

FACTORS THAT CONTRIBUTE TO MENTAL HEALTH IN COMBAT
INJURED MILITARY WOMEN

by

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STATEMENT BY AUTHOR

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DEDICATION

This work is dedicated to the servicewomen of the United States armed forces. Their sacrifice and commitment to duty have inspired generations of women to serve their country with the greatest pride, patriotism, and esprit de corps.

TABLE OF CONTENTS

LIST OF FIGURES	9
LIST OF TABLES	10
ABSTRACT	11
CHAPTER 1: INTRODUCTION.....	13
Statement of the Problem.....	14
Purpose of the Study.....	16
Research Questions.....	16
Background of the Study.....	17
Characterizing Trauma.....	17
Physical Trauma in Combat	18
Mental Health Issues in the Deployed Military Member	19
PTSD, Depression and Anxiety.....	20
Quality of Life	22
Significance of the Research	23
CHAPTER 2: REVIEW OF THE LITERATURE.....	25
Philosophical Perspective	25
Postmodernism.....	25
Theoretical Framework.....	27
Stress and Coping	27
Stress, Coping and Behavioral Organization.....	27
The Transactional Theory of Stress and Coping	27
Application of Theory.....	29
State of the Science – Mental Health Issues in Military Members.....	31
Post-Deployment	31
Combat Exposure.....	34
Physical Injury	37
Research Discussion.....	38
Literature Gaps.....	39
Summary.....	40
CHAPTER 3: METHODOLOGY	41
Research Design	42
Sample and Setting	42
Criteria for Inclusion.....	44
Human Subjects Protection	45
Data Collection	45
Data Management.....	46
Personal Variables	47

TABLE OF CONTENTS – *Continued*

Age.....	47
Rank.....	48
Previous Deployment.....	48
Military Occupation.....	49
Injury Severity.....	50
Social Support.....	50
Environment.....	51
Type of Treatment Facility.....	51
Measurement Instruments.....	52
AIS.....	52
Quality of Well-Being Self-Administered (QWB-SA) Scale.....	55
Mental Health Screening.....	57
PTSD Screening.....	59
Procedures.....	60
Data Limitations.....	61
Data Analysis.....	62
Question 1. <i>In military women who have sustained combat related injuries, what types of mental health issues manifest within one year post-injury?</i>	62
Question 2. <i>Do increased injury severity, age, rank, branch of service, number of deployments, military occupation, social support, environment where injury occurred and type of treatment facility in women who have sustained combat related injuries correlate with higher incidence of mental health diagnoses?</i>	62
Question 3. <i>Is Quality of Life (QOL) in combat injured service women affected by injury severity, age at time of injury, rank, branch of service, number of deployments, military occupation, social support, environment where injury occurred and type of initial treatment facility?</i>	63
Question 4. <i>How does QOL differ in combat injured women with diagnosed mental health issues compared to those women injured in combat without mental health issues?</i>	63
Summary.....	63
CHAPTER 4: RESULTS	64
Sample Characteristics.....	64
Sample Size and Deleted Cases.....	64
Demographics.....	65
Military Status.....	65
Deployment Status.....	66
Research Question Results.....	69
Summary.....	76

TABLE OF CONTENTS – *Continued*

CHAPTER 5: DISCUSSION	77
Specific Sample Characteristics	77
Types of Mental Health Outcomes	78
Factors that Predict Mental Health	80
Factors that Predict Quality of Life	83
Comparing Quality of Life	84
Study Strengths and Limitations	86
Implications for Healthcare Clinicians and Military Leadership	87
Future Research	88
Conclusion	90
APPENDIX A: IRB APPROVALS.....	91
REFERENCES	96

LIST OF FIGURES

<i>FIGURE 1.</i>	Transactional Theory of Stress and Coping.....	28
<i>FIGURE 2.</i>	Adaptation of the Transactional Theory of Stress and Coping.....	31
<i>FIGURE 3.</i>	Linkage of Personal Variables to Concept of Appraisal in the TTSC.....	42
<i>FIGURE 4.</i>	Medical Data Input Into the EMED.....	43
<i>FIGURE 5.</i>	Mean Difference Values between Service Branches.....	84

LIST OF TABLES

TABLE 1.	<i>Suggested PTSD Checklist (PCL) Cut-Point Scores</i>	56
TABLE 2.	<i>Suggested Outcome Categories for the Center for Epidemiologic Studies (CES)</i>	56
TABLE 3.	<i>Instrument Scoring Ranges</i>	57
TABLE 4.	<i>Demographics at Time of Injury Episode</i>	67
TABLE 5.	<i>Military Occupation Specialties in Combat-Injured Women</i>	68
TABLE 6.	<i>Mental Health Diagnosis Categories</i>	69
TABLE 7.	<i>Types of Mental Health Diagnoses One Year Post Combat-Related Injury</i>	70
TABLE 8.	<i>Co-Occurring Mental Health Diagnoses</i>	70
TABLE 9.	<i>Logistic Regression Predicting Likelihood of Mental Health Issues in Combat Injured Women</i>	72
TABLE 10.	<i>Linear Regression Relationships in Predicting Quality of Life</i>	74
TABLE 11.	<i>Quality of Life Differences in Combat Injured Enlisted and Officer Females</i>	75
TABLE 12.	<i>Quality of Life Differences in Combat Injured Women With and Without Mental Health Diagnoses</i>	75

ABSTRACT

Background: As military women enter roles directly related to combat, they will have greater risk of injury. The present study examined the prevalence of mental health conditions among female service members one year postinjury, and analyzed factors which may place women at risk for mental health concerns and lower quality of life (QOL).

Methods: A total of 1,012 U.S. servicewomen who sustained combat-related injury in Iraq and Afghanistan were identified from the Expeditionary Medical Encounter Database (EMED). Injury severity was calculated and QOL scores were collected from a subset of the women. Injury severity, military occupation, branch of service, age, rank, marital status, number of deployments, initial treatment facility, and environment of care were collected as predictor variables. The Military Health System Data Repository was queried for mental health *International Classification of Diseases*, 9th and 10th Revision codes occurring within one year postinjury.

