was also a moderate rate of correspondence between having no behavioral health concerns on the PDHRA and not developing a diagnosis of PTSD or depression following a deployment. The relationship between behavioral health concerns categorization on the PDHRA and diagnostic PTSD and depression is suggestive of known-groups validity within the PDHRA. Known-groups validity is a form of criterion validation in which the validity is determined by the degree to which an instrument can demonstrate different scores for groups known to vary on the variables being measured (Springer, 1997). In this study individuals were known to vary on their diagnostic category. For those in the category of PTSD and depression diagnosis the PDHRA correctly categorized at a rate of over 70%.

To further support the known-groups validity of the PDHRA future studies should assess the ability of the PDHRA to differentiate between subject pools known to have diagnostic PTSD or depression and subject pools known to not have these disorders at the time the assessment is administered. The degree to which the PDHRA can correctly differentiate between diagnostic and non-diagnostic subjects will be suggestive of the known-groups validity of the PDHRA for PTSD and depression (Bianchini, Etherton, Greve, Heinly, & Meyers, 2008; Hung, Lubetkin, Fahs, & Shelley, 2009). If the known-groups validity of the PDHRA can be established it could suggest that the criterion validity of the PDHRA is good.

V.4.1. Post-Deployment Health Reassessment (PDHRA) Path Models

The model fit of Post-Deployment Health Reassessment (PDHRA) Path Model 1 and PDHRA Path Model 2 were good. This suggests that the model used in the current study if the PDHRA data well (Kline, 2005). Good model fit suggests that that significant correlations and direct effects within the model are meaningful and can be interpreted (Dion, 2008). In PDHRA Path Model 1 and PDHRA Path Model 2 *depression* produced a large direct effect on the "depression diagnosis" variable and *trauma* produced a large direct effect on the "PTSD" diagnosis variable. This suggests that the PDHRA is a useful tool for identifying individuals who are likely to develop diagnostic depression or PTSD (Kline, 2005).

When paths to diagnostic categorizations are added to PDHRA measurement models 1 and 2 (see Figures 29 & 31) the relationships within each path model remain virtually the same as they were in the corresponding measurement models (see Figures 24 & 26). The path from *trauma* to "trauma diagnosis" and the path from *depression* to "depression diagnosis" are both statistically significant with a moderate effect sizes. This further suggests that the PDHRA is of significant clinical value in identifying post-deployed Airmen with diagnostic depression and PTSD.

Surprisingly, the effect size on "trauma diagnosis" slightly decreased from PDHRA path model 1 (b=.61, p=<.001) to PDHRA path model 2 (b=.55, p=<.001). Similarly, the effect size on "depression diagnosis" slightly decreased from path model 1 (b=.52, p=<.001) to Path Model 2 (b=.51, p=<.001). In other words, the effect of the PDHRA on diagnostic variables decreases when the standardized supplemental

assessments (AUDIT, PCL-M and PHQ-9) are added. This is puzzling because the clinical utility of the AUDIT, PCL-M and PHQ-9 for identifying diagnostic conditions has been demonstrated in extensive research (Allen et al., 1997; Hancock & Larner, 2009; Weathers & Ford, 1996). These supplemental instruments clearly add a great deal to the factors of *level of alcohol use, trauma* and *depression.* While the decrease between models is slight, a significant increase in effect size was expected because of the significant factor loadings that were observed during confirmatory factor analysis. This finding brings in to question the clinical value of these additional measures. In each model in this study, the model fit was not improved by the inclusion of the AUDIT, PCL-M or PHQ-9. The inclusion of the AUDIT, PCL-M and PHQ-9 decreases the degrees of freedom within each model. This decrease is not offset by the information that is added by the supplemental scales. These findings suggest that models that exclude the supplemental scales are the more parsimonious. Additionally, these measures represent an additional 36 items that PDHRA respondents must complete. This additional burden on respondents increases the potential for random measurement error due to respondent fatigue or indifference (Netemeyer, Bearden, & Sharma, 2003). Policymakers must weigh the additional burden of these questions on respondents with the limited benefit they seem to offer clinicians.

V.5. Strengths and Limitations

This was one of the first studies to assess the psychometric properties and clinical utility of the Post-Deployment Health Reassessment (PDHRA). This study employed a very large sampling frame, which enhanced the generalizability of the findings of this

research to the larger Air Force population. Additionally, the large sample size allowed for the use of thresholds for statistically significance (p=<.001) that minimized the possibility that positive findings in the current study were caused by chance (Rubin & Babbie, 2008, pp. 506-515). Additionally, the large sample used in the current study minimized the potential for type II error. A type II error occurs when no statistically significant relationship is observed in the data, when a significant relationship actually exists. As a sample size increases the minimum effect size that can be observed decreases. Therefore, relationships that do not produce large effects may not have statistical significance in small sample (Rubin & Babbie, 2008, p. 525).

Another benefit of the large sample was that it facilitated the use of advanced statistical analysis to model the complex relationships that impact *depression* and *trauma.* In structural equation modeling the upper bound of parameters that can be estimated in a model is set by the number of observations in the sample (Kline, 2005). The large sample size allowed for the development of a large, complex model which included all theoretically relevant variables measured by the Post-Deployment Health Reassessment (PDHRA). The findings of this study should be of benefit to military medical providers and policy makers because they identify the variables within the PDHRA that are significant risk factors for *trauma* and *depression*.

The use of statistical modeling techniques in the current study allowed for the modeling of all coefficients simultaneously. Thus, the significance and strength of specific relationships within the models could be assessed in the context of the complete

model. This provides a more thorough understanding of the factors that impact the measurement of *trauma* and *depression* as measured by the PDHRA (Dion, 2008).

Large Sample Size

While the large sample size of this study provided benefits, there are also limitations associated with the use of a large sample. A very large sample size results in very high statistical power. The power of a statistical test is the probability that the test will not produce a Type II error or false negatives (Ellis, 2010). Type I error rate and effect size are merely a function of the sample size (Kane, 2008). An effect found in a very small sample will almost certainly be statistically significant in a sufficiently large sample, but a relatively large effect may not be judged statistically significant with a small sample. Although statistical significance tests are necessary to protect against Type I errors, attained significance levels should never be regarded as a measure of the magnitude of an effect (Mallinckrodt, Abraham, Wei, & Russell, 2006). Instead, additional descriptive statistics about the extent and form of an effect should be reported. Some researchers advocate focusing on effect magnitude rather than the statistical significance of a relationship to diminish the influence of a large sample size (Sawyer, 1982). In this study effects were described as trivial, small, moderate or large. Statistically significant effects which were small or trivial may not have practically meaningful implications.

In this study several additional steps were taken to diminish the influence of high statistical power resulting from large size of the sample. First, the use of Structural Equation Modeling (SEM) in this study was helpful to minimize the impact of a large

sample. SEM is a "large-sample technique" (Kline, 2005, p. 14) which simultaneously evaluates all of the relationship within a proposed statistical model which provides a higher level perspective to the analysis. The degree to which all of the relationships within a statistical model compare to expected values is described by fit indices. A good fitting model is one in which the value of modeled relationship is very close to the expected values. This is an advantage to linear regression techniques which only describe the significance and effect size of modeled effects. With SEM, poor model fit suggests that statistically significant relationships may be the product of chance (Dion, 2008). Additionally, several of the fit indices used in this study (RMSEA, CFI/TLI) are adjusted to account for sample size. This suggests that in spite of a very large sample and associated statistical power the overall fit of the models evaluated in this study was not significantly influenced by sample size (Kline, 2005).

A second step was to recognize that individual relationships within the model may be subject to the influence of sample size. Therefore, a more rigorous significance threshold (p=<.001) was used in this study. This stringent criterion meant that the chances of an individual relationship being the product of chance were 1 in 1000 and diminished the potential for Type I error in bivariate relationships within each model (Kane, 2008). While, the chances of any one relationship being the product of chance in this study was small, the large number of relationships reported in this paper increased the likelihood that some of the findings reported may be a product of chance.

Third, each model in this study was replicated 5 times using a randomly generated subsample that was half the size of the original sample. This process reduced the

statistical power of the model by reducing the sample in each model. None of the model replications produced significantly different results than those reported above for the original models. Thus, the validity of the original findings appears to be supported (Fornell & Larcker, 1981).

When interpreting the findings of this study both statistical significance and the effect size of relationships should be considered in tandem (Sawyer, 1982). In the models reported above, several relationships were statistically significant, but had small effect sizes that should be considered when drawing conclusions concerning the importance of these relationships. For example, in each of the 4 structural models in this study there was a statistically significant relationship between "pay grade" and *depression;* however, the effect size of these relationships was trivial (.01). Therefore, making recommendations regarding *depression* based on an Airmen's "pay grade" because of the statistically significance relationship is not be indicated due to the likely inconsequential relationship found in real world settings.

Relationship Problems

The results of this study expand the understanding of *depression* and *trauma* among military members following a deployment by identifying factors that may be associated with these constructs in post-deployed Airmen. In this study the largest direct effect on *trauma* and *depression* in post-deployed Airmen was *relationship problems*. In fact, the effect size of *relationship problems* on trauma and *depression* was more than three times larger than any other direct effects that were modeling in this study. This finding was consistent with a large body of literature that identified relationship problems

as a risk factor for depression and PTSD (Boscarino, 1995; Bozo, Anahar, Ates, & Etel, 2010; McFarlane, 2008; Tucker & Pfefferbaum, 2000; Ullman, Townsend, Filipas, & Starzynski, 2007). This study provided more detailed information about the size of the relationship between relationship conflict and PTSD and depression. The findings of this study suggest that relationship problems are the largest risk factor for PTSD and depression for Airmen following a deployment. This finding has significant implications for helping professionals providing care to post-deployed Airmen.

The results of this study also clarify the usefulness of the PDHRA as a post-deployment mental health triage tool. A number of factors which are measured on the PDHRA were identified by the current study as statistically significant indicators of *depression* and *trauma* (see Figures 24 & 26). Several indicators of *depression* and *trauma*, including "gender", "pay grade" and *exposure symptoms* are not presently being used to identify *depression* and *trauma* among PDHRA completers (Ozanian et al., 2008). The results of this study may be a helpful guide for the development of future iterations of the Post-Deployment Health Reassessment (PDHRA) which do take statistically significant indicators of *trauma* and *depression* in to account.

While the current study is a significant contribution to the field of military social work, there were a number of limitations that must be noted. The findings of this study should be considered exploratory and used to guide future research. While the findings of this study are supportive of the use of the Post-Deployment Health Reassessment (PDHRA) as a post-deployment screening tool, a number of factors still need to be assessed.

Limitations Related to the Lack Post-PDHRA Controls

This study could not control for any variables following PDHRA completion. For some Airmen in this study, there could have been more than 2 years between PDHRA completion and a diagnostic categorization. A great deal can happen in two years. An individual's experience following the completion PDHRA will likely influence the development of a mental health diagnosis during this time frame. For instance, traumatic events that occurred following PDHRA completion were not controlled for in this study. Airmen who experienced a traumatic event after they completed the PDHRA may be at increased risk for trauma and *depression.* Research conducted with military veterans suggests that post-combat traumatic experiences are common and may enhance risk for mental health disorders (Smith, Frueh, Sawchuk, & Johnson, 1999).

Changes in support structures, physical health and financial status that occurred following PDHRA completion were also not accounted for in the current analysis. Future research which includes a description of Airmen's experience after the PDHRA screening would provide a better understanding of the factors that lead to the development of mental health disorders. Controlling for theoretically relevant variables following the completion of the PDHRA would also help to establish the clinical utility of the PDHRA.

Limitations Related to Post-PDHRA Assignment Location Heterogeneity

Another consideration that may have influenced the findings of this paper is the varying degree of training and intervention among the medical personnel tasked to meet post-deployment mental health needs of PDHRA completers. A pilot study which employs medical personnel to intervene following a positive PDHRA, with standardized

training and intervention techniques would provide a more accurate appraisal of the prevalence of post-deployment mental health disorders and the efficacy of post-deployment screening and intervention.

The data for this study were drawn from Air Force bases around the world. It is likely that risk and protective factors are not the same at an Air Force base in Missouri as they are at an Air Force base in Korea, for instance. Being stationed in Korea is designated as a "remote" assignment, which means that family members may not accompany the Airman (Donley, 2009). The support dynamics for a "remote" Airman may differ in important ways from a traditional assignment where Airmen continue to live with their families. Additionally, different Air Force bases have different missions. This means that Airmen from one base may deploy for different lengths of time and to areas with different threat levels than Airmen from another base. Mission type could also impact the amount of work Airmen are expected to do when they return to their in-garrison assignment. These are important considerations when assessing the emotional vulnerability of deployed military members. However, these factors could not be included in this analysis. A multi-group analysis of the findings within this research which compares different types of Air Force bases based on size, mission type or location of the base, may paint a more detailed picture of the role of location in shaping the post-deployment experience of Airmen.

Limitations Related to Unit Cohesion

A number of important variables in addition to geographic location, support structure and mission differences may have affected the results of this paper. Previous

research suggests that unit cohesion is an important component of resiliency among military members (Brailey et al., 2007). A number of factors can impact the degree of cohesion within a unit. The type and competence of leadership, the rate of turnover, the quality of life on the base and in the surrounding community and the mission readiness of the unit can all impact the cohesion within a military unit (Burrell et al., 2006). The PDHRA does not include items which assess cohesion within the deployed unit or the in-garrison unit. Unit dynamics may explain some of the unexplained variance within the models proposed. Future research which assesses the relationship between unit cohesion and *trauma* and *depression* within the PDHRA measurement models proposed in this study may clarify if unit cohesion is an important aspect of the measurement of *trauma* and depression among post-deployed Airmen. The absence of a measure of unit cohesion may account for some of the unexplained variance in *trauma* and *depression* in the current study.

Limitations Related Treatment Facility Heterogeneity

There is significant variance in level of care that is available at different military medical centers. Some military installations have large medical centers, with capabilities matching those of a regional medical center. Other military installations have small clinics with 1 or fewer licensed mental health providers. This results in a variety of PDHRA triage processes. While the PDHRA handbook suggests a standardized protocol for implementing post-deployment health assessment, in practice the process is far from standardized (Ozanian et al., 2008). From location to location different intervention protocols are implemented by medical staff with different levels of training. This

variance may impact the extent to which at-risk individuals are identified and eventually diagnosed with a mental health condition. These factors could not be controlled for in this study, however future multi-base analysis should attempt to control for inter-location heterogeneity. Inadequate control of Air Force base heterogeneity may account for a significant amount of the unexplained variance in the current study. Additionally, administering a standardized diagnostic assessment to all individuals who complete the PDHRA at several time points would provide a more reliable measurement of the rates of PTSD and depression in the sample.

As discussed above, different military occupations have inherently different levels of risk. Some jobs within the military are "direct-combat" occupations, while other military occupational specialties have a very low incidence of combat exposure. In its present form the PDHRA does not include a military specialty code. It may be that a considerable amount of the explained variance in the models proposed is spurious and could be better accounted for by the inclusion of an occupational code variable.

Limitations Related to the Exclusion Traumatic Brain Injury (TBI) Variables

A primary purpose of the PDHRA is to identify military members with traumatic brain injury (TBI) (Ozanian, 2010). A large number of the questions on the PDHRA and several of the variables used in this study were designed for this purpose. This study did not assess the psychometric properties or clinical utility of the PDHRA for identifying TBI. Previous literature has identified a significant relationship between TBI and PTSD and TBI and depression (Aaron et al., 2008; Jean-Bay, 2000). This relationship was not modeled in this paper, but it might be that a significant amount of the unexplained

variance in *trauma* and *depression* in this analysis may have been explained by TBI. Additionally, it is possible that some of the relationships that are modeled in the current study are spurious and the variance explained by these spurious associations could be better accounted for by the inclusion of TBI. Consequently, if traumatic brain injury factors had been included in the models used in this study, the degree of model fit may have been significantly different. Thus, this study must be considered an incomplete assessment of the Post-Deployment Health Reassessment (PDHRA).