Results: Within the first year postinjury, 404 women (40%) were diagnosed with mental health conditions. The most common were posttraumatic stress disorder (PTSD), ($n = 203$, 20%), depressive disorders ($n = 123$, 12.1%), adjustment disorders ($n = 92$, 9.0%), and anxiety disorders ($n = 81$, 8.0%). Logistic regression identified that women with minor or moderate injuries had lower odds of mental health diagnoses. Occupation categories of combat support and communications predicted fewer mental health issues. Enlisted women had increased risk of mental health issues. Linear regression showed that officers had higher QOL compared with enlisted women 0.055 (95% CI, 0.005-0.183), $p < .05$. Women serving in the Air Force had higher QOL postinjury 0.119 (95% CI, .055-.183), $p < .000$. An independent samples t -test showed that

women with mental health diagnoses postinjury ($M = 0.46$, $SD = 0.12$) had significantly lower QOL scores (range 0-1) compared to those without mental health diagnoses ($M = 0.52$, $SD = 0.13$), $t(3.46)$, $p < .05$.

Conclusions: These findings showed that PTSD, depression, adjustment disorder, and anxiety comprise the most prevalent mental health diagnoses in this population. QOL is significantly lower in injured women with mental health issues after injury. Further research is needed to discover strategies for maintaining optimum health in this population.

CHAPTER 1: INTRODUCTION

Military women today perform multifaceted duties working alongside men in specialties that often relate directly to combat operations while also taking on roles traditionally filled by males such as providing unit and convoy security (Fitts, 2009). Even prior to the elimination of the direct combat exclusion rule for women in 2013, military women who served in the counter-insurgency campaigns in Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) were frequently placed in wartime scenarios where there were no clear distinctions between the front lines of battle and the rear echelons (Barry, 2013). This lack of definition of battle lines placed military women at a greater risk of physical injury due to military operations than in previous conflicts.

Women have engaged in enemy operations in every US war starting with the War for Independence. Past wars saw nurses as the principal female military members serving in combat zones with increased risk of exposure to the horrors of war (Murdoch et al., 2006). In recent conflicts, these exposures have become common in women who deploy in non-medical capacities. Exposure to combat can affect mental health in ways comparable to sexual assault, necessitating the awareness of healthcare providers that deployment related stressors could possibly explain a female veteran's increased risk of mental health issues as well as drug related disorders (Murdoch et al., 2006).

With the elimination of the direct combat exclusion rule for women in 2013, mission responsibilities of female service members continue to change along with increased physical and mental risks related to their military duties. The armed services have robust health promotion programs and resources but military personnel who deploy overseas in times of war, have added

physical and emotional challenges. It has been noted that deployment-related stressors can affect physical and mental health both during deployment and after returning home (Dolan & Adler, 2008). Once home, military women may also experience issues related to being absent from their children for extended time periods causing a readjustment process for both child and mother (Mattocks et al., 2012).

In 2010, Trego, Wilson and Steele presented a call to action for evidence-based military women's health care to support service women today. The goal of this effort is to provide a platform for establishing a military women's health research agenda. While conceptualizing a comprehensive approach to health and medical needs specific to military females who have served in a deployed environment, it is important to account for gender-specific needs that encompass a wide range of physical and psychological issues.

Statement of the Problem

Women represent 14% of the forces deployed in support of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) (Street, Vogt, & Dutra, 2009). The most predominant injury mechanism suffered by women service members during these conflicts has been blasts (e.g., improvised explosive devices), which have led to women suffering severe physical injuries resulting from poly-trauma as well as traumatic brain injuries (Dye, Eskridge, Tepe, Clouser, & Galarneau, 2016).

With physical trauma, there can also be psychological reactions that occur. In a civilian study that evaluated gender differences in post-traumatic stress disorder (PTSD) outcomes after major physical trauma, Holbrook, Hoyt, Stein, and Sieber (2002) reported that women had significantly higher risk of prolonged PTSD than men. Prolonged PTSD was also shown by the

researchers to reduce quality of life in women and men, as evidenced by women having worse Quality of Well-being (QWB) scores than men.

Within a military context mental health issues have been observed in veterans who suffered battle injuries in Iraq or Afghanistan and present with posttraumatic stress disorder (PTSD) and/or depression after battle injury (Grieger et al., 2006). In a study comprised primarily of men, MacGregor et al. (2009) found that injury severity in military personnel who had suffered combat related injury was a significant predictor of mental health and PTSD. More recently, a study looked at the effects of physical injury in Army women in which researchers reported on the results of Physical Evaluation Boards (PEBs) of women who had suffered traumatic amputation. The results reported that women amputees had an increased proportion of disability ratings related to PTSD than male amputees (Rivera, Krueger, & Johnson, 2015).

The current state of the science highlights the work of several research teams, namely: 1) Carlson, Stromwall, and Lietz (2013); 2) Vogt (2014); 3) Street et al. (2009); and 4) Dutra et al., (2011), who have investigated the effects of wartime deployment and how experiences from deployments affects the mental health of female military members. Other than the study by Rivera, Krueger and Johnson (2015), current literature is sparse regarding mental health issues in women that occur after suffering combat-related injuries. As women represent increasing numbers in military populations taking on more roles traditionally held by men, it is becoming ever more important to examine mental health issues in military women and to identify how they may differ from men (Mota et al., 2012).

Purpose of the Study

It is reported that over 1000 military women suffered combat related physical injuries in the wars in Iraq and Afghanistan, and 161 military women lost their lives in combat related events (Defense Casualty Analysis System [DCAS], 2015). In order to address current gaps that are present regarding mental health concerns in military women who have suffered combat-related injury, this study took a critical look at what types of mental health diagnoses military women present with after sustaining these types of injuries. The primary aim of the study will be to evaluate the relationships between several variables including total injury severity score (ISS), age, number of deployments, and military occupation with the presence of mental health diagnoses in military women within one year of combat-related injury. A secondary aim will be to investigate quality of life (QOL) outcomes in female service members who have been injured in combat. For purposes of this study, combat-related injuries will be defined as physical injuries incurred because of hostile actions during an armed conflict. This research is novel in that by identifying mental health issues and the variables that may contribute to or possibly prevent the occurrence of mental health issues in combat-injured women, military leaders and health care professionals will be provided information to develop strategies to improve overall health in this population.

Research Questions

The study answered the following questions:

1. In military women who have sustained combat related injuries, what types of mental health issues manifest within one year post-injury?

2. Do increased injury severity, age, rank, branch of service, number of deployments, military occupation, social support, environment where injury occurred, and type of initial medical facility where treatment was received in women who have sustained combat related injuries correlate with higher incidence of mental health diagnoses?
3. Is Quality of Life (QOL) in combat injured service women affected by injury severity, age, rank, number of deployments, military occupation, social support, environment where injury occurred, and type of initial medical facility where treatment was received?
4. How did QOL differ in combat injured women with subsequent diagnosed mental health issues compared to those women injured in combat without mental health issues?

Background of the Study

In the population of military women who have served in deployed environments in Iraq and Afghanistan and have suffered injuries sustained in combat related incidents, it is important to identify the psychological issues that these women may deal with. This section will present an overview of how physical trauma injuries are characterized and scored, discuss psychological issues seen in military members, and present literature regarding QOL.

Characterizing Trauma

Physical injury resulting from trauma has been described using the Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS) since the 1970s. These scoring systems were originally developed in response to the requirement by the federal government that health care

organizations that had received funds from the Emergency Medical Services Systems Act of 1973 perform impact studies utilizing outcome measures (MacKenzie, 1984).

Originally introduced in 1971 by the Joint Committee on Injury Scaling, the AIS provides a method for rating injuries sustained in automobile crashes and standardizing injury descriptions (MacKenzie, Shapiro, & Eastham, 1985). Since that time, the AIS coding system has evolved through several iterations in order to address needs for greater specificity of injuries as well as to better identify injury locations on the body or within an organ. The most recent revision published in 2005 attempts to address the needs of AIS users internationally (Gennarelli & Wodzin, 2006). The ISS is a derivative score obtained from the AIS. It summarizes the severity of multiple injuries in one person by calculating a score derived from the AIS scores from three of the most severely injured body regions (Champion, 2002). The ISS score is a number on an ordinal scale, which can range from a minimum score of one, up to a maximum score of 75, which is reflective of the most severe, usually un-survivable injury profile. If age of the trauma victim is also accounted for, the ISS has been shown to correlate well with mortality as well as length of hospital stay (MacKenzie, Shapiro, & Eastham, 1985).

Physical Trauma in Combat

Despite publicity highlighting the horrific injuries sustained by service members in the wars in Iraq and Afghanistan, the majority of battle injuries is survivable, and when scored using the AIS fall into minor or moderate range of an ISS between 1 and 8. This is illustrated in the current literature on battle injuries from OIF and OEF. In a blast related injury study of a male cohort, more than 85% of injury episodes were mild to moderate in severity with an average ISS of 4.5 (Eskridge et al., 2012). Preliminary studies on combat related injuries in women have

shown similar results in which the majority (> 90%) of combat-related injuries suffered by female service members were mild to moderate with a mean ISS of 3.3 on a scale of 1 to 75. Of note, polytrauma was evident in the majority of women injured in these conflicts as findings showed that almost 65% of injury episodes had more than one injury (Dye, Eskridge, Tepe, Clouser, & Galarneau, 2016).

A pre-eminent injury of the Iraq and Afghanistan wars has been traumatic brain injuries (TBI), which can occur concurrently with other physical injuries or as an isolated injury due to blast exposure. This physical insult to the head can result in disrupted brain function from either an open or a closed head wound. TBI has been reported to have an estimated occurrence of up to 20% in combat injured individuals (Iverson, Pogoda, Gradus, & Street, 2013). Psychiatric comorbidities such as post-traumatic stress disorder (PTSD) and depression have been observed in veterans with TBI but the reasons for the high rate of these occurrences are unknown (Sayer, 2012). In 2009 the VA medical system reported three quarters of veterans diagnosed with TBI had PTSD and almost half had depression. As deployed service members are exposed to a variety of stressors that may precede TBI injury events, clinicians should also be aware that psychiatric issues in patients with TBI could possibly be a continuation of preexisting mental health conditions (Sayer, 2012).

Mental Health Issues in the Deployed Military Member

The wars in Iraq and Afghanistan launched in 2003 have become the longest military ground operations since the war in Vietnam (Hoge, Auchterlonie, & Milliken, 2006). Hoge et al. (2008), reported on outcomes from an anonymous survey administered to Army and Marine

Corps personnel returning from combat which primarily showed mental health complaints of major depression, generalized anxiety and PTSD.

In the combat injured population, psychological health has become a priority for military healthcare providers as survivability from severe injuries has increased from previous wars but still often results in loss of physical function or disfigurement (Grieger et al., 2006).

Psychological consequences of trauma have also been documented in civilian populations. In a narrative review of mostly civilian patients who had suffered orthopedic trauma, the three mental health outcomes of PTSD, depression, and anxiety were recognized, similar to findings in the military population that Hoge et al. reported on in 2008. In the review of civilian trauma outcomes it was also identified that some patients have subsequent issues that can affect QOL such as chronic pain, isolation from social contacts, and dependence on pain medication (Vincent, Horodyski, Vincent, Brisbane, & Sadasivan, 2015). The next section of this paper will discuss PTSD, depression, anxiety, and present reasons why military members may experience them.

PTSD, Depression and Anxiety

PTSD can occur after a person has been exposed to extreme stress or a traumatic experience, which results in the person reacting in fear or horror or helplessness (Yehuda, 2002). Three distinct symptoms occurring for at least one month are necessary for a diagnosis of PTSD. These are re-experiencing the event, avoidance of event reminders, and hyperarousal. Cognitive deficits related to attention, learning, and memory can be observed in PTSD. Although PTSD symptoms are usually easily recognized, there may be overlap between PTSD symptoms and those of anxiety disorders and depression (Yehuda, 2002).