Generalizability

The military members in this sample were drawn only from the Air Force. However, the PDHRA is a primary screening tool that is used in all branches of service across the Department of Defense (DoD). As discussed above, there are significant differences in the demographic makeup and mission requirements between military branches; thus, the results reported in this study should only be applied to Air Force members. Replicating this study with a sample from another branch of the military or a heterogeneous military sample which includes service members from each military branch would provide a more generalizable description of the psychometric properties and clinical utility of the PDHRA.

V.6. Implications for Social Work Policy and Practice

This study used a population sample of Air Force members who had been deployed and returned home. Therefore, the findings of this study have the most direct implications to the field of military social work, but are relevant to social work practitioners, educators, and researchers. The results of this study may increase

professional knowledge regarding the factors that are associated with trauma and depression in Airmen following a deployment.

The United States Air Force employs 330 active duty social workers and several hundred contract social workers around the world. Additionally, social workers are employed in every Department of Veterans' Affairs Medical Centers, Veteran Centers and in many community-based clinics that service military members and their families. (*National Defense Authorization Act for Fiscal Year 2011*, 2010). Military social work is already one of the largest fields in social work. However, the extremely large number of military members who have deployed over the last 10 years suggests that increased social work education and skill capabilities are needed. While some universities like Smith and the University of Southern California have begun to offer courses which focus on social work with military clients, most social work schools do not offer courses specifically related to serving military populations. Consequently, social workers who service military clients must rely solely on the job training to develop expertise in areas that are unique to military populations. Social workers should advocate for more widely available education and training opportunities that focus on military social work.

The large sample used in this study (N=58,242) represents only one year of deployments for one branch of service, the Air Force. The Department of Defense has been deploying military members from each branch of service since 2001. The large number of Airmen who deploy in just one year suggests the scope of the problems that may result from current military operations. Military deployment has been associated with increased mental health problems (Milliken, Auchterlonie, & Hoge, 2007). For

nearly 10 years military members from each branch of service have been deploying, often repeatedly, to combat zones. The large number of men and women who have been exposed to combat over the past decade suggests that a large need for social work intervention exists within the military. Social workers should advocate for increased screenings and support services for military members following a deployment to ensure that all military members who have experienced the disruption and potential trauma of combat deployments receive the highest quality of care possible.

Support Networks

The findings of this study highlight the importance of social, family and occupational support following a deployment. Previous research has found that supportive friends, family members and co-workers are all protective factors when Airmen return home following deployment (Boscarino, 1995; Brailey, Vasterling, Proctor, Constans, & Friedman, 2007; Burrell, Adams, Durand, & Castro, 2006). Social workers providing services to military members following a deployment should assess the level of support available to their clients and address perceived deficits in support structures.

Repeated deployments can negatively impact support networks (Burrell, Adams, Durand, & Castro, 2006). Military members spend significant amounts of time away from their support networks and the inadequate availability of telephones and internet access in a deployed setting make it difficult for military members to communicate with family and friends. Often social and familial dynamics change in the absence of the deployed military members. Often military members have difficulty adjusting to these

changed dynamics upon their return (Mazzuchi, Trump, Riddle, Hyams, & Balough, 2002). Recent reports have found that, in the current environment, military members have inadequate "dwell time" to reestablish social and familial bonds (Volpe & Carroll, 2010). Military members who do not have time to adjust to new dynamics and strengthen social and familial bonds may perceive that they have adequate support network which can increase their vulnerability to psychopathology during future deployments (Johansen, Wahl, Eilertsen, & Weisaeth, 2007). Advocacy for changes in requirements for dwell time following deployments and for increased services to support families following a deployment may be an effective way for social workers to improve mental health outcomes for military members.

Evidence-Based Care

Evidence-based care involves guiding clinical expertise with the best research evidence to provide the best care in accordance with the patients values (Thyer, 2004). Combat veterans often have complicated mental health needs, with PTSD and depression the most commonly diagnosed conditions following deployment (Kang & Hyams, 2005; Schneider, Haack, Owens, Herrington, & Zelek, 2009). It is essential that social workers provide the highest quality of care to these returning veterans to diminish the proliferation of psychopathology in this group (Seal, Bertenthal, Miner, Sen, & Marmar, 2007). In recent years an emphasis has been placed on evidence-based practice in social work schools (Rubin 2008). Unfortunately, recent research suggests that social workers are inadequately trained to provide evidence-based care to military members following deployment (Burnam, Meredith, Tanielian, & Jaycox, 2009). This may suggest that the

evidence-based practices that are taught to social workers in an educational setting or through continuing professional education and not emphasizing evidence-based practices which are appropriate for military members following a deployment. While there seems to be an emphasis on evidence-based care for common mental health disorders as component of foundational and continuing social work education, additional programming which focuses on treatments that are most effective for military members following deployment may improve the ability of social workers to respond to this need.

Evidence-based practice requires both familiarity with effective treatment modalities and consideration of the client's values. While authors have written about the warrior culture for thousands of years, social work literature and education provides little practical guidance to civilian social workers on how best to provide culturally competent intervention to military clients (Gillespie, 2007; Savitsky, Illingworth, & DuLaney, 2009). Failure to provide culturally competent services to veterans may negatively impact s social workers ability to establish therapeutic rapport and diminish the efficacy of intervention (Reger, Etherage, Reger, & Gahm, 2008; Steiker et al., 2008). The inclusion of military culture in to the cultural competency components of social work education may enhance the ability of social workers to provide effective care to veterans.

V.7. Conclusion

This study was conducted with the primary purpose of assessing the psychometric properties and clinical utility of the Post-Deployment Health Reassessment (PDHRA) for use with Air Force members. As this was the first study to assess the clinical utility and psychometric properties of the PDHRA, this research is a significant contribution to the

field of military mental health. The PDHRA is the primary assessment used throughout the Department of Defense (DoD) to identify mental health risks among military members who have recently returned from a deployment. Therefore it is important to establish that the PDHRA is a valid measure of *trauma* and *depression.* Additionally, understanding the best ways to interpret PDHRA results and use them as guide to clinical interventions may improve the quality of care post-deployed military members receive.

Many of the findings of this study were consistent with previous research on trauma, depression and measurement. For example, this study found that *exposure symptoms, support network conflict,* and traumatic exposures had a direct effect on depressive and trauma-related symptoms. Other findings were less consistent with previous literature. Alcohol use, for instance, did not affect *trauma* or *depression* in this study. However, the preliminary findings of this research suggest that the PDHRA is a well constructed assessment tool. Subscales within the PDHRA generally had a high level of internal consistency. Individuals with diagnostic depression and PTSD were consistently differentiated from individuals without these disorders.

Several factors identified in this research are suggestive of aspects of the PDHRA's reliability and validity as an assessment tool for *trauma* and *depression*. However, the psychometric analysis in this study was limited and only suggests a direction for additional assessment in future research.

The findings of this study also suggest that the PDHRA is a useful tool for identifying Airmen who are at increased risk for depression and PTSD. Medical and mental health providers who treat post-deployed military members may benefit from

understanding that most Airmen who were later diagnosed with depression or PTSD were identified as at-risk by the PDHRA. Future changes to the PDHRA which increase its ability to efficiently identify vulnerable, post-deployed military members may facilitate the efficient allocation of scarce medical resources.

During the current period of extensive deployments and prolonged combat the role of military social workers in the identification and treatment of *trauma* and *depression* is vital to the health of military members. The findings in this study make a significant contribution to the field of military social work by clearly illustrating the strengths and limitations of the PDHRA as a triage tool. Military social workers are tasked with meeting the mental health needs of post-deployed military members. This study expands our understanding of the post-deployment experience of returning military members and describes the prevalence of post-deployment diagnosis of PTSD and depression. Additionally, this study clarified how a number of PDHRA variables, including: *exposure symptoms, support network conflict, alcohol concerns, level of alcohol abuse,* "gender", "pay grade", combat experiences and combat related injuries, impact *trauma* and *depression* in Airmen following a deployment. Understanding which PDHRA variables have a significant impact on *trauma* and *depression* and what the effect sizes of these relationships are may help military social workers, during post-deployment social work interventions, by clarifying the level of risk an Airman has for developing depressive or *trauma*-related symptoms.

The results of this study may also be used to improve the PDHRA as a tool for identifying *trauma* and *depression*. Several variables were identified in the discussion

section of this study which are inadequately measured or absent from the PDHRA. Further research which improves the PDHRA's ability to accurately identify *trauma* and *depression* will provide additional, clinically relevant information to social workers who provide care to military members following a deployment.

Appendix A. DD Form 2900, The Post Deployment Health Reassessment (PDHRA)

POST-DEPLOYMENT HEALTH RE-ASSESSMENT (PDHRA)

PRIVACY ACT STATEMENT

AUTHORITY: 10 U.S.C. 136, 1074f, 3013, 5013, 8013 and E.O. 9397.

PRINCIPAL PURPOSE(S): To assess your state of health after deployment in support of military operations and to assist military healthcare providers in identifying and providing present and future medical care you may need. The information you provide may result in a referral for additional healthcare that may include medical, dental or behavioral healthcare or diverse community support services.

ROUTINE USE(S): In addition to those disclosures generally permitted under 5 U.S.C. 552a(b) of the Privacy Act, to other Federal and State agencies and civilian healthcare providers, as necessary, in order to provide necessary medical care and treatment.

DISCLOSURE: Voluntary. If not provided, healthcare WILL BE furnished, but comprehensive care may not be possible.

INSTRUCTIONS: Please read each question completely and carefully before entering your response or marking your selection. **YOU ARE ENCOURAGED TO ANSWER EACH QUESTION.** Withholding or providing inaccurate information may impair a healthcare provider's ability to identify health problems and refer you to appropriate sources for additional evaluation or treatment. If you do not understand a question, please ask for help. Please respond based on your **MOST RECENT DEPLOYMENT**.

DEMOGRAPHICS

Last Name _____ **First Name** _____ **Middle Initial** _____

Social Security Number _____ **Date of Birth** *(dd/mmm/yyyy)* _____ **Today's Date** *(dd/mmm/yyyy)* _____

Date arrived theater *(dd/mmm/yyyy)* _____ **Date departed theater** *(dd/mmm/yyyy)* _____

Gender
- O Male
- O Female

Marital Status
- O Never Married
- O Married
- O Separated
- O Divorced
- O Widowed

Service Branch
- O Air Force
- O Army
- O Navy
- O Marine Corps
- O Coast Guard
- O Civilian Employee
- O Other

Status Prior to Deployment
- O Active Duty
- O Selected Reserves - Reserve - Unit
- O Selected Reserves - Reserve - AGR
- O Selected Reserves - Reserve - IMA
- O Selected Reserves - National Guard - Unit
- O Selected Reserves - National Guard - AGR
- O Ready Reserves - IRR
- O Ready Reserves - ING
- O Civilian Government Employee
- O Other

Pay Grade

O E1	O O1	O W1
O E2	O O2	O W2
O E3	O O3	O W3
O E4	O O4	O W4
O E5	O O5	O W5
O E6	O O6	
O E7	O O7	O Other
O E8	O O8	
O E9	O O9	
	O O10	

Location of Operation
To what areas were you mainly deployed *(land-based operations more than 30 days)*? Please mark all that apply, including the number of months spent at each location.
- O Country 1 _____ Months ____
- O Country 2 _____ Months ____
- O Country 3 _____ Months ____
- O Country 4 _____ Months ____
- O Country 5 _____ Months ____

Since return from deployment I have:
- O Maintained/returned to previous status
- O Transitioned to Selected Reserves
- O Transitioned to IRR
- O Transitioned to ING
- O Retired from Military Service
- O Separated from Military Service

Current Contact Information:
Phone: _____
Cell: _____
DSN: _____
Email: _____
Address: _____

Total Deployments in Past 5 Years:

OIF	OEF	Other
O 1	O 1	O 1
O 2	O 2	O 2
O 3	O 3	O 3
O 4	O 4	O 4
O 5 or more	O 5 or more	O 5 or more

Current Unit of Assignment _____

Current Assignment Location _____

Point of Contact who can always reach you:
Name: _____
Phone: _____
Email: _____
Mailing Address: _____

DD FORM 2900, 20080103 DRAFT PREVIOUS EDITION IS OBSOLETE. Page 1 of 5 Pages
Adobe Professional 7.0

■ Physical Positive ● Behavioral Health Positive ◌ Conditional

Service Member's Social Security Number:

1. Overall, how would you rate your health during the PAST MONTH?
- ○ Excellent
- ○ Very Good
- ○ Good
- ■ Fair
- ■ Poor

2. Compared to before your most recent deployment, how would you rate your health in general now?
- ○ Much better now than before I deployed
- ○ Somewhat better now than before I deployed
- ○ About the same as before I deployed
- ■ Somewhat worse now than before I deployed
- ■ Much worse now than before I deployed

3. During the past 4 weeks, how difficult have physical health problems *(illness or injury)* **made it for you to do your work or other regular daily activities?**
- ○ Not difficult at all
- ■ Very difficult
- ■ Somewhat difficult
- ■ Extremely difficult

4. During the past 4 weeks, how difficult have emotional problems *(such as feeling depressed or anxious)* **made it for you to do your work, take care of things at home, or get along with other people?**
- ○ Not difficult at all
- ● Very difficult
- ● Somewhat difficult
- ● Extremely difficult

5. Since you returned from deployment, about how many times have you seen a healthcare provider for any reason, such as in sick call, emergency room, primary care, family doctor, or mental health provider?
- ○ No visits
- ○ 1 visit
- ○ 2-3 visits
- ■ 4-5 visits
- ■ 6 or more

6. Since you returned from deployment, have you been hospitalized? ■ Yes ○ No

7. During your deployment, were you wounded, injured, assaulted or otherwise physically hurt? ◌ Yes ○ No

If **NO**, skip to Question 8.

7a. If **YES**, are you still having problems related to this wound, assault, or injury? ■ Yes ○ No ■ Unsure

8. In addition to wounds or injuries you listed in question 7., do you currently have a health concern or condition that you feel is related to your deployment? ■ Yes ○ No ■ Unsure

If **NO**, skip to Question 9.

8a. If **YES**, please mark the item(s) that best describe your deployment-related condition or concern:

○ Fever	○ Dimming of vision, like the lights were going out
○ Cough lasting more than 3 weeks	○ Chest pain or pressure
○ Trouble breathing	○ Dizzy, light headed, passed out
○ Bad headaches	○ Diarrhea, vomiting, or frequent indigestion/heartburn
○ Generally feeling weak	○ Problems sleeping or still feeling tired after sleeping
○ Muscle aches	○ Trouble concentrating, easily distracted
○ Swollen, stiff or painful joints	○ Forgetful or trouble remembering things
○ Back pain	○ Hard to make up your mind or make decisions
○ Numbness or tingling in hands or feet	○ Increased irritability
○ Trouble hearing	○ Taking more risks such as driving faster
○ Ringing in the ears	○ Skin diseases or rashes
○ Watery, red eyes	○ Other *(please list)*: _____

9a. During this deployment, did you experience any of the following events? *(Mark all that apply)*

	Yes	No
(1) Blast or explosion *(IED, RPG, land mine, grenade, etc.)*	○	○
(2) Vehicular accident/crash *(any vehicle, including aircraft)*	○	○
(3) Fragment wound or bullet wound above your shoulders	○	○
(4) Fall	○	○
(5) Other event *(for example, a sports injury to your head)*. Describe:	○	○

9b. Did any of the following happen to you, or were you told happened to you, IMMEDIATELY after any of the event(s) you just noted in question 9a.? *(Mark all that apply)*

	Yes	No
(1) Lost consciousness or got "knocked out"	○	○
(2) Felt dazed, confused, or "saw stars"	○	○
(3) Didn't remember the event	○	○
(4) Had a concussion	○	○
(5) Had a head injury	○	○

9c. Did any of the following problems begin or get worse after the event(s) you noted in question 9a.? *(Mark all that apply)*

	Yes	No
(1) Memory problems or lapses	○	○
(2) Balance problems or dizziness	○	○
(3) Ringing in the ears	○	○
(4) Sensitivity to bright light	○	○
(5) Irritability	○	○
(6) Headaches	○	○
(7) Sleep problems	○	○

9d. In the past week, have you had any of the symptoms you indicated in 9c.? *(Mark all that apply)*

	Yes	No
(1) Memory problems or lapses	■	○
(2) Balance problems or dizziness	■	○
(3) Ringing in the ears	■	○
(4) Sensitivity to bright light	■	○
(5) Irritability	■	○
(6) Headaches	■	○
(7) Sleep problems	■	○

■ Physical Positive ● Behavioral Health Positive ◌ Conditional

Service Member's Social Security Number:

10. Do you have any persistent major concerns regarding the health effects of something you believe you may have been exposed to or encountered while deployed? ■ Yes ○ No

If **NO**, skip to question 11.