Screening for PTSD in the military routinely occurs using the four-item Primary Care PTSD screen (PC-PTSD) that has been incorporated into the Post Deployment Health Assessment (PDHA), a self-report health questionnaire that all service members complete upon return from deployment (Macera, Aralis, Highfill-McCoy, & Rauh, 2014). An additional tool for screening and identifying cognitive problems is the 17-item PTSD checklist used by the Department of Veterans Affairs (Grieger et al., 2006).

Depression has been noted to be a common comorbidity with PTSD along with other psychiatric disorders such as anxiety and irritability (Sayer, 2012). In the military population, strong associations among battle injury, PTSD and depression were reported by Grieger et al. in 2006 in a study primarily comprised of men. Rates of PTSD were 4.2% one month after injury and increased to 12% at four and seven months after injury. Interestingly 78.8% of the injured servicemen who screened positive for PTSD or depression at seven months post-injury, had screened negative for both conditions at one month post-injury. Depression screening post military deployment also utilizes the PDHA, which additionally contains the Patient Health Questionnaire (PHQ-2) depression screen along with other general health questions (Macera, Aralis, Highfill-McCoy, & Rauh, 2014).

Along with depression, patients may also experience co-morbid anxiety especially when experiencing pain (Gureje, 2008). In the Helping Veterans Experience Less Pain Study conducted on patients seen at VA clinics, researchers measured psychological distress in patients who reported pain in routine pain screening by using the PHQ-2 and the General Anxiety Disorder-2 (GAD-2). The GAD-2 has been used to screen for four common anxiety disorders observed in primary care settings: panic disorders, social anxiety, generalized anxiety disorder,

and PTSD (Sherbourne et al., 2009). In this study, it was found that patients reporting moderate to severe pain were at higher risk for psychological distress. Recommendations from the study included early treatment of co-occurring depression and anxiety in hopes to facilitate favorable treatment responses (Sherbourne et al., 2009). As patients suffering from physical trauma experience pain due to injury as well as post-injury surgical procedures, it is important to understand that these military members need careful observation of potential mental health issues related to their injury and related discomfort.

This section has provided background on common mental health diagnoses in military members returning from combat zones and psychological diagnoses post traumatic injury. As combat injury related to physical trauma is an unfortunate sequela to war, questions remain as to what psychological impact injured male and female veterans sustain and what variables can perhaps mitigate psychological issues.

Quality of Life

When measured correctly, the concept of QOL brings to light subjective and objective experiences of individuals (Woodruff, Galarneau, Luu, Sack, & Han, 2014), and focuses on aspects of overall well-being (Wilson & Cleary, 1995). In 2010, a report from the Institute of Medicine (IOM) to the Secretary of Defense called for long-term studies that evaluate readjustment issues and challenges of service members who have deployed in support of OIF and OEF, (Institute of Medicine [IOM], 2010). In response to this, the Department of Defense (DoD) is currently tracking long and short-term QOL outcomes in military members wounded in those conflicts through the Wounded Warrior Recovery Project (WWRP), a longitudinal study being

conducted through the Naval Health Research Center in San Diego, CA, (Woodruff, Galarneau, Luu, Sack, and Han, 2014).

Health-related quality of life (HRQOL) has been progressively used to identify an individual's self-perceived influence of health on their general QOL (Fang et al., 2015). The concept of HRQOL includes several functioning dimensions of individuals such as physical, social, and role functioning along with the person's health perceptions regarding their physical and mental health status (Wilson & Cleary, 1995). Variations in HRQOL dimensions as they relate to injury characteristics and diagnoses such as PTSD and depression can assist clinicians and researchers in predicting changes over time, providing vital information to military health care policy makers in order to ensure proper resource allocation for injured service members (Woodruff et al., 2014).

Significance of the Research

During the counter-insurgency, campaigns in OIF and OEF military women were often placed in harm's way, even though they served primarily in support roles. To date there have been 161 female deaths in these conflicts (Fischer, 2014). The physical trauma and subsequent mental health problems that military women suffer from may not be exclusive to women, but may uniquely affect their health (Dye et al., 2016). Fortunately, the body of knowledge regarding post-deployment mental health issues in military women is growing, but research is needed on the scope of mental health issues after the trauma of combat injury. The utilization of large clinical datasets can assist with research on physical injuries and subsequent mental health outcomes in military women by providing accurate representation of patient conditions with documented clinical information and diagnosis codes that have been recorded by clinical

providers. By identifying mental health outcomes in service women after they have suffered combat related injuries, military health care providers can gain clinical guidance that is needed to individualize care.

CHAPTER 2: REVIEW OF THE LITERATURE

This chapter will present literature concerning the theory of postmodernism and conceptual models of stress and coping as well as the current state of the science on mental health outcomes of military members who have returned from deployment. Contemporary research regarding post-deployment mental health issues in the military frequently focuses on gender differences when women are included in the study cohorts. This review will present these studies as they relate to the proposed research with care to highlight mental health outcomes observed in military women.

Philosophical Perspective

Postmodernism

Although the exact meaning and intent of the theory of Postmodernism is difficult to convey, it describes the rejection of single descriptions of reality that are presumed to apply to all people and circumstances. In rejecting these circumstances, multiple truths and realities are acknowledged allowing the possibility of different interpretations for all events (Rodgers, 2005).

A postmodern view may assist with understanding some aspects of the personality and genetic make-up that is part of a military woman. It also may explain the innate desires of women to experience roles that have been traditionally held by men. Women have been carrying arms in every conflict fought by the United States since the War for Independence (Murdoch et al., 2006). The military service of women is not without risk as there have been female Prisoners of War (POW) in most major U.S. conflicts. Even though women have historically been considered non-combatants, they risk death or injury due to the “fog of war” when smoke, dust, and noise make identification of friends or foes difficult. As military nurses are frequently

assigned to medical units near the front lines, they have historically accounted for the majority of female POWs (Murdoch et al., 2006).