10a. If **YES,** please mark the item(s) that best describe your concern:

○ Animal bites	○ Loud noises
○ Animal bodies *(dead)*	○ Paints
○ Chlorine gas	○ Pesticides
○ Depleted uranium *(If yes, explain)* _____	○ Radar/Microwaves
○ Excessive vibration	○ Sand/dust
○ Fog oils (smoke screen	○ Smoke from burning trash or feces
○ Garbage	○ Smoke from oil fire
○ Human blood, body fluids, body parts, or dead bodies	○ Solvents
○ Industrial pollution	○ Tent heater smoke
○ Insect bites	○ Vehicle or truck exhaust fumes
○ Ionizing radiation	○ Other exposures to toxic chemicals or materials, such as ammonia, nitric acid, etc.: *(If yes, explain)* _____
○ JP8 or other fuels	
○ Lasers	

11. Since return from your deployment, have you had serious conflicts with your spouse, family members, close friends, or at work that continue to cause you worry or concern? ● Yes ○ No ● Unsure

12. Have you ever had any experience that was so frightening, horrible, or upsetting that, IN THE PAST MONTH, you ....

a. Have had nightmares about it or thought about it when you did not want to? ● Yes ○ No

b. Tried hard not to think about it or went out of your way to avoid situations that remind you of it? ● Yes ○ No

c. Were constantly on guard, watchful, or easily startled? ● Yes ○ No

d. Felt numb or detached from others, activities, or your surroundings? ● Yes ○ No

13a. In the PAST MONTH, Did you use alcohol more than you meant to? ● Yes ○ No

b. In the PAST MONTH, have you felt that you wanted to or needed to cut down on your drinking? ● Yes ○ No

c. How often do you have a drink containing alcohol?

○ Never +0 ○ Monthly or less +1 ○ 2 to 4 times a month +2 ○ 2 to 4 times a week +3 ○ 4 or more times a week +4

d. How many drinks containing alcohol do you have on a typical day when you are drinking?

○ 1 or 2 +0 ○ 3 or 4 +1 ○ 5 or 6 +2 ○ 7 to 9 +3 ○ 10 or more +4

e. How often do you have six or more drinks on one occasion?

○ Never +0 ○ Less than monthly +1 ○ Monthly +2 ○ Weekly +3 ○ Daily +4

● Positive if c.+d.+e.= ≥4 for men or ≥3 for women.

14. Over the PAST MONTH, have you been bothered by the following problems?

	Not at all	Few or several days	More than half the days	Nearly every day
a. Little interest or pleasure in doing things	○	○	●	●
b. Feeling down, depressed, or hopeless	○	○	●	●

15. Would you like to schedule a visit with a healthcare provider to further discuss your health concern(s)? ● Yes ○ No

16. Are you currently interested in receiving information or assistance for a stress, emotional or alcohol concern? ● Yes ○ No

17. Are you currently interested in receiving assistance for a family or relationship concern? ● Yes ○ No

18. Would you like to schedule a visit with a chaplain or a community support counselor? ● Yes ○ No

Conditional

Service Member's Social Security Number: **Date** *(dd/mmm/yyyy)*:

Health Care Provider Only

Provider Review and Interview

1. Review symptoms and deployment concerns identified on form:

O Confirmed screening results as reported

O Screening results modified, amended, clarified during interview:

_____

2. Ask behavioral risk questions. Conduct risk assessment.

a. Over the PAST MONTH, have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way? O Yes O No

IF **YES**, about how often have you been bothered by these thoughts? O Very few days O More than half of the time O Nearly every day

b. Since return from your deployment, have you had thoughts or concerns that you might hurt or lose control with someone? O Yes O No O Unsure

3. If member reports positive or unsure response to 2a. or 2b., conduct risk assessment.

a. Does member pose a current risk for harm to self or others? O No, not a current risk O Yes, poses a current risk O Unsure

b. Outcome of assessment O Immediate referral O Routine follow-up referral O Referral not indicated

4. Alcohol screening result

O No evidence of alcohol-related problems.

Potential alcohol problem (positive response to either question 13a. or 13b. and/or AUDIT-C (questions 13c.-e.) score of 4 or more for men or 3 or more for women). Automatically checked if Q.13=positive. Can be unchecked if interviewer finds no alcohol problem. Refer to PCM for evaluation. O Yes O No

5. Traumatic Brain Injury (TBI) risk assessment

O No evidence of risk based on responses to questions 9a. - d.

O Potential TBI with persistent symptoms, based on responses to question 9d.

Refer for additional evaluation (see DoD/VA TBI Clinical Practice Guideline for details). O Yes O No

6. Record additional questions or concerns identified by patient during interview:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Service Member's Social Security Number: **Date** *(dd/mmm/yyyy)*:

Assessment and Referral: After my interview with the service member and review of this form, there is a need for further evaluation and follow-up as indicated below. (More than one may be noted for patients with multiple concerns.)

7. Identified Concerns	Minor Concern	Major Concern	Already Under Care	
			Yes	No
○ Physical Symptom(s)	○	○	○	○
○ Exposure Symptom(s)	○	○	○	○
○ Depression symptoms	○	○	○	○
○ PTSD symptoms	○	○	○	○
○ Anger/Aggression	○	○	○	○
○ Suicidal Ideation	○	○	○	○
○ Social/Family Conflict	○	○	○	○
○ Alcohol Use	○	○	○	○
○ Other: _____	○	○	○	○

8. Referral Information	Within 24 hours	Within 7 days	Within 30 days
a. Primary Care, Family Practice	○	○	○
b. Behavioral Health in Primary Care	○	○	○
c. Mental Health Specialty Care	○	○	○
d. Other specialty care:			
Audiology	○	○	○
Cardiology	○	○	○
Dentistry	○	○	○
Dermatology	○	○	○
ENT	○	○	○
GI	○	○	○
Internal Medicine	○	○	○
Neurology	○	○	○
OB/GYN	○	○	○
Ophthalmology	○	○	○
Optometry	○	○	○
Orthopedics	○	○	○
Pulmonology	○	○	○
Urology	○	○	○
e. Case Manager, Care Manager	○	○	○
f. Substance Abuse Program	○	○	○
g. Health Promotion, Health Education	○	○	○
h. Chaplain	○	○	○
i. Family Support, Community Service	○	○	○
j. Military OneSource	○	○	○
k. Other: _____	○	○	○
l. No referral made ○			

9. Comments:

_____

I certify that this review process has been completed.

10. Provider's signature and stamp:

ICD-9 Code for this visit: V70.5 _ F

Ancillary Staff/Administrative Section

11. Member was provided the following:	12. Referral was made to the following healthcare or support system:
○ Health Education and Information	○ Military Treatment Facility
○ Health Care Benefits and Resources Information	○ Division/Line-based medical resource
○ Appointment Assistance	○ VA Medical Center or Community Clinic
○ Service member declined to complete form	○ Vet Center
○ Service member declined to complete interview/assessment	○ TRICARE Provider
○ Service member declined referral for services	○ Contract Support: _____
○ LOD	○ Community Service: _____
○ Other: _____	○ Other: _____
	○ None

Appendix B. Co-Variance Matrix for all Modeled Variables

1	1																																			
2	.17*	1																																		
3	-.11*	-.02*	1																																	
4	-.01*	-.02*	.07*	1																																
5	-.01*	-.01	.00	.11*	1																															
6	.00	.02*	.01	.11*	.70*	1																														
7	-.01*	-.04*	-.02*	.12*	.08*	.07*	1																													
8	.01*	-.04	-.02*	.07*	.07*	.05*	.21*	1																												
9	-.01	-.00	-.01	.02*	.05*	.04*	.04*	..05*	1																											
10	.01	-.00	.00	.15*	.10*	.11*	.09*	.07*	.06*	1																										
11	.01*	-.00	.02*	.11*	.08*	.09*	.05*	.05*	.05*	..39*	1																									
12	.00	-.00	-.00	.12*	.10*	.11*	.09*	.08*	.10*	.39*	.31*	1																								
13	.00	-.01	.01	.11*	.08*	.09*	.06*	.05*	.09*	.38*	.43*	..36*	1																							
14	.00	-.01	.01	.18*	.13*	.14*	.12*	.09*	.08*	.53*	.42*	.44*	.42*	1																						
15	.00	-.01	.02*	.14*	.13*	.13*	.09*	.09*	.08*	.40*	.40*	.42*	.44*	..58*	1																					
16	.01	-.01	.01*	.17*	.14*	.14*	.12*	.10*	.09*	.48*	.36*	.44*	.37*	.68*	.57*	1																				
17	-.00	-.01	.04*	.43*	.09*	.09*	.08*	.05*	.01	.10*	.06*	.09*	.09*	.13*	.10*	..12*	1																			
18	-.01	.00	.04*	.30*	.10*	.10*	.16*	.08*	.04*	.15*	.12*	.14*	.12*	.19*	.16*	.19*	..23*	1																		
19	.00	-.01	.04*	.32*	.08*	.09*	.13*	.08*	.03*	.16*	.11*	.15*	.13*	.20*	.15*	.20*	.27*	..57*	1																	
20	-.00	-.02*	.03*	.30*	.12*	.12*	.21*	.09*	.02*	.16*	.11*	.14*	.13*	.20*	.15*	.19*	.21*	.43*	..40*	1																
21	.00	-.01	.04*	.40*	.10*	.10*	.13*	.07*	.04*	.16*	.12*	.12*	.12*	.20*	.14*	.19*	.33*	.42*	.48*	..44*	1															
22	-.01	-.01	.05*	.42*	.12*	.13*	.19*	.10*	.03*	.21*	..16*	.17*	.16*	.24*	.18*	.23*	.32*	.60*	.56*	.64*	.63*	1														
23	-.02*	-.00	.05*	.56*	.11*	.11*	.12*	.05*	.02*	.15*	.10*	.10*	.11*	.16*	.12*	.16*	.35*	.26*	.30*	.27*	.41*	.39*	1													
24	-.02*	.00	.08*	.62*	.10*	.11*	.11*	.06*	.01	.13*	.10*	.10*	.11*	.03*	.12*	.16*	.41*	.29*	.32*	.27*	.41*	.41*	.71*	1												
25	-.01	-.02	.04*	.45*	.07*	.07*	.07*	.04*	.01	.15*	.12*	.10*	.12*	.16*	.12*	.15*	.30*	.24*	.27*	.22*	.34*	.46*	.60*	.58*	1											
26	-.01	-.02*	-.00	.19*	.04*	.04*	.05*	.03*	.00	.07*	.05*	.06*	.04*	.09*	.06*	.08*	.15*	.12*	.12*	.12*	.15*	.14*	.20*	.20*	.15*	1										
27	-.01	-.01	-.01	.16*	.05*	.04*	.05*	.03*	.01	.07*	.04*	.04*	.04*	.06*	.05*	.05*	.13*	.09*	.08*	.09*	.12*	.11*	.16*	.15*	.11*	.50*	1									
28	.02*	.15*	-.07*	.07*	.02*	.02*	.04*	.02*	.00	.02*	.00	.00	.01	.02*	.01	.02*	.05*	.04*	.03*	.04*	.05*	.05*	.08*	.07*	.04*	.15*	.15*	1								
29	.00	-.16*	-.08*	.09*	.02*	.01	.06*	.04*	.01	.02*	.01	.02*	.02*	.03*	.02*	.03*	.06*	.04*	.04*	.06*	.06*	.06*	.11*	.09*	.06*	.18*	.17*	.30*	1							
30	.04*	-.10*	-.13*	.09*	.02*	.00	.06*	.04*	.01	.02*	.01	.02*	.01	.03*	.02*	.03*.	.06*	.04*	.04*	.06*	.06*	.06*	.11*	.09*	.06*	.19*	.18*	.48*	.57*	1						
31	.01	-.05*	.02*	.11*	.03*	.02*	.05*	.04*	.00	.03*	.01	.02*	.01	.03*	.02*	.03*	.07*	.06*	.05*	.06*	.07*	.13*	.13*	.12*	.12*	.21*	.18*	.48*	.52*	.55*	1					
32	-.01	-.02*	.04*	.12*	.01*	.02*	.00	.00	.00	.02*	.03*	.02*	.03*	.03*	.03*	.04*	.08*	.04*	.04*	.04*	.06*	.07*	.09*	.13*	.12*	.04*	.03*	.01	.02*	.01	.03*	1				
33	-.00	-.01	.02*	.10*	.03*	.03*	.03*	.02*	.03*	.06*	.05*	.06*	.08*	.07*	.05*	.07*	.08*	.07*	.07*	.07*	.07*	.09*	.08*	.10*	.10*	.05*	.03*	.00	.01	.01	.02*	.35*	1			

***p=<.001**

Co-variance Variable Key

1.Total Deployments
2.Pay Grade
3.Gender
4.emoprob
5. hurt
6. hurtprob
7. blast
8. crash
9. shot
10. memlap
11. dizzy
12. earsring
13. photosense
14. irritable
15. headache
16. insomnia
17. conflict
18. nitemare
19. avoid
20. onguard
21. numb
22. PCLMtot
23. interest
24. feeldown
25. PHQ9tot
26. usemore
27. cutdown
28. often
29. howmany
30. $\geq$6
31. audittot
32. depression
33. PTSD

References

Aaron, I. S., Elisa, R. B., & Han, K. K. (2008). Understanding Sequelae of Injury Mechanisms and Mild Traumatic Brain Injury Incurred during the Conflicts in Iraq and Afghanistan: Persistent Post-concussive Symptoms and Posttraumatic Stress Disorder. *American Journal of Epidemiology, 167*(12), 1446-1452.

Abell, N., Springer, D., & Kamata, A. (2009). *Developing and Validating Rapid Assessment Instruments*. Oxford: Oxford University Press.

Adewuya, A. O., Ola, B. A., & Afolabi, O. O. (2006). Validity of the patient health questionnaire (PHQ-9) as a screening tool for depression amongst Nigerian university students. *Journal of Affective Disorders, 96*(1-2), 89-93.

Aflakseir, A., & Coleman, P. G. (2009). The influence of religious coping on the mental health of disabled Iranian war veterans. *Mental Health, Religion & Culture, 12*(2), 175-190.

Air Force Instruction 44-154. (2006). *Suicide and Violence and Prevention and Education*. Washington D.C.: Office of the Secretary of the Air Force.

Air Force Manual 10-100: Airman's Manual. (1999).

Aisenberg, E., Ayan, C., & Orozco-Figueroa, A. (2008). The Role of Young Adolescents' Perception in Understanding the Severity of Exposure to Community Violence and PTSD. *Journal of Interpersonal Violence, 23*(11), 1555-1578.

Akobeng, A. K. (2007). Understanding diagnostic tests 1: sensitivity, specificity and predictive values. *Acta Pædiatrica, 96*(3), 338-341.

Aldwin, C. M., Levenson, M.R. and Spiro, A, . (1994). Vulnerability and Resilience to Combat. *Exposure, Psychology and Aging, 9*(1), 33-44.

Allen, J., Litten, R., Fertig, J., & Babor, T. (1997). A Review of Research on the Alcohol Use Disorders Identification Test (AUDIT). *Alcoholism: Clinical and Experimental Research, 21*(4), 613-619.