The historical trials of women attaining equality in the military demonstrate the persistence, dedication and spirit of adventure that is in alignment with basic components of Postmodernism. Postmodernists have been described as those who “share a value for skepticism; an enthusiasm for discovery, and a desire for emancipation from ignorance, prejudice, and oppressive authority” (Reed & Crawford-Shearer, 2011, p. 13). Women in the military have successfully entered a male dominated organization in order to serve their country and experience non-traditional professional careers making them pluralistic by nature in a way that embraces postmodern thinking. This can be further illustrated by the fact that even though they may be drawn to a profession that is primarily occupied by men, they also retain their culture as females.

For the profession of nursing, Postmodernism offers alternative perspectives for inquiry and possibly supplies a means for rebelling against the dominance of the medical profession (Mackay, 2009). It challenges stereotypes and hierarchies that have been embedded in our culture allowing us to take advantage of new opportunities presented by this philosophy. Postmodernism is a cultural change, not necessarily a different epistemology (Rodgers, 2005). In understanding the tenets of the theory we see how Postmodernism also provides unconventional pathways into inquiry for nurses allowing permission to expand ways of thinking in a world that changes rapidly.

Theoretical Framework

Stress and Coping

This section of the paper presents background on stress and coping theories in general and presents the Transactional Theory of Stress and Coping, which will be used to guide this research. These theories and frameworks are relevant when attempting to understand how a combat injured individual struggles to maintain equilibrium after experiencing physical trauma and what factors may contribute to positive coping and recovery of health.

Stress, Coping and Behavioral Organization

The stress and coping theories describe the idea that stress disorganizes behavior while coping aims to reorganize it (Van Egeren, 2000). This description can also be related to a model of emotion and behavior control, which first looks at the human being as a “functional whole” and then attempts to examine the logic that exists innately inside all of us. We can interpret this to mean that we all are equipped with certain skills based on logic that allow us to deal with stressful situations with intentional actions that translate into coping techniques (Van Egeren, 2000).

The Transactional Theory of Stress and Coping

The transactional theory of stress and coping (TTSC) was originally conceived by Lazarus in 1966. According to Lazarus (1966), stress is not present in an event, but is a result of a transaction that occurs between an individual and her or his environment. Due to this transaction, stress involves a collection of cognitive, adaptive, as well as coping factors (Lyon, 2012). When originally developed, this theory provided a structural framework that assisted in recognizing, defining, and relating concepts relevant to coping. As the theory identifies

antecedents as well as consequences that can occur during appraisal and coping when individuals are dealing with a stressful situation, it provides to health care professionals understanding in what mechanisms underpin the recovery process of an individual (Provencher, 2007).

In 1984, Lazarus teamed with Folkman to further develop the concepts of cognitive appraisal and coping instilling new character and content to the TTSC. Figure 1 depicts the 1984 model of the TTSC showing how individuals experience stress when a situation becomes too demanding exceeding an individual's resources and harm is anticipated (Lyon, 2012).

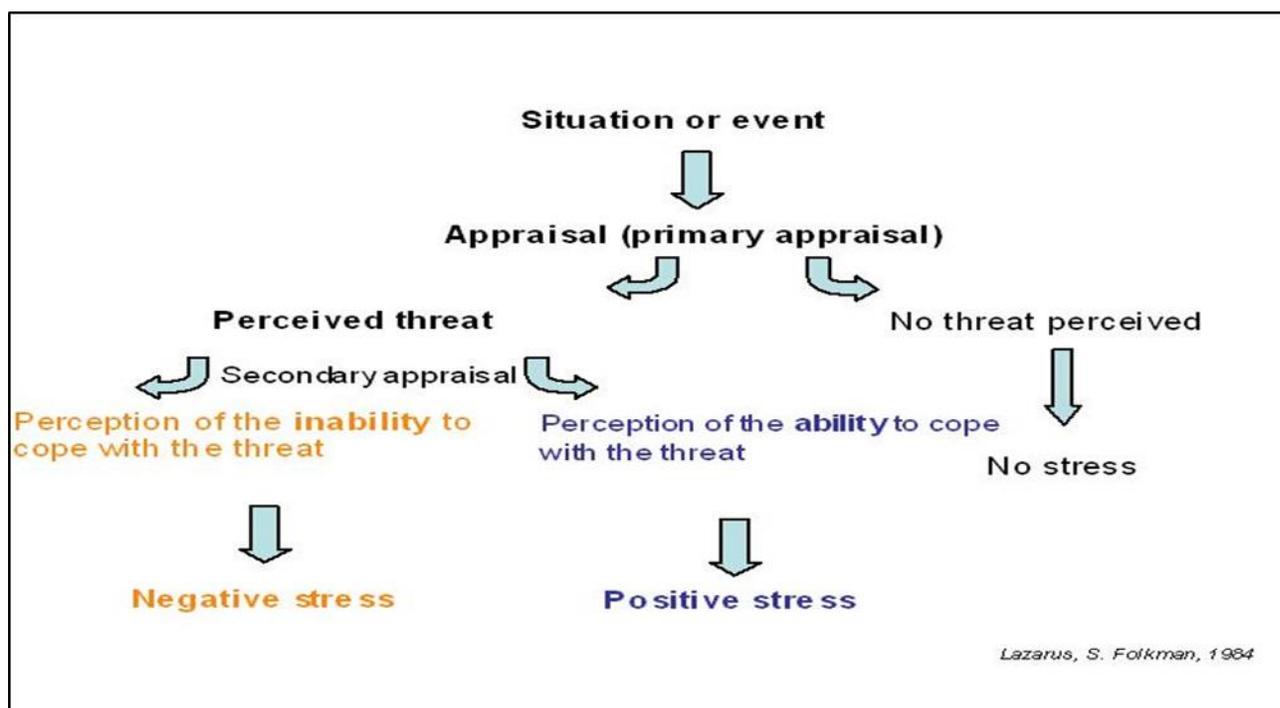


FIGURE 1. Transactional Theory of Stress and Coping (Lazarus & Folkman, 1984).

In this model, the TTSC identifies that personal control can have multiple functions in a stressful encounter. The theory presents the idea that there is a dynamic relationship between a person and their environment, which is constantly changing thus allowing a bi-directional relationship in which the person and environment act on each other during a stressful encounter

(Folkman, 1984). The updated TTSC model created by Lazarus and Folkman (1984) asserts that through cognitive appraisal and coping, stress, and stress-related outcomes are mediated. Three sets of appraisals exist within the framework, primary, secondary and reappraisal. Primary appraisal is the initial judgement as to how the person perceives a situation. During this time the individual may feel that the situation is either benign or holds a threat. If the primary appraisal identifies a stressful situation, it may be categorized as: 1) harm/loss, as in a physical injury, 2) threat, which is the possibility of harm/loss; 3) challenge, which may be an opportunity for benefit or gain. If a threat is perceived, secondary appraisal then occurs which leads the individual in identifying what coping strategies may be available to deal with the threat. Primary and secondary appraisal can be interactive and occur simultaneously (Lazarus & Folkman, 1984, Lyon, 2012). Reappraisal is then the continual process of evaluating the threat, and often this process results in the cognitive elimination of a threat that has been perceived (Lyon, 2012).

Application of Theory

Recovering from a traumatic injury is a complex process in which there can be stressful and challenging times for patients. For purposes of this research the TTSC presented by Lazarus and Folkman in 1984 will be applied to female military members who have suffered combat related injuries. This theory has previously been applied to people living with HIV, where it assisted in comprehensively informing researchers how inevitable stress and coping situations are faced by patients with chronic illness (Graham, 2015). In a qualitative study by Lee and Poole (2005), the researchers sought to describe patient's experiences with chronic disease. In this study the TTSC was used to understand how chronically ill patients found meaning through environmental interactions and cognitive coping strategies.

Certain personality factors can act as a coping resource and help patients to successfully deal with events that may possibly interfere with the successful achievement of recovery (Provencher, 2007). The goal in applying the TTSC to research on injured female military population is that it will provide insight and clarity in understanding how different factors contribute to individual adaptability and coping. In a military population, variables such as age, previous deployment experience, military occupation and injury severity may contribute to cognitive appraisal by the injured individual leading to positive coping and positive stress. It is theorized that when an individual embraces positive coping the incidence of negative outcomes such as PTSD, depression, and anxiety will be decreased. Figure 2 depicts how these variables specific to military trauma can integrate with the core framework of the TTSC and aid in understanding psychological outcomes in an injured individual. Also identified are mediators that may contribute to positive coping of individuals when appraising circumstances after injury.

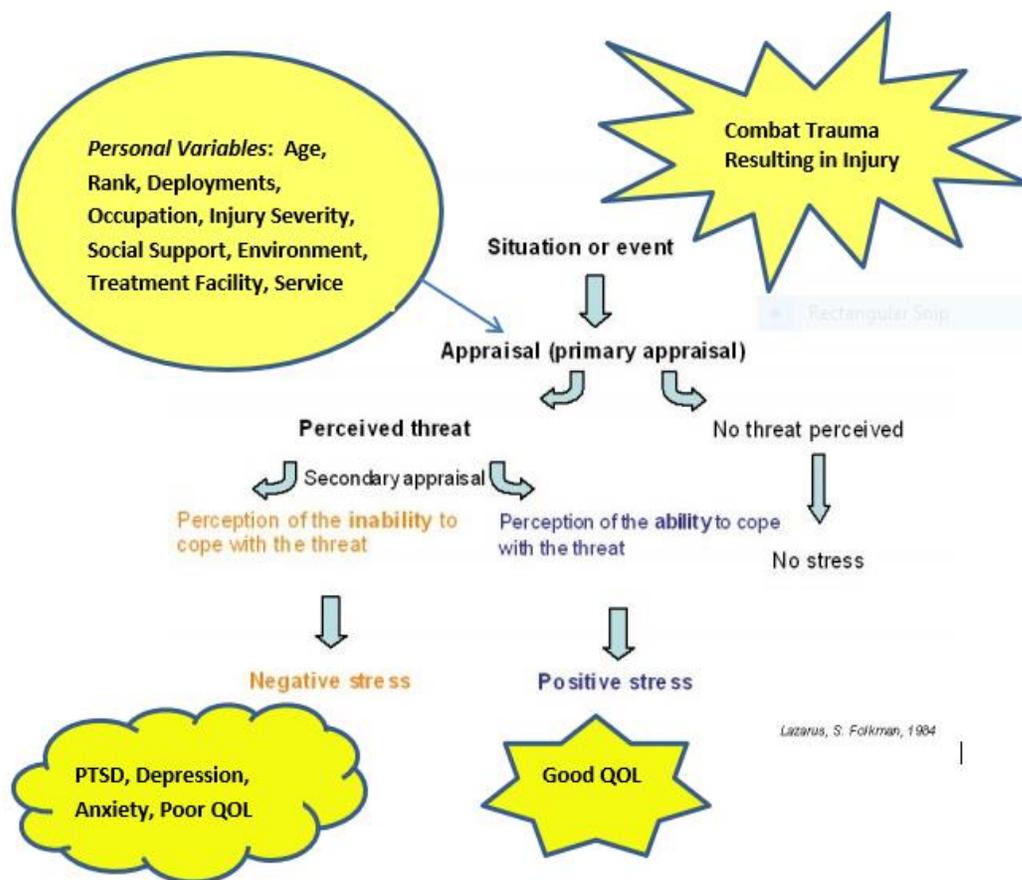


FIGURE 2. Adaptation of the Transactional Theory of Stress and Coping (Lazarus & Folkman, 1984).