Altman, D. G., & Bland, J. M. (1994). Diagnostic tests 2: predictive values. (Statistics Notes, part 4). *British Medical Journal, v309*(n6947), p102(101).

American Psychiatric Association. (2000). Diagnostic Statistical Manuel-IV-TR. Washington DC.

Angst, J., Gamma, A., Gastpar, M., Lépine, J. P., Mendlewicz, J., & Tylee, A. (2002). Gender differences in depression. *European Archives of Psychiatry and Clinical Neuroscience, 252*(5), 201-209.

Anja, M., & Uwe, K. (2007). Prevalence of acute and post-traumatic stress disorder and co-morbid mental disorders in breast cancer patients during primary cancer care: a prospective study. *Psycho-Oncology, 16*(3), 181-188.

Armour, M. (2003). Meaning Making in the Aftermath of Homicide. *Death Studies, 27*(6), 519-540.

Attig, T. (2001). Relearning the World: Making and Finding Meaning. In R. Neimeyer (Ed.), *Meaning Reconstruction and the Experience of Loss* (pp. 35-53). Washington D. C. : American Psychological Association.

Averill, P. M., Novy, D. M., Nelson, D. V., & Berry, L. A. (1996). Correlates of depression in chronic pain patients: A comprehensive examination. *Pain, 65*(1), 93-100.

Babor, T. F., Ritson, E. B., & Hodgson, R. J. (1986). Alcohol-Related Problems in the Primary Health Care Setting: a review of early intervention strategies. *British Journal of Addiction, 81*(1), 23-46.

Baker, M. S. (2007). Creating Order from Chaos: Part I: Triage, Initial Care, and Tactical Considerations in Mass Casualty and Disaster Response. *Military Medicine, 172*, 232-236.

Bal, A. (2008). Post-Traumatic Stress Disorder in Turkish Child and Adolescent Survivors Three Years after the Marmara Earthquake. *Child & Adolescent Mental Health, 13*(3), 134-139.

Bambauer, K. Z., Safran, D. G., Ross-Degnan, D., Zhang, F., Adams, A. S., Gurwitz, J., et al. (2007). Depression and Cost-Related Medication Non-adherence in Medicare Beneficiaries. *Arch Gen Psychiatry, 64*(5), 602-608.

Baron, S. W. (2004). General Strain, Street Youth and Crime: A Test of Agnew's Revised Theory. *Criminology, 42*(2), 457-483.

Beck, A. T., Guth, D., Steer, R. A., & Ball, R. (1997). Screening for major depression disorders in medical inpatients with the Beck Depression Inventory for Primary Care. *Behaviour Research and Therapy, 35*(8), 785-791.

Beckner, V., Howard, I., Vella, L., & Mohr, D. (2010). Telephone-administered psychotherapy for depression in MS patients: moderating role of social support. *Journal of Behavioral Medicine, 33*(1), 47-59.

Belmont, P. J., Jr., Goodman, G. P., Zacchilli, M., Posner, M., Evans, C., & Owens, B. D. Incidence and Epidemiology of Combat Injuries Sustained During "The Surge" Portion of Operation Iraqi Freedom by a U.S. Army Brigade Combat Team. *The Journal of Trauma, 68*(1), 204-210 210.1097/TA.1090b1013e3181bdcf1095.

Biro, M., Novovi, Z., & Gavrilov, V. (1997). Coping Strategies in PTSD. *Behavioural and Cognitive Psychotherapy, 25*(04), 365-369.

Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy, 34*(8), 669-673.

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *BMJ, 314*(7080), 572-.

Benard, B. (1993). Fostering resiliency in kids. *Educational Leadership, 51*(3), 44-48.

Benard, B. (1995). Fostering Resilience in Children [Electronic Version]. *ERIC Digest, 95*,

Bernat, J. A., Ronfeldt, H. M., Calhoun, K. S., & Arias, I. (1998). Prevalence of Traumatic Events and Peri-traumatic Predictors of Posttraumatic Stress Symptoms in a Nonclinical Sample of College Students. *Journal of Traumatic Stress, 11*(4), 645.

Bianchini, K. J., Etherton, J. L., Greve, K. W., Heinly, M. T., & Meyers, J. E. (2008). Classification Accuracy of MMPI-2 Validity Scales in the Detection of Pain-Related Malingering. *Assessment, 15*(4), 435-449.

Bicksler, B., Gilroy, C. L., & Warner, J. T. (Eds.). (2004). *The All Volunteer Force: Thirty Years of Service* (1st ed.). Washington D.C.: Brassey's, Inc.

Bisson, J. I., Ehlers, A., Matthews, R., Pilling, S., Richards, D., & Turner, S. (2007). Psychological treatments for chronic post-traumatic stress disorder: Systematic review and meta-analysis. *The British Journal of Psychiatry, 190*(2), 97-104.

Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy, 34*(8), 669-673.

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *BMJ, 314*(7080), 572-.

Bleich, A., Koslowsky, M., Dolev, A., & Lerer, B. (1997). Post-traumatic stress disorder and depression. An analysis of co-morbidity. *The British Journal of Psychiatry, 170*(5), 479-482.

Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110*(2), 305-314.

Bonanno, G. A. (2005). Resilience in the Face of Potential Trauma. *Current Directions in Psychological Science, 14*(3), 135-138.

Boscarino, J. (1995). Post-traumatic stress and associated disorders among Vietnam veterans: The significance of combat exposure and social support. *Journal of Traumatic Stress, 8*(2), 317-336.

Boy, A. (2010). *Intimate Partner Violence among Latinas in Central Alabama: Socio-demographic Characteristics, Perceptions of Abuse, and Help-Seeking Behaviors.* Unpublished Dissertation, University of Alabama Birmingham, Birmingham.

Bozo, O., Anahar, S., Ates, G., & Etel, E. (2010). Effects of Illness Representation, Perceived Quality of Information Provided by the Health-Care Professional, and Perceived Social Support on Depressive Symptoms of the Caregivers of Children with Leukemia. *Journal of Clinical Psychology in Medical Settings, 17*(1), 23-30.

Bradley, R., Greene, J., Russ, E., Dutra, L., & Westen, D. (2005). A Multidimensional Meta-Analysis of Psychotherapy for PTSD. *Am J Psychiatry, 162*(2), 214-227.

Bradley, R., Schwartz, A. C., & Kaslow, N. J. (2005). Posttraumatic stress disorder symptoms among low-income, African American women with a history of intimate partner violence and suicidal behaviors: Self-esteem, social support, and religious coping. *Journal of Traumatic Stress, 18*(6), 685-696.

Brady, K. T., Grice, D. E., Dustan, L., & Randall, C. (1993). Gender differences in substance use disorders. *Am J Psychiatry, 150*(11), 1707-1711.

Brailey, K., Vasterling, J. J., Proctor, S. P., Constans, J. I., & Friedman, M. J. (2007). PTSD symptoms, life events, and unit cohesion in U.S. soldiers: Baseline findings from the neurocognition deployment health study. *Journal of Traumatic Stress, 20*(4), 495-503.

Bremner, J. D., Southwick, S. M., Darnell, A., & Charney, D. S. (1996). Chronic PTSD in Vietnam combat veterans: course of illness and substance abuse. *Am J Psychiatry, 153*(3), 369-375.

Breslau, N. (2009). The Epidemiology of Trauma, PTSD, and other Post-trauma Disorders. *Trauma, Violence & Abuse, 10*(3), 198-210.

Breslau, N., & Anthony, J. C. (2007). Gender Differences in the Sensitivity to Posttraumatic Stress Disorder: An Epidemiological Study of Urban Young Adults. *Journal of Abnormal Psychology, 116*(3), 607-611.

Breslau, N., Davis, G. C., Peterson, E. L., & Schultz, L. R. (2000). A second look at co-morbidity in victims of trauma: the posttraumatic stress disorder-major depression connection. *Biological Psychiatry, 48*(9), 902-909.

Brewin, C. R., Andrews, B., & Valentine, J. (2000). Meta-Analysis of Risk Factors for Posttraumatic Stress Disorder in Trauma-Exposed Adults. *Journal of Consulting & Clinical Psychology, 68*(5), 748.

Bridger, R. S., Kilminster, S., & Slaven, G. (2007). Occupational stress and strain in the naval service: 1999 and 2004. *Occup Med (Lond), 57*(2), 92-97.

Brown, J., Fielding, J., & Grover, J. (1999). Distinguishing traumatic, vicarious and routine operational stressor exposure and attendant adverse consequences in a sample of police officers. *Work & Stress, 13*(4), 312 - 325.

Brown, J. M., Bray, R. M., & Hartzell, M. C. A Comparison of Alcohol Use and Related Problems Among Women and Men in the Military. *Military Medicine, 175*, 101-107.

Brown, S. L. (2000). The Effect of Union Type on Psychological Well-Being: Depression among Cohabitors versus Marrieds. *Journal of Health and Social Behavior, 41*(3), 241-255.

Brugha, T. S., Bebbington, P. E., MacCarthy, B., Sturt, E., Wykes, T., & Potter, J. (2009). Gender, Social support and recovery from depressive disorders: a prospective clinical study. *Psychological Medicine, 20*(01), 147-156.

Buchanan, J., Davis, M. Y., & Wight, L. T. (2009). Death of the Combatant Command? Toward a Joint Interagency Approach, Descriptive Note : Journal article. *Joint Force Quarterly, 52*(1).

Buckley, P. (Ed.). (1986). *Essential Papers on Object Relations*. New York: New York University Press.

Budd, F. (2007). U.S. Air Force Wingman Culture: A Springboard for Organizational Development. *Organization Development Journal, 25*(3), P17-P22.

Burnam, M., Meredith, L., Tanielian, T., & Jaycox, L. (2009). Mental Health Care for Iraq and Afghanistan War Veterans. *Health Affairs, 28*(3), 771-782.

Burrell, L., Adams, G., Durand, D., & Castro, C. (2006). The Impact of Military Lifestyle Demands on Well-Being, Army, and Family Outcomes. *Armed Forces & Society 33*(1), 43-59.

Butterworth, P., Rodgers, B., & Windsor, T. D. (2009). Financial hardship, socio-economic position and depression: Results from the PATH Through Life Survey. *Social Science & Medicine, 69*(2), 229-237.

Cabrera, O. A., Hoge, C. W., Bliese, P. D., Castro, C. A., & Messer, S. C. (2007). Childhood Adversity and Combat as Predictors of Depression and Post-Traumatic Stress in Deployed Troops. *American Journal of Preventive Medicine, 33*(2), 77-82.

Campbell, D., Felker, B., Liu, C.-F., Yano, E., Kirchner, J., Chan, D., et al. (2007). Prevalence of Depression–PTSD Co-morbidity: Implications for Clinical Practice Guidelines and Primary Care-based Interventions. *Journal of General Internal Medicine, 22*(6), 711-718.

Campbell, R., Sefl, T., Barnes, H. E., Ahrens, C. E., Wasco, S. M., & Zaragoza-Diesfeld, Y. (1999). Community services for rape survivors: Enhancing psychological well-being or increasing trauma? *Journal of Consulting and Clinical Psychology, 67*(6), 847-858.

Campbell, R., Wasco, S. M., Ahrens, C. E., Sefl, T., & Barnes, H. E. (2001). Preventing the "Second Rape": Rape Survivors' Experiences With Community Service Providers. *J Interpers Violence, 16*(12), 1239-1259.

Carreiras, H. (2008). From Loyalty to Dissent: How Military Women Respond to Integration Dilemmas. In *Women in the Military and in Armed Conflict* (pp. 161-181).

Castro, C., Hoge, C., Milliken, C., McGurk, D., Adler, A., Cox, A., et al. (2006). *Battlemind Training: Transitioning Home from Combat*.

Caulfield, M., Wolfe, J., Turner, K., Newton, T. L., Melia, K., Martin, J., et al. (2005). Gender and Trauma as Predictors of Military Attrition - A Study of Marine Corps Recruits. *Military Medicine, 170*, 1037-1043.

Cheeta, S., Drummond, C., Oyefeso, A., Phillips, T., Deluca, P., Perryman, K., et al. (2008). Low identification of alcohol use disorders in general practice in England. *Addiction, 103*(5), 766-773.

Chen, X., Lu, W., Zheng, Y., Gu, K., Chen, Z., Zheng, W., et al. Exercise, Tea Consumption, and Depression Among Breast Cancer Survivors. *J Clin Oncol, 28*(6), 991-998.

Chonody, J. (2009). *Exploring sexual prejudice in context: History, theory, and measurement.* The Florida State University, Tallahassee.

Christensen, L. W. (Ed.). (2004). *Warriors: On Living with Courage, Discipline and Honor*. Boulder: Paladin Press.

Chu, D. (2006). *Deployment Health*.

Chu, D. (2006). *Rank and Seniority of Commissioned Officers*.

Chu, D. (2007). *Department of Defense Instruction 1304.26: Qualification Standards for Enlistment, Appointment, and Induction*. http://www.dtic.mil/whs/directives/corres/pdf/130426p.pdf.

Cicchetti, D., & Rogosch, F. A. (2009). Adaptive coping under conditions of extreme stress: Multilevel influences on the determinants of resilience in maltreated children. *New Directions for Child and Adolescent Development, 2009*(124), 47-59.

Cieslak, R., Benight, C., Schmidt, N., Luszczynska, A., Curtin, E., Clark, R. A., et al. (2009). Predicting posttraumatic growth among Hurricane Katrina survivors living with HIV: the role of self-efficacy, social support, and PTSD symptoms. *Anxiety, Stress & Coping, 22*(4), 449-463.

Coco, E. L., & Courtney, L. J. (1998). A family systems approach for preventing adolescent runaway behavior. *Adolescence, 33*(130), 485.

Coetzee, S., & Viviers, R. (2007). An Overview of Research on Positive Psychology in South Africa. *South African Journal of Psychology, 37*(3), 470-490.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). New York, NY: Taylor & Francis.

Coker, C. (2007). *The Warrior Ethos: Military Culture and the War on Terror*. Florence: Routledge.

Compas, B. E., Hinden, B. R., & Gerhardt, C. A. (1995). Adolescent development: Pathways and processes of risk and resilience. *Annual Review of Psychology, 46*(1), 265.

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety, 18*(2), 76-82.

Conradi, H. J., de Jonge, P., & Ormel, J. (2008). Prediction of the three-year course of recurrent depression in primary care patients: Different risk factors for different outcomes. *Journal of Affective Disorders, 105*(1-3), 267-271.

Cowger, C. D., Anderson, K. M., & Snively, C. A. (2006). Assessing Strengths: The Political Context of Individual, Family and Community Empowerment. In D. Saleebey (Ed.), *The Strengths Perspective in Social Work Practice* (4th ed., pp. 93-115). Boston: Allyn & Bacon.

Crawford, J. R., & Henry, J. D. (2003). The Depression Anxiety Stress Scales (DASS): Normative data and latent structure in a large non-clinical sample. *British Journal of Clinical Psychology, 42*(2), 111.

Creamer, M., Bell, R., & Failla, S. (2003). Psychometric properties of the Impact of Event Scale--Revised. *Behaviour Research and Therapy, 41*(12), 1489-1496.

Crocker, L., & Algina, J. (1986). *Introduction to Classical and Modern Test Theory*. New York: Holt, Rinehart and Winston.

Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin, 52*(4), 281-302.

Cummins, R. O., & Hazinski, M. F. (2000). Guidelines Based on Fear of Type II (False-Negative) Errors: Why We Dropped the Pulse Check for Lay Rescuers. *Circulation, 102*(90001), I-377-379.

Darley, W. M. (2006). Clausewitz's Theory of War and Information Operations. *JFQ: Joint Force Quarterly* (40), 73-79.

Darnell, D. (2006). *NUCLEAR WEAPONS PERSONNEL RELIABILITY PROGRAM (PRP) REGULATION*.