State of the Science - Mental Health Issues in Military Members

Post-Deployment

In 2007 British researchers utilized a cross-sectional approach to investigate gender differences in posttraumatic stress disorder (PTSD) and posttraumatic stress reaction (PTSR) diagnoses in military members (Rona, Fear, Hull, & Wessely, 2007). A random sample of men and a non-random, over sampling of women was obtained in military members who had deployed to Iraq, and other military operations. Primary measures used in this study were the General Health Questionnaire-12 (GHQ-12), and the post-traumatic stress disorder checklist

(PCL-C). A notable finding in this study in terms of PTSD among Iraq war veterans was the lack of differences between genders. A limitation of this study noted by the researchers was the fact that few women who participated in the study had a combat role. It was identified that future studies will need to better understand the relationship of combat to mental health outcomes in women and men. Other variables that should also be included are the incidence of prior mental health issues and factors such as previous sexual abuse or harassment in military women, which could impact results (Rona, Fear, Hull, & Wessely, 2007).

In a study that focused on gender differences and the effects of stressors experienced during pre-deployment and deployment periods on the development of PTSD symptoms, Polusny et al. (2014) conducted a prospective, longitudinal study on National Guard soldiers who had deployed to Iraq and Afghanistan. The study was comprised of 712 men and 89 women who completed questionnaires one month prior to deployment assessing psychosocial risk, protective factors and baseline psychiatric symptoms. The subjects were then surveyed by mail 2-3 months after returning home from deployment. The post-deployment surveys assessed any exposure to a variety of stressors that may have been experienced during deployment by the service member. Present psychosocial functioning was also assessed. There were no gender differences identified regarding pre-deployment PTSD symptoms but it was reported that more women reported post-deployment PTSD symptoms than men. It was not stated in the findings whether there was a precipitating event that occurred during deployment that may have caused PTSD. No gender differences were reported for exposure to battle, but over half of the women surveyed were in combat support roles, and may not have been exposed to the type of combat intensity that the men experienced. A noted strength of the study is that it was a longitudinal

evaluation of the National Guard personnel. A primary limitation is that relatively small subsets of women were studied and the researchers reported insufficient statistical power, although the numbers of women represented in the study do represent the overall percentage of women compared to men that deployed in support of OIF/OEF (Polusny et al., 2014). Another possible limitation of this study is that only National Guard personnel were evaluated which may not be generalizable to service members from other branches of the military.

In a study that utilized the Post Deployment Health Assessment (PDHA), data were collected from the validated two-item Patient Health Questionnaire (PHQ-2) depression screen as well as the four-item Primary Care PTSD screen (PC-PTSD) that are incorporated into the PDHA, along with other general health questions (Macera, Aralis, Highfill-McCoy, & Rauh, 2014). The goal of the 2014 study was to conduct analyses on PDHA data from Navy and Marine Corps service members to identify differences in symptoms of PTSD between genders after deployment to a combat zone. The final sample included 29,640 men and 1,894 women. There was overrepresentation of women in the occupations of administrative support and healthcare specialists. In combat specialty roles, men were overrepresented. Final conclusions of the researchers were that men and women had a similar probability in screening positive for PTSD post-deployment. The findings from this study were similar to the earlier findings of the British researchers, Rona et al. (2007), who did not find differences in psychological symptoms between genders in service members who had deployed. Limitations of the Macera et al. (2014) study are similar to other studies in this review, primarily the reliance on self-report data without any clinical correlation by a healthcare provider of physical or psychological symptoms.

Combat Exposure

In a group of 54 Army women stationed in Hawaii researchers examined exposure to combat as well as military sexual harassment and assessed the impact of these experiences on post-deployment PTSD and depression. Utilizing a cross-sectional approach, study personnel collected self-report data from participants at their 3-month post-deployment wellness visit (Dutra et al., 2011). Study participants completed the Deployment Risk and Resilience Inventory (DRRI) in order to measure combat exposure and sexual harassment. Symptoms of PTSD were measured with the four-item Primary Care PTSD Screen (PC-PTSD). Depressive symptoms were evaluated using the two-item abbreviated version of the Center for Epidemiological Studies-Depression scale (CES-D) due to time constraints (Dutra et al., 2011). The researchers noted that use of the CES-D for screening depression has been shown to have excellent sensitivity, but it was unclear from the report whether this level of sensitivity referred to the two-item scale or the full scale, which is comprised of 20 items. Results reported by Dutra et al. showed that 11% of the participants screened positive for PTSD. The results section of the study was confusing as the researchers reported a range of 9 to 14% of participants endorsing symptoms of depression. Through regression analyses, it was found that sexual harassment and combat experiences jointly accounted for variance in post-deployment symptoms of PTSD while military sexual harassment was the only unique predictor of PTSD. Limitations of this study include the small sample size, no data available to assess pre-deployment mental health, and the sample may not be generalizable due to all the data being collected within three months of returning home so long-term impact of deployment-related stressors may have been missed (Dutra et al., 2011).

In a study published in 2011 by Vogt et al. data were reviewed from a random sample of 340 women and 252 men who had returned from deployment to OIF or OEF. The goal of the research was to evaluate differences between genders in different dimensions of combat-related stress and associate relationships with mental health status post deployment. Combat stressors were measured by the DRRI, which had previously demonstrated good reliability and validity based on samples from both OEF and OIF veterans (Vogt, Proctor, King, King, & Vasterling, 2008). Posttraumatic stress symptomatology (PTSS) was measured by the widely used military version of the PTSD checklist, which has demonstrated high coefficient alphas and good test-retest reliability. The military version of the PTSD checklist is also highly correlated with the Clinician-Administered PTSD scale. Depression and substance abuse were measured using the 24-item Behavior and Symptom Identification Scale (BASIS-24), which has been used extensively as a multidimensional instrument to measure mental health. In this study, women as well as Reserve and National Guard members were oversampled in order to conduct meaningful comparisons between subgroups (Vogt et al., 2011). As expected, results revealed that men experienced more combat exposures than women, but these differences were small, suggesting that women's combat exposure may only have been slightly lower than men's on average. Final results reported by Vogt et al. (2011) were interesting in that the difference between men and women was trivial suggesting that female military members may be as resilient to combat-related stress as men. These results are consistent with comments made by Hoge, Clark, and Castro (2007) who suggest that combat may be an equalizer of risk due to the level of threat that persists at all times.