Davis, L. L., Wisniewski, S. R., Howland, R. H., Trivedi, M. H., Husain, M. M., Fava, M., et al. (2010). Does comorbid substance use disorder impair recovery from major depression with SSRI treatment? An analysis of the STAR*D level one treatment outcomes. *Drug & Alcohol Dependence, 107*(2/3), 161-170.

de Vries, A. P. J., Kassam-Adams, N., Cnaan, A., Sherman-Slate, E., Gallagher, P. R., & Winston, F. K. (1999). Looking Beyond the Physical Injury: Posttraumatic Stress Disorder in Children and Parents After Pediatric Traffic Injury. *Pediatrics, 104*(6), 1293-1299.

de Zulueta, C. F. (2007). Mass violence and mental health: Attachment and trauma. *International Review of Psychiatry, 19*(3), 221-233.

Defenselink. (2009). Defenselink Casualty Report 2009. from http://www.defenselink.mil/news/casualty.pdf

Deployment Relevant Training. (2010). from http://www.cs.amedd.army.mil/deployment2.aspx#

DeRijk, R., & DeKloet, E. (2008). Corticosteroid Receptor Polymorphisms: Determinants of Vulnerability and Resilience. *European Journal of Pharmachology, 583*(2/3), 303-311.

DeVeaux, R., Velleman, P., & Bock, D. (2007). *Stats: Data and Models* (2nd ed.). Boston: Addison Wesley.

DiGrande, L., Perrin, M. A., Thorpe, L. E., Thalji, L., Murphy, J., Wu, D., et al. (2008). Posttraumatic stress symptoms, PTSD, and risk factors among lower Manhattan residents 2 to 3 years after the September 11, 2001 terrorist attacks. *Journal of Traumatic Stress, 21*(3), 264-273.

Dikel, T. N., Engdahl, B., & Eberly, R. (2005). PTSD in Former Prisoners of War: Prewar, Wartime, and Postwar Factors. *Journal of Traumatic Stress, 18*(1), 69-77.

Dillman, D. A., Phelps, G., Tortora, R., Swift, K., Kohrell, J., Berck, J., et al. (2009). Response rate and measurement differences in mixed-mode surveys using mail, telephone, interactive voice response (IVR) and the Internet. *Social Science Research, 38*(1), 1-18.

Dion, P. (2008). Interpreting Structural Equation Modeling Results: A Reply to Martin and Cullen. *Journal of Business Ethics, 83*(3), 365-368.

Dixon, A., Howie, P., & Starling, J. (2005). Trauma Exposure, Post-traumatic Stress and Psychiatric Co-morbidity in Female Juvenile Offenders. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*(8), 798-806.

Dobie, D. J., Kivlahan, D. R., Maynard, C., Bush, K. R., McFall, M., Epler, A. J., et al. Screening for post-traumatic stress disorder in female Veteran's Affairs patients: validation of the PTSD checklist. *General Hospital Psychiatry, 24*(6), 367-374.

Dohrenwend, B. P., Levav, I., Shrout, P. E., Schwartz, S., Naveh, G., Link, B. G., et al. (1992). Socioeconomic status and psychiatric disorders: the causation-selection issue. *Science, v255*(n5047), p946(947).

Dohrenwend, B. P., Turner, J. B., Turse, N. A., Adams, B. G., Koenen, K., & Marshall, R. (2007). Continuing Controversy Over the Psychological Risks of Vietnam for U.S. Veterans. *Journal of Traumatic Stress, 20*(4), 449-465.

Dohrenwend, B. P., Turner, J. B., Turse, N. A., Lewis-Fernandez, R., & Yager, T. J. (2008). War-related posttraumatic stress disorder in Black, Hispanic, and majority White Vietnam veterans: The roles of exposure and vulnerability. *Journal of Traumatic Stress, 21*(2), 133-141.

Doll, B., & Lyon, M. (1998). Risk and Resilience: Implications for the Delivery of Educational and Mental Health Services in Schools. *School Psychology Review, 27*, 348-366.

Dong, X., Beck, T., & Simon, M. A. (2010). The associations of gender, depression and elder mistreatment in a community-dwelling Chinese population: The modifying effect of social support. *Archives of Gerontology & Geriatrics, 50*(2), 202-208.

Dorn, E. (1996). Commissioned Officer Promotion Program Procedures. Washington D.C.: Department of Defense.

Dudek, F. J. (1979). The continuing misinterpretation of the standard error of measurement. *Psychological Bulletin, 86*(2), 335-337.

Duma, S. J., Reger, M. A., Canning, S. S., McNeil, J. D., & Gahm, G. A. (2010). Longitudinal mental health screening results among post-deployed U.S. soldiers preparing to deploy again. *Journal of Traumatic Stress, 23*(1), 52-58.

Dunn, A. L., Trivedi, M. H., Kampert, J. B., Clark, C. G., & Chambliss, H. O. (2005). Exercise treatment for depression: Efficacy and dose response. *American Journal of Preventive Medicine, 28*(1), 1-8.

Earvolino-Ramirez, M. (2007). Resilience: A Concept Analysis. *Nursing Forum, 42*(2), 73-82.

Ellis, A. A., Nixon, R. D. V., & Williamson, P. (2009). The effects of social support and negative appraisals on acute stress symptoms and depression in children and adolescents. *British Journal of Clinical Psychology, 48*(4), 347-361.

Ellis, P. (2010). *The Essential Guide to Effect Sizes: An Introduction to Statistical Power, Meta-Analysis and the Interpretation of Research Results*. London: Cambridge University Press.

Epstein, J. N., Saunders, B. E., Kilpatrick, D. G., & Resnick, H. S. (1998). PTSD as a mediator between childhood rape and alcohol use in adult women. *Child Abuse & Neglect, 22*(3), 223-234.

Epstein, R. S., Fullerton, C. S., & Ursano, R. J. (1998). Posttraumatic stress disorder following air disaster: A prospective study. *American Journal of Psychiatry, 155*(7), 934.

Esmond, E. (1999). *Aerospace, Expeditionary Force Planning*.

Fan, X., Thompson, B., & Wang, L. (1999). Effects of sample size, estimation method, and model specification on structural equation modeling fit indexes. *Structural Equation Modeling, 6*(1), 56-83.

Fear, N. T., Jones, M., Murphy, D., Hull, L., Iversen, A. C., Coker, B., et al. (2010). What are the consequences of deployment to Iraq and Afghanistan on the mental health of the UK armed forces? A cohort study. *The Lancet, 375*(9728), 1783-1797.

Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2009). Tests of Causal Links Between Alcohol Abuse or Dependence and Major Depression. *Arch Gen Psychiatry, 66*(3), 260-266.

Feske, U. (2008). Treating Low-Income and Minority Women with Posttraumatic Stress Disorder: A Pilot Study Comparing Prolonged Exposure and Treatment as Usual Conducted by Community Therapists. *Journal of Interpersonal Violence, 23*(8), 1027-1040.

Fogleman, R. (1995). The Profession of Arms. *Air Power Journal* (Fall), 18-19.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research (JMR), 18*(1), 39-50.

Fowler, F. J., Jr. (2008). Worried Sick. *JAMA, 300*(16), 1946-1947.

Frank, J. E. (2008). What the Military Taught Me about Practice Management. *Family Practice Management, 15*(5), 23-25.

Frankenberg, E., Friedman, J., Gillespie, T., Ingwersen, N., Pynoos, R., Rifai, L. U., et al. (2008). Mental Health in Sumatra after the Tsunami. *American Journal of Public Health, 98*(9), 1671-1677.

Frans, O., Rimmo, P. A., Aberg, L., & Fredrikson, M. (2005). Trauma exposure and post-traumatic stress disorder in the general population. *Acta Psychiatrica Scandinavica, 111*(4), 291-290.

Fraser, M. (1997). The Ecology of Childhood: A Multisystems Approach. In M. Fraser (Ed.), *Risk and Resilience in Childhood* (pp. 1-9). Washington, D. C. : NASW Press.

Fraser, M. W., & Richman, J. M. (1999). Risk, production, and resilience: Toward a conceptual framework for social work practice. *Social Work Research, 23*(3), 131.

Frasure-Smith, N., Lesperance, F., Habra, M., Talajic, M., Khairy, P., Dorian, P., et al. (2009). Elevated Depression Symptoms Predict Long-Term Cardiovascular Mortality in Patients With Atrial Fibrillation and Heart Failure. *Circulation, 120*(2), 134-140.

Gabora, L., Rosch, E., & Aerts, D. (2008). Toward an Ecological Theory of Concepts. *Ecological Psychology, 20*(1), 84-116.

Gabriel, R., Ferrando, L., Cortan, E. S., Mingote, C., Garcia-Camba, E., Liria, A. F., et al. (2007). Psychopathological consequences after a terrorist attack: An epidemiological study among victims, the general population, and police officers. *European Psychiatry, 22*(6), 339-346.

Gahm, G. A., Lucenko, B. A., Retzlaff, P., & Fukuda, S. (2007). Relative impact of adverse events and screened symptoms of posttraumatic stress disorder and depression among active duty soldiers seeking mental health care. *Journal of Clinical Psychology, 63*(3), 199-211.

Galaif, E. R., Sussman, S., Newcomb, M. D., & Locke, T. F. (2007). Suicidality, depression, and alcohol use among adolescents: A review of empirical findings. *International Journal of Adolescent Medicine and Health, 19*(1), 27-35.

Galea, S., Ahern, J., Resnick, H., Kilpatrick, D., Bucuvalas, M., Gold, J., et al. (2002). Psychological Sequelae of the September 11 Terrorist Attacks in New York City. *N Engl J Med, 346*(13), 982-987.

Galea, S., Tracy, M., Norris, F., & Coffey, S. F. (2008). Financial and social circumstances and the incidence and course of PTSD in Mississippi during the first two years after Hurricane Katrina. *Journal of Traumatic Stress, 21*(4), 357-368.

Gamble, S. A., Conner, K. R., Talbot, N. L., Qin, Y., Tu, X. M., & Connors, G. J. (2010). Effects of Pretreatment and Post-treatment Depressive Symptoms on Alcohol

Consumption Following Treatment in Project MATCH. *Journal of Studies on Alcohol & Drugs, 71*(1), 71-77.
Gardner, T. W., Dishion, T. J., & Connell, A. M. (2008). Adolescent Self-Regulation as Resilience: Resistance to Antisocial Behavior within the Deviant Peer Context. *Journal of Abnormal Child Psychology, 36*(3), 273-284.
Garnett, J., & Kouzmin, A. (2009). Crisis Communication Post Katrina: What are we Learning? *Public Organization Review, 9*(4), 385-398.
Gates, R. (2009). *Fiscal Year 2009 Department of Defense Budget*.
Gay, M. C., Vrignaud, P., Garitte, C., & Meunier, C. (2010). Predictors of depression in multiple sclerosis patients. *Acta Neurologica Scandinavica, 121*(3), 161-170.
Gaynes, B. N., Rush, A. J., Trivedi, M. H., Wisniewski, S. R., Balasubramani, G. K., Spencer, D. C., et al. (2007). Major Depression Symptoms in Primary Care and Psychiatric Care Settings: A Cross-Sectional Analysis. *Ann Fam Med, 5*(2), 126-134.
Gillespie, M. (2007). Nietzsche and Plato on Warriors. *Conference Papers -- American Political Science Association*, 1.
Gilligan, R. (2008). Promoting Resilience in Young People in Long-Term Care - The Relevance of Roles and Relationships in the Domains of recreation and Work. *Journal of Social Work Practice, 22*(1), 37-50.
Godin, I., Kornitzer, M., Clumeck, N., Linkowski, P., Valente, F., & Kittel, F. (2009). Gender specificity in the prediction of clinically diagnosed depression. *Social Psychiatry and Psychiatric Epidemiology, 44*(7), 592-600.
Gordon, A. J., Maisto, S. A., McNeil, M., Kraemer, K. L., Conigliaro, R. L., Kelley, M. E., et al. (2001). Three Questions Can Detect Hazardous Drinkers. *Journal of Family Practice, 50*(4), 313-320.
Grant, B. F., & Harford, T. C. (1995). Co-morbidity between DSM-IV alcohol use disorders and major depression: results of a national survey. *Drug and Alcohol Dependence, 39*(3), 197-206.
Grant, D. H. (2004). Post-Traumatic Stress Disorder: A Sign of Weakness or Strength? *Federal Practitioner*(March), 53-54.
Green, B. (1995). *AFI 40-301 FAMILY ADVOCACY*.
Greene, R. (2001). *Resiliency: an integrated approach to practice, policy, and research*. Washington D.C.: NASW Press.
Greene, R. (Ed.) (2008) Encyclopedia of Social Work (20 ed., Vols. 3). Washington D.C.: NASW Press.
Greene, R. R., & Conrad, A. (2002). Basic Assumptions and Terms. In R. R. Greene (Ed.), *Resiliency: An Integrated Approach to Practice Policy and Research* (pp. 29-62). Washington D. C. : NASW Press.
Greene-Shortridge, T. M., Britt, T. W., & Castro, C. A. (2007). The Stigma of Mental Health Problems in the Military. *Military Medicine, 172*(2), 157-161.
Grieger, T. A., Cozza, S. J., Ursano, R. J., Hoge, C., Martinez, P. E., Engel, C. C., et al. (2006). Posttraumatic Stress Disorder and Depression in Battle-Injured Soldiers. *American Journal of Psychiatry, 163*(10), 1777-1783.

Guay, S., Billette, V., & Marchand, A. (2006). Exploring the links between posttraumatic stress disorder and social support: Processes and potential research avenues. *Journal of Traumatic Stress, 19*(3), 327-338.

Gully, S. M., Devine, D. J., & Whitney, D. J. (1995). A Meta-Analysis of Cohesion and Performance. *Small Group Research, 26*(4), 497-520.

Gunnarsson, R. K., & Lanke, J. (2002). The predictive value of microbiologic diagnostic tests if asymptomatic carriers are present. *Statistics in Medicine, 21*(12), 1773-1785.

Haden, S. C., Scarpa, A., Jones, R. T., & Ollendick, T. H. (2007). Posttraumatic stress disorder symptoms and injury: the moderating role of perceived social support and coping for young adults. *Personality & Individual Differences, 42*(7), 1187-1198.

Hair, J., Black, W., Babin, B., & Anderson, R. (2010). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Haley, R. W., Kurt, T. L., & Hom, J. (1997). Is There a Gulf War Syndrome? Searching for Syndromes by Factor Analysis of Symptoms. *JAMA, 277*(3), 215-222.

Hancock, P., & Larner, A. J. (2009). Clinical utility of Patient Health Questionnaire-9 (PHQ-9) in memory clinics. *International Journal of Psychiatry in Clinical Practice, 13*(3), 188 - 191.

Harris, I. A., Young, J. M., Rae, H., Jalaludin, B. B., & Solomon, M. J. (2008). Predictors of Post-Traumatic Stress Disorder Following Major Trauma. *ANZ Journal of Surgery, 78*(7), 583-587.

Harrison, D. (2006). The role of military culture in military organizations' responses to woman abuse in military families. *Sociological Review, 54*(3), 546-574.

Harvey, F., & Schoomaker, P. (2005). *Posture Statement: Our Army at War- Relevant and Ready... Today and Tomorrow*.

Harvey, M. R. (1996). An Ecological View of Psychological Trauma and Trauma Recovery. *Journal of Traumatic Stress, 9*(1), 3-23.

Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin, 112*(1), 64-105.

Herman, J. (1992). *Trauma and Recovery: The Aftermath of Violence- from Domestic Violence to Political Terror*. New York, NY: Basic Books.

Ho, S., Chu, K., & Yiu, J. (2008). The Relationship Between Explanatory Style and Posttraumatic Growth after Bereavement in a Non-Clinical Sample. *Death Studies, 32*(5), 461-478.

Hobfoll, S. E., Johnson, R. J., Hall, B. J., Palmieri, P. A., Canetti-Nisim, D., & Galea, S. (2009). Trajectories of Resilience, Resistance, and Distress During Ongoing Terrorism: The Case of Jews and Arabs in Israel. *Journal of Consulting & Clinical Psychology, 77*(1), 138-148.

Hobfoll, S. E., Tracy, M., & Galea, S. (2006). The impact of resource loss and traumatic growth on probable PTSD and depression following terrorist attacks. *Journal of Traumatic Stress, 19*(6), 867-878.

Hoge, C. W., Auchterlonie, J. L., & Milliken, C. S. (2006). Mental Health Problems, Use of Mental Health Services, and Attrition From Military Service After Returning From Deployment to Iraq or Afghanistan. *JAMA, 295*(9), 1023-1032.

Hoge, C. W., Castro, C. A., Messer, S. C., McGurk, D., Cotting, D. I., & Koffman, R. L. (2008). Combat Duty in Iraq and Afghanistan, Mental Health Problems and Barriers to Care. *U.S. Army Medical Department Journal*, 7-17.

Homaifar, B. Y., Brenner, L. A., Gutierrez, P. M., Harwood, J. F., Thompson, C., Filley, C. M., et al. (2009). Sensitivity and Specificity of the Beck Depression Inventory-II in Persons with Traumatic Brain Injury. *Archives of Physical Medicine and Rehabilitation, 90*(4), 652-656.

Hu, L.T., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus. *Structural Equation Modeling, 6*(1), 1.

Hudson, W. W. (1978). Notes for practice. *Social Work, 23*(1), 65.

Hung, D. Y., Lubetkin, E. I., Fahs, M. C., & Shelley, D. R. (2009). Assessing the Impact of Behavioral Risk Factors and Known-Groups Validity of the SF-12 in a US Chinese Immigrant Population. *Medical Care, 47*(2), 262-267 210.1097/MLR.1090b1013e3181844de3181844.

Iezzoni, L. I., & Ronan, L. J. Disability Legacy of the Haitian Earthquake. *Annals of Internal Medicine*, -.

Jacobsen, L. K., Southwick, S. M., & Kosten, T. R. (2001). Substance Use Disorders in Patients With Posttraumatic Stress Disorder: A Review of the Literature. *Am J Psychiatry, 158*(8), 1184-1190.

Jean-Bay, E. (2000). The Biobehavioral Correlates of Post-traumatic Brain Injury Depression. *Journal of Neuroscience Nursing, 32*(3), 169.

Jeavons, S., Greenwood, K. M., & de L. Horne, D. J. (2000). Accident Cognitions and Subsequent Psychological Trauma. *Journal of Traumatic Stress, 13*(2), 359-365.

Jehn, C. (1990). *Department of Defense Instruction 1338.19: Relocation Assistance Programs*.

Johansen, V., Wahl, A., Eilertsen, D., & Weisaeth, L. (2007). Prevalence and predictors of post-traumatic stress disorder (PTSD) in physically injured victims of non-domestic violence. *Social Psychiatry & Psychiatric Epidemiology, 42*(7), 583-593.

Johnson, R. J., Rew, L., & Kouzekanani, K. (2006). Gender Differences in Victimized Homeless Adolescents. *Adolescence, 41*(161), 40-53.

Jones, E., & Wessely, S. (2001). Psychiatric battle casualties: an intra- and inter-war comparison. *British Journal of Psychiatry, 178*(3), 242-247.

Jones, E., & Wessely, S. (2005). *Shell Shock to PTSD: Military Psychiatry from1900 to the Gulf War*. New York: Psychology Press.

Jordan, A. A., Taylor, W. J., & Mazarr, M. J. (1999). *American National Security* (5th ed.). Baltimore: Johns Hopkins Press.

Kaminsky, M., McCabe, O., Langlieb, A., & Everly, G. (2007). An Evidence-Informed Model of Human Resistance, Resilience, and Recovery: The Johns Hopkins' Outcome-Driven Paradigm for Disaster Mental Health Services *Brief Treatment and Crisis Intervention 7*(1), 1-11.

Kane, R. C. (2008). The Clinical Significance of Statistical Significance. *Oncologist, 13*(11), 1129-1133.

Kang, H. K., & Hyams, K. C. (2005). Mental Health Care Needs among Recent War Veterans. *New England Journal of Medicine, 352*(13), 1289-1289.

Kaplan, C., Turner, S., Norman, E., & Stillson, K. (1996). Promoting resilience strategies: A modified consultation model. *Social Work in Education, 18*(3), 158-168.

Kaplan, D., & Wenger, R. N. (1993). Asymptotic independence and separability in covariance structure models: Implications for specification error, power, and model modification. *Multivariate Behavioral Research, 28*, 483-498.

Kar, N., Mohapatra, P. K., Nayak, K. C., Pattanaik, P., Swain, S. P., & Kar, H. C. (2007). Post-traumatic stress disorder in children and adolescents one year after a super-cyclone in Orissa, India: exploring cross-cultural validity and vulnerability factors. *BMC Psychiatry, 7*, 8-9.

Kazak, A. E., Alderfer, M. A., Streisand, R., Simms, S., Rourke, M. T., Barakat, L. P., et al. (2004). Treatment of Posttraumatic Stress Symptoms in Adolescent Survivors of Childhood Cancer and Their Families: A Randomized Clinical Trial. *Journal of Family Psychology, 18*(3), 493-504.

Kazis, L. E., Miller, D. R., Clark, J., Skinner, K., Lee, A., Rogers, W., et al. (1998). Health-Related Quality of Life in Patients Served by the Department of Veterans Affairs: Results from the Veterans Health Study. *Arch Intern Med, 158*(6), 626-632.

Keane, T. M., Weathers, F., & Foa, E. B. (2000). Diagnosis and Assessment. In E. B. Foa, T. M. Keane & M. Friedman (Eds.), *Effective Treatments for PTSD* (pp. 18-36). New York Gilliford.

Kelley, K. (2007). Confidence intervals for standardized effect sizes: Theory, application, and implementation. *Journal of Statistical Software, 20*(8), 1-24.

Klein, R. M. (2007). Adaptive Planning: Not Your Great Grandfather's Schlieffen Plan. *JFQ: Joint Force Quarterly*(45), 84-88.

Keith, T. (2006). *Multiple Regression and Beyond*. Boston: Pearson.

Kessler, R., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. (1995). Posttraumatic Stress Disorder in the National Co-morbidity Survey. *Arch Gen Psychiatry, 52*(12), 1048-1060.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., & Walters, E. (2005). Lifetime Prevalence and Age-of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*(6), 593-602.

Kessler, R. C., McGonagle, K. A., Swartz, M., Blazer, D. G., & Nelson, C. B. (1993). Sex and depression in the National Co-morbidity Survey I: Lifetime prevalence, chronicity and recurrence. *Journal of Affective Disorders, 29*(2-3), 85-96.

Kilbourne, A., McCarthy, J., Post, E., Welsh, D., & Blow, F. (2007). Social support among veterans with serious mental illness. *Social Psychiatry and Psychiatric Epidemiology, 42*(8), 639-646.

Kim, J.-S., Lim, H.-S., Cho, S.-I., Cheong, H.-K., & Lim, M.-K. (2003). Impact of Agent Orange Exposure among Korean Vietnam Veterans. *Industrial Health, 41*(3), 149-157.

Kirby, L., & Fraser, M. (1997). Risk and Resiliency in Childhood. In M. Fraser (Ed.), *Risk and Resiliency in Childhood: An Ecological Perspective*. Washington D. C.: NASW Press.

Klein, D. N. (2008). Classification of Depressive Disorders in the DSM-IV: Proposal for a Two-Dimension System. *Journal of Abnormal Psychology, 117*(3), 552-560.

Kline, A., Falca-Dodson, M., Sussner, B., Ciccone, D. S., Chandler, H., Callahan, L., et al. (2010). Effects of Repeated Deployment to Iraq and Afghanistan on the Health of New Jersey Army National Guard Troops: Implications for Military Readiness. *American Journal of Public Health, 100*(2), 276-283.

Kline, R. (2005). *Principles and Practices of Structural Equation Modeling* (2 ed.). New York: Gulliford Press.

Koenen, K. C., Harley, R., Lyons, M. J., Wolfe, J., Simpson, J. C., Goldberg, J., et al. (2002). A Twin Registry Study of Familial and Individual Risk Factors for Trauma Exposure and Posttraumatic Stress Disorder. *The Journal of Nervous and Mental Disease, 190*(4), 209-218.

Koenen, K., Nugent, N., & Amstadter, A. (2008). Gene-Environment Interaction in Posttraumatic Stress Disorder. *European Archives of Psychiatry & Clinical Neuroscience, 258*(2), 82-96.

Kroenke, K., Spitzer, R., & Williams, J. (2001). The PHQ-9. *Journal of General Internal Medicine, 16*(9), 606-613.

Krovetz, M. L. (1999). Fostering Resiliency. *Thrust for Educational Leadership, 28*(5), 28.

Krulak, C. C. (1997). *Marine Corps Doctrine Publication 1: War Fighting*.

Kulenovic, A. D., Kucukalic, A., Malec, D., Fisekovic, S., Suljic, E. M., & Mehmedbasic, A. B. (2009). P03-243 'The body keeps the score' revisited: Changes in lipid levels and coronary disease risk in army veterans suffering from chronic PTSD. *European Psychiatry, 24*, S1242-S1242.

Lacquement, R. A. (2003). *Shaping American Military Capabilities After the Cold War*. Westport: Praeger.

Lamprecht, F., & Martin, S. (2002). Posttraumatic Stress Disorder Revisited. *Psychosomatic Medicine, 64*, 222-237.

Lance, C., Dawson, B., Birkelbach, D., & Hoffman, B. (2010). Method Effects, Measurement Error, and Substantive Conclusions. *Organizational Research Methods OnlineFirst*, 1-21.

Lande, R. G., Marin, B. A., Chang, A. S., & Lande, G. R. (2007). Gender Differences and Alcohol Use in the US Army. *J Am Osteopath Assoc, 107*(9), 401-407.

Larson, G. E., Highfill-McRoy, R. M., & Booth-Kewley, S. (2008). Psychiatric Diagnoses in Historic and Contemporary Military Cohorts: Combat Deployment and the Healthy Warrior Effect. *Am. J. Epidemiol., 167*(11), 1269-1276.

Laubmeier, K. K., & Zakowski, S. G. (2004). The role of objective versus perceived life threat in the psychological adjustment to cancer. *Psychology & Health, 19*(4), 425-437.

Leckie, R. (1992). *The Wars of America: From 1900 to 1992* (Vol. 2). New York: Harper Collins.

Lederman, L., & Steward, L. (2005). *Changing the Culture of College Drinking: A Socially Situated Health Communication Campaign*. Cresskill, NJ: Hampton Press.

Leentjens, A. F. G., Verhey, F. R. J., Luijckx, G.-J., & Troost, J. (2000). The validity of the Beck Depression Inventory as a screening and diagnostic instrument for depression in patients with Parkinson's disease. *Movement Disorders, 15*(6), 1221-1224.

Lerner, D., & Henke, R. M. (2008). What Does Research Tell Us About Depression, Job Performance, and Work Productivity? *Journal of Occupational and Environmental Medicine, 50*(4), 401-410 410.1097/JOM.1090b1013e31816bae31850.

Lichte, A. (2006). *AFI 90-501, Community Action Information Board and Integrated Delivery System*.

Lilly, M. M., Pole, N., Best, S. R., Metzler, T., & Marmar, C. R. (2009). Gender and PTSD: What can we learn from female police officers? *Journal of Anxiety Disorders, 23*(6), 767-774.

Linley, P., Joseph, S., Harrington, S., & Wood, A. (2006). Positive Psychology: Past, Present and (Possible) Future. *The Journal of Positive Psychology, 1*(1), 3-16.

Linley, A., & Joseph, S. (2005). The Human Capacity for Growth Through Adversity. *American Psychologist, 60*(3), 262-264.

Liu, P., Shi, Z., Wang, C., Yang, H., Li, L., Dai, Y., et al. (2008). The false-positive and false-negative predictive value of HIV antibody test in the Chinese population. *J Med Screen, 15*(2), 72-75.

Loftus, T. (2008). *Implementation of Revised DD Forms 2796 and 2900*.

Lorant, V., Croux, C., Weich, S., Deliege, D., Mackenbach, J., & Ansseau, M. (2007). Depression and socio-economic risk factors: 7-year longitudinal population study. *The British Journal of Psychiatry, 190*(4), 293-298.

Lowery, K., & Stokes, M. A. (2005). Role of Peer Support and Emotional Expression on Posttraumatic Stress Disorder in Student Paramedics. *Journal of Traumatic Stress, 18*(2), 171-179.

Lunsaco, T., & Bredlow, B. (2008). *One Shot One Kill: Performance Enhancement and Resiliency Training*. Paper presented at the Operational Problems in Behavioral Sciences Symposium.

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work. *Child Development, 71*(3), 543-562.

MacGregor, A. J., Corson, K. S., Larson, G. E., Shaffer, R. A., Dougherty, A. L., Galarneau, M. R., et al. (2009). Injury-specific predictors of posttraumatic stress disorder. *Injury, 40*(9), 1004-1010.

Maes, M., Delmeire, L., Mylle, J., & Altamura, C. (2001). Risk and preventive factors of post-traumatic stress disorder (PTSD): alcohol consumption and intoxication prior to a traumatic event diminishes the relative risk to develop PTSD in response to that trauma. *Journal of Affective Disorders, 63*(1-3), 113-121.

Mallinckrodt, B., Abraham, W. T., Wei, M., & Russell, D. W. (2006). Advances in testing the statistical significance of mediation effects. *Journal of Counseling Psychology, 53*(3), 372-378.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin, 103*(3), 391-410.

Marmar, C. R. (2009). Mental Health Impact of Afghanistan and Iraq Deployment: Meeting the Challenge of Veterans. *Depression and Anxiety, 26*(6), 493-497.

Marmorstein, N. R., Iacono, W. G., & Malone, S. M. (2010). Longitudinal associations between depression and substance dependence from adolescence through early adulthood. *Drug & Alcohol Dependence, 107*(2/3), 154-160.

Masten, A. (1994). Resilience in Individual Development: Successful Adaptation Despite Risk and Adversity. In M. Wang & E. Gordon (Eds.), *Educational Resilience in Inner-City America: Challenges and Prospects*. Hillsdale: Lawerance Erlbaum.

Mayer, D. (2004). *Essential Evidence-Based Medicine*. New York, NY: Cambridge University Press.

Mazzuchi, J. F., Trump, D. H., Riddle, J., Hyams, K. C., & Balough, B. (2002). Force Health Protection: 10 Years of Lessons Learned by the Department of Defense. *Military Medicine, 167*(3), 179-186.

McFarlane, A. C. (1998). Epidemiological evidence about the relationship between PTSD and alcohol abuse: The nature of the association. *Addictive Behaviors, 23*(6), 813-825.

McKinnon, A. C., Nixon, R. D. V., & Brewer, N. (2008). The influence of data-driven processing on perceptions of memory quality and intrusive symptoms in children following traumatic events. *Behaviour Research & Therapy, 46*(6), 766-775.

Meichenbaum, D. (1994). *A Clinical Handbook/Practical Therapist Manual for Assessing and Treating Adults with Post-Traumatic Stress Disorder (PTSD)*. Waterloo, Ont.: Institute Press.

Mental Health Advisory Team (MHAT), Operation Iraqi Freedom 06-08: Iraq, Operation Enduring Freedom 8: Afghanistan. (2008).

Meririnne, E., Kiviruusu, O., Karlsson, L., Pelkonen, M., Ruuttu, T., Tuisku, V., et al. (2010). Brief Report: Excessive alcohol use negatively affects the course of adolescent depression: One year naturalistic follow-up study. *Journal of Adolescence, 33*(1), 221-226.

Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist, 50*(9), 741-749.

Michael, B. S. (2008). Military Culture and Transformation. *JFQ: Joint Force Quarterly*(49), 103-106.

Military Demographics. (2010). *Air Force Demographics*, from http://www.afpc.randolph.af.mil/library/airforcepersonnelstatistics.asp

Milliken, C., Auchterlonie, J., & Hoge, C. (2007). Longitudinal Assessment of Mental Health Problems Among Active and Reserve Component Soldiers Returning from the Iraq War. *Journal of the American Medical Association, 298*(18), 2141-2148.

Miranda, O., Draijer, N., Langeland, W., & Gersons, B. P. R. (2007). Gender Differences in Posttraumatic Stress Disorder. *Psychological Bulletin, 133*(2), 183-204.

Moseley, M. (2005). *Air Force Mission Statement*.

Mount, M. K., Judge, T. A., Scullen, S. E., Sytsma, M. R., & Hezlett, S. A. (1998). Trait, Rater and Level Effects in 360-Degree Performance Ratings. *Personnel Psychology, 51*(3), 557-576.

Moyer, A., Finney, J. W., Swearingen, C. E., & Vergun, P. (2002). Brief interventions for alcohol problems: a meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. *Addiction, 97*(3), 279-292.

Murata, C., Kondo, K., Hirai, H., Ichida, Y., & Ojima, T. (2008). Association between depression and socio-economic status among community-dwelling elderly in Japan: The Aichi Gerontological Evaluation Study (AGES). *Health & Place, 14*(3), 406-414.

Murphy, F. M. (1999). Gulf war syndrome. *BMJ, 318*(7179), 274-275.

Murphy, P., & Fogarty, G. J. (2009). Leadership: the key to meaning and resilience on deployment? In P. Murphy (Ed.), *Focus on Human Performance in Land Operations, Vol. 1* (pp. 92-101). Canberra, Australia: Australian Defense Force Psychology Organization.

Murray, C. K., Reynolds, J. C., Schroeder, J. M., Harrison, M. B., Evans, O. M., & Hospenthal, D. R. (2005). Spectrum of Care Provided at an Echelon II Medical Unit during Operation Iraqi Freedom. *Military Medicine, 170*, 516-520.

Muthen, L., & Muthen, B. (2007). *Mplus User's Guide* (5th ed.). Los Angeles: Muthen & Muthen.

National Defense Authorization Act for Fiscal Year 2011. (2010).

Neimeyer, R., Prigerson, H., & Davies, B. (2002). Mourning and Meaning. *American Behavioral Scientist, 46*(2), 235-251.

Nemeroff, C. B., Bremner, J. D., Foa, E. B., Mayberg, H. S., North, C. S., & Stein, M. B. (2006). Posttraumatic stress disorder: A state-of-the-science review. *Journal of Psychiatric Research, 40*(1), 1-21.

Netemeyer, R., Bearden, W., & Sharma, S. (2003). Scaling Procedures: Issues and Applications.

Newman, E. (2010). *Diagnostic Utility of the Pediatric Attention Disorders Diagnostic Screener.* Unpublished Dissertation, Fairleigh Dickenson University, Teaneck.

Newton, R. (2008). *AFI 36-3009: AIRMAN AND FAMILY READINESS CENTERS*.

Nitko, A., & Brookhart, S. (2007). *Educational Assessment of Students* (5th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.

Nolen-Hoeksema, S., & Hilt, L. (2006). Possible Contributors to the Gender Differences in Alcohol Use and Problems. *Journal of General Psychology, 133*(4), 357-374.

Norris, F. H., VanLandingham, M. J., & Lung, V. (2009). PTSD in Vietnamese Americans following Hurricane Katrina: Prevalence, patterns, and predictors. *Journal of Traumatic Stress, 22*(2), 91-101.

Norris, F. H., Perilla, J. L., & Ibanez, G. E. (2001). Sex differences in symptoms of posttraumatic
stress disorder: does culture play a role? . *Journal of Traumatic Stress, 14*(1), 7-28.

Nugent, W. (Ed.). (2009). *Understanding a Diagnosis, What it Does and Does Not Tell You* (2nd ed.). New York, NY: Oxford University Press.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw_Hill.

Nutt, D., & Malizia, A. (2004). Structural and Functional Brain Changes in Posttraumatic Stress Disorder. *Journal of Clinical Psychiatry, 65*(1), 11-17.

Olff, M., Sijbrandij, M., Opmeer, B. C., Carlier, I. V. E., & Gersons, B. P. R. (2009). The structure of acute posttraumatic stress symptoms: Reexperiencing, Active avoidance, Dysphoria, and Hyperarousal. *Journal of Anxiety Disorders, 23*(5), 656-659.

Olofsson, E., Bunketorp, O., & Andersson, A.-L. (2009). Children and adolescents injured in traffic- associated psychological consequences: a literature review. *Acta Paediatrica, 98*(1), 17-22.

Orcutt, H. K., Erickson, D. J., & Wolfe, J. (2004). The Course of PTSD Symptoms Among Gulf War Veterans: A Growth Mixture Modeling Approach. *Journal of Traumatic Stress, 17*(3), 195-205.

Ostaszewski, K., & Zimmerman, M. A. (2006). The Effects of Cumulative Risks and Promotive Factors on Urban Adolescent Alcohol and Other Drug Use: A Longitudinal Study of Resiliency. *American Journal of Community Psychology, 38*(3/4), 237-249.

Ozanian, A. (2010). Development of the Post-Deployment Health Reassessment. Unpublished Phone interview.

Ozanian, A., Middleton, S., Myatt, R., Henry, T., Kirkland, R., Wright-Jackson, K., et al. (2008). *Post-Deployment Health Reassessment Application User's Guide*.

Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of Posttraumatic Stress Disorder and Symptoms in Adults: A Meta-Analysis. *Psychological Bulletin, 129*(1), 52.

Pagani, L., Japel, C., Vaillancourt, T., Cote, S., & Tremblay, R. (2008). Links Between Life Course Trajectories of Family Dysfunction and Anxiety During Middle Childhood. *Journal of Abnormal Psychology, 36*(1), 41-53.

Palmer, C. (2008). A Theory of Risk and Resilience Factors in Military Families. *Military Psychology, 20*(3), 205 - 217.

Palmer, N. (1997). Resilience in Adult Children of Alcoholics: A Nonpathological Approach to Social Work Practice. *Health & Social Work, 22*(3), 201-209.

Paykel, E. S., Cooper, Z., Ramana, R., & Hayhurst, H. (1996). Life events, social support and marital relationships in the outcome of severe depression. *Psychological Medicine, 26*(01), 121-133.

Peebles-Kleiger, M. J., & Kleiger, J. H. (1994). Re-integration stress for Desert Storm families: Wartime deployments and family trauma. *Journal of Traumatic Stress, 7*(2), 173-194.

Pervanidou, P. (2008). Biology of Post-Traumatic Stress Disorder in Childhood and Adolescence. *Journal of Neuroendocrinology, 20*, 632-638.

Peter, J. (1981). Construct Validity: A Review of Basic Issues and Marketing Practices. *Journal of Marketing Research, 18*(2), 133-145.

Peterson, A. L., Baker, M. T., & McCarthy, K. R. (2008). Combat Stress Casualties in Iraq. Part 1: Behavioral Health Consultation at an Expeditionary Medical Group. *Perspectives in Psychiatric Care, 44*(3), 146-158.

Piccinelli, M., & Wilkinson, G. (2000). Gender differences in depression: Critical review. *The British Journal of Psychiatry, 177*(6), 486-492.

Pietrzak, R. H., Johnson, D. C., Goldstein, M. B., Malley, J. C., & Southwick, S. M. (2009). Psychological resilience and postdeployment social support protect against traumatic stress and depressive symptoms in soldiers returning from Operations Enduring Freedom and Iraqi Freedom. *Depression and Anxiety, 26*(8), 745-751.

Piug, A., Koro-Ljungberg, M., & Echevarria-Doan, S. (2008). Social Constructionist Family systems Research: Conceptual Considerations. *Family Journal, 16*(2), 139-146.

Plaisier, I., de Bruijn, J. G. M., de Graaf, R., Have, M. t., Beekman, A. T. F., & Penninx, B. W. J. H. (2007). The contribution of working conditions and social support to the onset of depressive and anxiety disorders among male and female employees. *Social Science & Medicine, 64*(2), 401-410.

Pratchett, L., Pelcovitz, M. R., & Yehuda, R. (2010). Trauma and Violence: Are Women the Weaker Sex? *Psychiatric Clinics of North America, 33*(2), 465-474.

Priebe, S., Grappasonni, I., Mari, M., Dewey, M., Petrelli, F., & Costa, A. (2009). Posttraumatic stress disorder six months after an earthquake. *Social Psychiatry & Psychiatric Epidemiology, 44*(5), 393-397.

Rand. (2008). *Invisible Wounds of War: Summary and Recommendations for Addressing Psychological and Cognitive Injuries*. Santa Monica, CA: Rand Center for Military Health Policy Researcho. Document Number)

Reger, M. A., Etherage, J. R., Reger, G. M., & Gahm, G. A. (2008). Civilian Psychologists in an Army Culture: The Ethical Challenge of Cultural Competence. *Military Psychology, 20*(1), 21-35.

Renshaw, K. D., Rodrigues, C. S., & Jones, D. H. (2009). Combat exposure, psychological symptoms, and marital satisfaction in National Guard soldiers who served in Operation Iraqi Freedom from 2005 to 2006. *Anxiety, Stress & Coping, 22*(1), 101-115.

Rhebergen, D., Beekman, A. T. F., Graaf, R. d., Nolen, W. A., Spijker, J., Hoogendijk, W. J., et al. (2009). The three-year naturalistic course of major depressive disorder, dysthymic disorder and double depression. *Journal of Affective Disorders, 115*(3), 450-459.

Richard, J. M. (2003). Psychological mechanisms in acute response to trauma. *Biological Psychiatry, 53*(9), 779-788.

Richardson, G. (2002). The Metatheory of Resilience and Resiliency. *Journal of Clinical Psychology, 58*(3), 307-321.

Richardson, G., & Gray, D. (1998). High-school curriculum fosters resiliency. *Education Digest, 63*(6), 23.

Richman, J., & Bowen, G. (1997). School Failure: An Ecological-Interactional-Developmental Perspective. In M. Fraser (Ed.), *Risk and Resilience in Childhood* (pp. 95-116). Washington D. C. : NASW Press.

Richardson, G. (2002). The Metatheory of Resilience and Resiliency. *Journal of Clinical Psychology, 58*(3), 307-321.

Riddle, J. R., Smith, T. C., Smith, B., Corbeil, T. E., Engel, C. C., Wells, T. S., et al. (2007). Millennium Cohort: The 2001-2003 baseline prevalence of mental disorders in the U.S. military. *Journal of Clinical Epidemiology, 60*(2), 192-201.

Riolo, S. A., Nguyen, T. A., Greden, J. F., & King, C. A. (2005). Prevalence of Depression by Race/Ethnicity: Findings From the National Health and Nutrition Examination Survey III. *Am J Public Health, 95*(6), 998-1000.

Roadman, C. (1998). *AIR FORCE INSTRUCTION 44-102: COMMUNITY HEALTH MANAGEMENT*.

Roberts, B., Damundu, E. Y., Lomoro, O., & Sondorp, E. (2009). Post-conflict mental health needs: a cross-sectional survey of trauma, depression and associated factors in Juba, Southern Sudan. *BMC Psychiatry, 9*, 1-10.

Roberts, B., Ocaka, K. F., Browne, J., Oyok, T., & Sondorp, E. (2008). Factors associated with post-traumatic stress disorder and depression amongst internally displaced persons in northern Uganda. *BMC Psychiatry, 8*, 1-9.

Roberts, F. (Ed.). (1979). *Measurement Theory with Applications to Decision making, Utility and the Social Sciences* (Vol. 7). Reading, MA: Addison-Wesley Publishing Company.

Romine, C. B., Lee, D., Wolfe, M. E., Homack, S., George, C., & Riccio, C. A. (2004). Wisconsin Card Sorting Test with children: a meta-analytic study of sensitivity and specificity. *Archives of Clinical Neuropsychology, 19*(8), 1027-1041.

Rona, R., Fear, N., Hull, L., Greenberg, N., Earnshaw, M., Hotopf, M., et al. (2007). Mental Health Consequences of Overstretch in the UK Armed Forces: First Phase of a Cohort Study. *British Medical Journal, 335*(7620), 335-343.

Room, R., Babor, T., & Rehm, J. (2005). Alcohol and public health. *The Lancet, 365*(9458), 519-530.

Rosenbaum, M., & Ben-Ari, K. (1985). Learned helplessness and learned resourcefulness: Effects of noncontingent success and failure on individuals differing in self-control skills. *Journal of Personality and Social Psychology, 48*(1), 198-215.

Rubin, A., & Babbie, E. (2008). *Research Methods for Social Work* (6th ed.). Belmont: Thompson Brooks/Cole.

Rutter, M. (1987). Psychosocial Resilience and Protective Mechanisms. *American Journal of Orthopsychiatry, 57*(3), 316-331.

Rutz, W., Knorring, L. v., & Wålinder, J. (1992). Long-term effects of an educational program for general practitioners given by the Swedish Committee for the Prevention and Treatment of Depression. *Acta Psychiatrica Scandinavica, 85*(1), 83-88.

Ruzek, J. (2008). Wanted: A Theory of Post-Trauma Information Delivery. *Psychiatry, 71*(4), 332-338.

Sarason, I. G., & Sarason, B. R. (1982). Concomitants of Social Support: Attitudes, Personality Characteristics and Life Experiences. *Journal of Personality, 50*(3), 331-345.

Saunders, J., Aasland, O., Babor, T., Fuente, J., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption-II. *Addiction, 88*(6), 791-804.

Savitsky, L., Illingworth, M., & DuLaney, M. (2009). Civilian Social Work: Serving the Military and Veteran Populations. *Social Work, 54*, 327-339.

Sawyer, A. G. (1982). Statistical Power and Effect Size in Consumer Research. *Advances in Consumer Research, 9*(1), 1-7.

Schervish, M. (1996). P Values: What They Are and What They Are Not. *The American Statistician, 50*(3), 203-206.

Schmidt, M., Kravic, N., & Ehlert, U. (2008). Adjustment to trauma exposure in refugee, displaced, and non-displaced Bosnian women. *Archives of Women's Mental Health, 11*(4), 269-276.

Schneider, S. L., Haack, L., Owens, J., Herrington, D. P., & Zelek, A. (2009). An Interdisciplinary Treatment Approach for Soldiers with TBI/PTSD: Issues and Outcomes. *Perspectives on Neurophysiology and Neurogenic Speech and Language Disorders, 19*(2), 36-46.

Schroeder, S. A. (1987). Strategies for Reducing Medical Costs by Changing Physicians' Behavior: Efficacy and Impact on Quality of Care. *International Journal of Technology Assessment in Health Care, 3*(01), 39-50.

Schumm, J. A., Briggs-Phillips, M., & Hobfoll, S. E. (2006). Cumulative interpersonal traumas and social support as risk and resiliency factors in predicting PTSD and depression among inner-city women. *Journal of Traumatic Stress, 19*(6), 825-836.

Schwinn, T. M., Schinke, S. P., & Trent, D. N. (2010). Substance use among late adolescent urban youths: Mental health and gender influences. *Addictive Behaviors, 35*(1), 30-34.

Seal, K. H., Bertenthal, D., Miner, C. R., Sen, S., & Marmar, C. (2007). Bringing the War Back Home: Mental Health Disorders Among 103 788 US Veterans Returning From Iraq and Afghanistan Seen at Department of Veterans Affairs Facilities. *Arch Intern Med, 167*(5), 476-482.

Seino, K., Takano, T., Mashal, T., Hemat, S., & Nakamura, K. (2008). Prevalence of and factors influencing posttraumatic stress disorder among mothers of children under five in Kabul, Afghanistan, after decades of armed conflicts. *Health & Quality of Life Outcomes, 6*, 1-5.

Shalev, A. Y., Freedman, S., Peri, T., Brandes, D., Sahar, T., Orr, S. P., et al. (1998). Prospective Study of Posttraumatic Stress Disorder and Depression Following Trauma. *Am J Psychiatry, 155*(5), 630-637.

Shen, Y.-C., Arkes, J., Kwan, B. W., Tan, L. Y., & Williams, T. V. (2009). The Effect of OEF/OIF Deployment Intensity on the Rate of Posttraumatic Stress Disorder Among Active Duty Population. *SSRN eLibrary*.

Shen, Y.-C., Arkes, J., & Pilgrim, J. (2009). The Effects of Deployment Intensity on Post-Traumatic Stress Disorder: 2002-2006. *Military Medicine, 174*, 217-223.

Shields, A. L., & Caruso, J. C. (2003). Reliability Generalization of the Alcohol Use Disorders Identification Test. *Educational and Psychological Measurement, 63*(3), 404-413.

Shultz, K., & Whitney, D. (2005). *Measurement Theory in Action: Case Studies and Exercises*. Thousand Oaks: Sage Publications Inc.

Siebold, G. L. (2007). The Essence of Military Group Cohesion. *Armed Forces & Society, 33*(2), 286-295.

Silverstein, B. (2002). Gender Differences in the Prevalence of Somatic Versus Pure Depression: A Replication. *Am J Psychiatry, 159*(6), 1051-1052.

Slesnick, N., & Prestopnik, J. L. (2004). Office versus Home-Based Family Therapy for Runaway, Alcohol Abusing Adolescents: Examination of Factors Associated with Treatment Attendance. *Alcoholism Treatment Quarterly, 22*(2), 3-19.

Slesnick, N., & Prestopnik, J. L. (2005). Ecologically based family therapy outcome with substance abusing runaway adolescents. *Journal of Adolescence, 28*(2), 277-298.

Smith, B., Smith, T. C., Gray, G. C., & Ryan, M. A. K. (2007). When Epidemiology Meets the Internet: Web-based Surveys in the Millennium Cohort Study. *Am. J. Epidemiol., 166*(11), 1345-1354.

Smith, D. W., Frueh, B. C., Sawchuk, C. N., & Johnson, M. R. (1999). Relationship between symptom over-reporting and pre- and post-combat trauma history in veterans evaluated for PTSD. *Depression and Anxiety, 10*(3), 119-124.

Smith, G. D., & Brunner, E. (1997). Socio-economic differentials in health: The role of nutrition. *Proceedings of the Nutrition Society, 56*(1A), 75-90.

Smits, F., Smits, N., Schoevers, R., Deeg, D., Beekman, A., & Cuijpers, P. (2008). An Epidemiological Approach to Depression Prevention in Old Age. *American Journal of Geriatric Psych, 16*(6), 444-453 410.1097/JGP.1090b1013e3181662ab3181666.

Solberg, L. I., Maciosek, M. V., & Edwards, N. M. (2008). Primary Care Intervention to Reduce Alcohol Misuse: Ranking Its Health Impact and Cost Effectiveness. *American Journal of Preventive Medicine, 34*(2), 143-152.e143.

Sotsky, S. M., Glass, D. R., Shea, M. T., Pilkonis, P. A., Collins, F., Elkin, I., et al. (2006). Patient Predictors of Response to Psychotherapy and Pharmacotherapy: Findings in the NIMH Treatment of Depression Collaborative Research Program. *Focus, 4*(2), 278-290.

Spearman, C. (1904). The Proof and Measurement of Association between Two Things. *American Journal of Psychology, 15*, 72-101.

Spearman, C. (1907). Demonstration of Formulae for True Measurement of Correlation. *American Journal of Psychology, 18*, 161-169.

Spearman, C. (1913). Correlations of sums or differences. *British Journal of Psychology, 5*(4), 417-426.

Spector, P. E. (2006). Method Variance in Organizational Research: Truth or Urban Legend? *Organizational Research Methods, 9*(2), 221-232.

Spera, C. (2009). Spouses' Ability to Cope with Deployment and Adjust to Air Force Family Demands. *Armed Forces & Society (Sage Publications Inc.), 35*(2), 286-306.

Spiegel, M. R. (1999). *Schaum's Outline of Theory and Problems of Statistics* (3rd ed.): McGraw-Hill.

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & and the Patient Health Questionnaire Primary Care Study, G. (1999). Validation and Utility of a Self-report Version of PRIME-MD: The PHQ Primary Care Study. *JAMA, 282*(18), 1737-1744.

Springer, D. (1997). *Development of the Adolescent Concerns Evaluation (ACE) Rapid Assessment Instrument : Detecting Risk Indicators of Runaway Behavior in Adolescents.* Unpublished Dissertation, Florida State University.

Stansfeld, S. A., Clark, C., Rodgers, B., Caldwell, T., & Power, C. (2008). Childhood and adulthood socio-economic position and midlife depressive and anxiety disorders. *The British Journal of Psychiatry, 192*(2), 152-153.

Steiker, L. K. H., Castro, F. G. l., Kumpfer, K., Marsiglia, F. F., Coard, S., & Hopson, L. M. (2008). A Dialogue Regarding Cultural Adaptation of Interventions. *Journal of Social Work Practice in the Addictions, 8*(1), 154-162.

Strümpfer, D. J. W. (1995). The origins of health and strength: From salutogenesis to fortigenesis. *South African Journal of Psychology, 25*(2), 81-89.

Surhone, L. M., Timpledon, M. T., & Marseken, S. F. (2009). *Sensitivity and Specificity: Statistical Hypothesis Testing, Receiver Operating Characteristic, Detection Dog, Law Enforcement, Positive Predictive Value, Faecal Occult Blood, Detection Theory*: Betascript Publishers.

Tampke, A. K., & Irwin, H. J. (1999). Dissociative Processes and Symptoms of Posttraumatic Stress in Vietnam Veterans. *Journal of Traumatic Stress, 12*(4), 725-738.

Terrio, H., Brenner, L. A., Ivins, B. J., Cho, J. M., Helmick, K., Schwab, K., et al. (2009). Traumatic Brain Injury Screening: Preliminary Findings in a US Army Brigade Combat Team. *Journal of Head Trauma Rehabilitation, 24*(1), 14-23.

Thomas, M. H., & Steven, M. D. (2004). Construct-Irrelevant Variance in High-Stakes Testing. *Educational Measurement: Issues and Practice, 23*(1), 17-27.

Thorndike, E. (1918). *An introduction to the theory of mental and social measurements*. New York, NY: Science Press.

Thyer, B. (2004). What is Evidence-Based Practice? *Brief Treatment and Crisis Intervention, 4*(2), 167-176.

Tolin, D. F., & Foa, E. B. (2006). Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychological Bulletin, 132*(6), 959-992.

Tourangeau, R., Groves, R. M., & Redline, C. D. (2010). Sensitive Topics and Reluctant Respondents: Demonstrating a Link between Nonresponse Bias and Measurement Error. *Public Opin Q*, nfq004.

Trim, R. S., Schuckit, M. A., & Smith, T. L. (2010). Predicting drinking onset with discrete-time survival analysis in offspring from the San Diego prospective study. *Drug & Alcohol Dependence, 107*(2/3), 215-220.

Tucker, P., & Pfefferbaum, B. (2000). Predictors of Post-Traumatic Stress Symptoms in Oklahoma City: Exposure, Social Support, Peri-Traumatic Responses. *Journal of Behavioral Health Services & Research, 27*(4), 406.

Tuerk, P. W., Grubaugh, A. L., Hamner, M. B., & Foa, E. B. (2009). Diagnosis and Treatment of PTSD-Related Compulsive Checking Behaviors in Veterans of the Iraq War: The Influence of Military Context on the Expression of PTSD Symptoms. *American Journal of Psychiatry, 166*(7), 762-767.

Tyler, K. A., Cauce, A. M., & Whitbeck, L. B. (2004). Family Risk Factors and Prevalence of Dissociative Symptoms among Homeless and Runaway Youth. *Child Abuse & Neglect, 28*(3), 355-367.

U.S. Code: Title 10- Armed Forces (2007).

Ullman, S. E. (1999). Social support and recovery from sexual assault: A review. *Aggression and Violent Behavior, 4*(3), 343-358.

Ullman, S. E., & Filipas, H. H. (2001). Predictors of PTSD Symptom Severity and Social Reactions in Sexual Assault Victims. *Journal of Traumatic Stress, 14*(2), 369.

Ullman, S. E., Townsend, S. M., Filipas, H. H., & Starzynski, L. L. (2007a). Structural Models of the Relations of Assault Severity, Social Support, Avoidance Coping, Self-Blame and PTSD among Sexual Assault Survivors. *Psychology of Women Quarterly, 31*(1), 23-37.

Ullman, S. E., Townsend, S. M., Filipas, H. H., & Starzynski, L. L. (2007b). Structural Models of the Relations of Assault Severity, Social Support, Avoidance Coping, Self-blame, and PTSD among Sexual Assault Survivors. *Psychology of Women Quarterly, 31*(1), 23-37.

Ulrich, S. (2010). What multi-method data tell us about construct validity. *European Journal of Personality, 24*(3), 241-257.

Ursano, R. J., Fullerton, C. S., Kao, T.-C., & Bhartiya, V. R. (1995). Longitudinal Assessment of Posttraumatic Stress Disorder and Depression after Exposure to Traumatic Death. *The Journal of Nervous and Mental Disease, 183*(1), 36-42.

Vaillant, G. E., & Davis, J. T. (2000). Social/emotional intelligence and midlife resilience in schoolboys with low tested intelligence. *American Journal of Orthopsychiatry, 70*(2), 215.

Van Breda, A. D. (2001). *Resilience theory: A literature review*.

Vernez, G., & Zellman, G. (1987). *Family and Mission: a Review of the Effects of Family Factors on Army Attrition, Retention and Readiness*. Santa Monica: Rando. Document Number)

Vijayakumar, L., Kannan, G. K., & Daniel, S. J. (2006). Mental health status in children exposed to tsunami. *International Review of Psychiatry, 18*(6), 507-513.

Volpe, P., & Carroll, B. (2010). *The Challenge and the Promise: Strengthening the Force, Preventing Suicides and Saving Lives*. Washington D.C.

Wald, J., Taylor, S. T., Asmundson, G. J. G., Jang, K. L., & Stapelton, J. (2003). *Literature review of concepts: Psychological resiliency*. Toronto: Defense R&D Canada-Toronto.

Walsh, F. (2002). Bouncing Forward: Resilience in the Aftermath of September 11. *Family Process, 41*(1), 34.

Walsh, F. (2003). Family Resilience: A Framework for Clinical Practice. *Family Process, 42*(1), 1.

Walsh, F. (2006). *Strengthening Family Resilience* (2 ed.). New York: Gulliford Press.

Warner, C. H., Warner, C. M., Breitbach, J., Rachal, J., Matuszak, T., & Grieger, T. A. (2007). Depression in Entry-Level Military Personnel. *Military Medicine, 172*, 795-799.

Weathers, F., & Ford, J. (1996). Psychometric properties of the PTSD checklist (PCL-C, PCL-S, PCL-M, PCL-PR) In B. H. Stamm (Ed.), *Measurement of stress, trauma, and adaptation*. Lutherville, MD: Sidran Press.

Weathers, F., & Ford, J. (1996). Psychometric review of PTSD Checklist (PCL-C, PCL-S, PCL-M, PCL-PR). In B. Stamm (Ed.), *Measurement of stress, trauma, and adaptation* (pp. 250-252). Lutherville, MD: Sidran Press.

Werner, E., & Smith, R. (1992). *Overcoming the Odds: High Risk Children from Birth to Adulthood*. Ithica, NY: Cornell University Press.

Westermeyer, J., Canive, J., Thuras, P., Thompson, J., Crosby, R. D., & Garrard, J. (2009). A Comparison of Substance Use Disorder Severity and Course in American Indian Male and Female Veterans. *American Journal on Addictions, 18*(1), 87-92.

Whitbeck, L. B., Hoyt, D. R., & Ackley, K. A. (1997). Abusive Family Backgrounds and Later Victimization Among Runaway and Homeless Adolescents. *Journal of Research on Adolescence (Lawrence Erlbaum), 7*(4), 375-392.

Whitehead, D. L., Perkins-Porras, L., Strike, P. C., & Steptoe, A. (2006). Post-traumatic stress disorder in patients with cardiac disease: predicting vulnerability from emotional responses during admission for acute coronary syndromes. *Heart, 92*(9), 1225-1229.

Whitfield, G., & Davidson, A. (2007). *Cognitive behavioral therapy explained*. London: Radcliff Publishing Ltd.

Williams, L. S., Brizendine, E. J., Plue, L., Bakas, T., Tu, W., Hendrie, H., et al. (2005). Performance of the PHQ-9 as a Screening Tool for Depression After Stroke. *Stroke, 36*(3), 635-638.

Wilson, P. H. (2008). Defining Military Culture. *Journal of Military History, 72*(1), 11-41.

Winter, D. (2008). *2008 Posture Statement of the Honorable Donald C. Winter, Secretary of the Navy*.

Wittchen, H. U. (2002). Generalized anxiety disorder: prevalence, burden, and cost to society. *Depression and Anxiety, 16*(4), 162-171.

Witvliet, C. V. O., Phipps, K. A., Feldman, M. E., & Beckham, J. C. (2004). Posttraumatic Mental and Physical Health Correlates of Forgiveness and Religious Coping in Military Veterans. *Journal of Traumatic Stress, 17*(3), 269-273.

Wong, B. Y. L. (2003). General and Specific Issues for Researchers' Consideration in Applying the Risk and Resilience Framework to the Social Domain of Learning Disabilities. *Learning Disabilities Research & Practice (Blackwell Publishing Limited), 18*(2), 68-76.

Wright, K. M., Ursano, R. J., Bartone, P. T., & Ingraham, L. H. (1990). THE SHARED EXPERIENCE OF CATASTROPHE: An Expanded Classification of the Disaster Community. *American Journal of Orthopsychiatry, 60*(1), 35-42.

Wright, M., Crawford, E., & Sebastian, K. (2007). Positive Resolution of Childhood Sexual Abuse Experiences: The Role of Coping, Benefit-Finding and Meaning-Making. *Journal of Family Violence, 22*(7), 597-608.

Zara-Page, A., Kaplan, H., Erdogan, N., & Guler, F. (2009). Posttraumatic Stress and Depression Reactions among Survivors of the Istanbul November 2003 Terrorist Attacks. *Journal of Aggression, Maltreatment & Trauma, 18*(3), 280-292.

Zimmerman, M. A., Bingenheimer, J. B., & Notaro, P. C. (2002). Natural Mentors and Adolescent Resiliency: A Study with Urban Youth. *American Journal of Community Psychology, 30*(2), 221.

VITA

Michael D. McCarthy received a Bachelor's Degree in Psychology from Texas Christian University in 1996. He then attended Fordham University where he received his Master in Social Work. Michael worked as an additions counselor at the Addiction Research Treatment Corporation while obtaining his Master's degree in at Fordham University. Following graduation in 2000, Michael commissioned as an officer in the United States Air Force as a First Lieutenant in 2001. While waiting to begin his service, Michael worked at the Harris County Mental Health Facility in Houston, TX. September 4, 2001 Michael reported to Andrews Air Force Base in Washington D.C. Four days later, September 11, 2001, Michael was transferred to the Pentagon Family Support Center, Washington D.C. to assist family members of 9/11 victims. Michael spent a year in Washington D.C. before transferring to Fairchild AFB, WA. Michael worked as a Family Advocacy Officer as well as an Alcohol & Drug Assessment and Treatment (ADAPT) Program Officer at Fairchild. He provided counseling services to family members, assisted in child abuse and prevention cases, provided alcohol and drug counseling and preventative outreach services to fellow military members and their dependents. Michael received the Air Force Company Grade Officer of the year award in 2005. Three years after arriving in Washington State he transferred to Patrick AFB, FL. Michael also served as a Family Advocacy Officer at Patrick AFB. Two years later, Michael was selected for an Air Force Institute of Technology (AFIT) Ph.D. fellowship. Michael began the doctoral program at the University of Texas at Austin School of Social

Work. He is currently serving as the United States Air Force Suicide Prevention Program Manager, assigned to the Air Force Medical Support Agency, Washington D.C.

Permanent Contact: Michael.McCarthy@pentagon.af.mil.

This dissertation was typed by the author.