The Millennium Cohort Study is a prospective, population based study of US military service members that surveys participants every three years in order to evaluate the long-term health effects of military service. At the time of this study in 2012, it was comprised of 150,000 service members of whom 48,074 were women (Seelig et al., 2012). In order to determine whether mental health outcomes in women such as PTSD, anxiety or depression correlated with combat exposures, researchers queried the Millennium Cohort database. Combat exposures were classified as witnessing death due to war, witnessing physical abuse, witnessing dead bodies, witnessing maimed soldiers, witnessing prisoners of war (POW) or refugees. PTSD was measured using the PTSD Checklist – Civilian Version. Anxiety and depression were measured using the PRIME-MD Patient Health Questionnaire. Results showed that women who deployed and had experienced combat exposures were significantly more likely to report mental health symptoms than women who had not deployed, or who did not have combat exposure. Of interest were that women in the Reserves or National Guard and those with higher education, demonstrated less risk of mental health conditions after combat exposure (Seelig et al., 2012).

To examine gender differences in military sexual trauma (MST), combat exposure and associations with mental health screen results, Maguen, Luxton, Skopp, and Madden (2012) reported on findings obtained from measures collected from the standard PDHA, the self-report tool administered to all returning service members after a deployment, on Army personnel. Depression symptoms were measured using the Patient Health Questionnaire (PHQ-9), and the Alcohol Use Disorder Identification Test (AUDIT) assessed alcohol use. Three multiple regression analyses were performed which showed no gender differences in post-deployment PTSD symptoms although there was a significant association between physical injuries and

PTSD that was stronger in women than men. Results showed that men were more likely to have issues with alcohol, and women reported more depressive symptoms after a deployment. MST significantly predicted depression and PTSD in both groups. Any pre-existing mental health issues prior to deployment were statistically controlled for. The primary limitation of the study is that data were obtained by self-report. In addition, the article did not identify whether the physical injuries reported were from combat-related injuries, occupational, or sports injuries that occurred while deployed. This study is helpful despite these limitations in that it did report on physical injuries and relationships to mental health outcomes in this population.

Physical Injury

To identify associations between traumatic brain injury (TBI) and post-deployment physical and mental health issues in each gender, Iverson, Pogoda, Gradus, and Street et al. (2013) performed a mail survey of OIF and OEF veterans to obtain data on post-deployment psychological and physical symptoms after experiencing a TBI. In this study, men were more likely to report a probable TBI than women (19.7% vs. 10.7%). In the group of women who reported a probable TBI, they were 2.4 times more likely to report depression compared to women who did not report a probable TBI. The researchers felt that the response rate of 48.6% may have limited the generalizability of the results. Another concern regarding this study was that data were obtained by self-report and not clinically correlated by a healthcare provider.

A retrospective study conducted by Rivera, Hylden, and Johnson (2015) investigated disability after deployment injury in Army and Air Force men and women. Injuries sustained were both combat and non-combat related. The researchers queried a Department of Defense (DoD) trauma registry to identify injured individuals and then reviewed results of the Physical

Evaluation Board (PEB). The PEB is a review board that evaluates whether or not a service member is fit for full duty after an injury is sustained. At the conclusion of the review, it was identified that women suffered from higher arthritis rates and more severe PTSD than men but had lower rates of pain (Rivera et al., 2015). This study did not report ISS and how injury severity may have contributed to disability outcomes. In the review article it was also unclear whether or not combat-related injuries had different outcomes than injuries incurred in a non-combat event.

Research Discussion

In the nine reviewed studies on mental health issues in military members, four utilized a cross-sectional design, two studies relied on retrospective review of health questionnaires, two studies utilized prospective, longitudinal designs and one study retrospectively queried injury data and outcome data from a large DoD database. In respect to study design, the two longitudinal studies provided the most rigor in design as several measurements were taken over time (Spector, 1981).

The populations studied were samples of convenience as researchers were able to readily access certain military units except in the longitudinal study using data from the Millennium Cohort (Seelig et al., 2012). In a few studies that compared gender differences and mental health outcomes women were overrepresented purposefully. In the studies that investigated military members from a particular service, such as the study by Polusny et al. (2014), results may not be generalizable to other branches of service due to types of wartime occupations in which particular service groups engage.

Consistent measurement tools were not used across studies. For example, one study used the civilian version of the PTSD checklist, and another investigation utilized a military version of the PTSD checklist. Depression was measured a variety of ways using the PRIME-MD, the PHQ-9, a nine item depression measure, and the PHQ-2, a two item depression measure. A consistent theme throughout the reviewed studies was the concern that data were self-reported, and no clinical correlation was performed. Another concern considering the mental health of members was that most studies did not collect pre-deployment mental health data in order to establish a baseline.

Due to the nature of the data and the primary aim of correlating military experiences while deployed to a combat zone with the incidence of mental health issues, regression analyses were primarily used as the form of statistical analysis. Since regression analysis predicts outcome from one or more predictor variables, the use of this test was appropriate (Field, 2009).

Literature Gaps

This presentation of the current state of the science highlights the work of several research teams who have investigated the effects of a wartime deployment and how experiences from that deployment may have affected the mental health of military members. A noticeable gap in the research literature is that few studies to date have reported on the effects of combat-related physical injury in women and subsequent mental health issues. One study reviewed did report on the incidence of depression after self-reported TBI noting that women who reported a TBI were 2.4 times more likely to report depression than women who did not report a TBI (Iverson, Pogoda, Gradus, & Street, 2013). In the study by Maguen, Luxton, Skopp, and Madden, (2012) the researchers did report a significant finding of PTSD occurring in women

after a deployment related injury. In these self-reported data, it was not specified whether the injury occurred as a result of combat.

Summary

Many of the studies reviewed looked at gender differences in regards to prevalence of PTSD and or depression and sometimes co-occurring anxiety. Perhaps clinicians and researchers should focus more on simply women cohorts without comparing them to men, finding trends within subsets of female military members and focusing efforts on specific female populations within the military such as occupational specialties, age groups, or specific service branches.

In studying this population of combat-injured military women, a postmodern approach will allow understanding as to what it means to be a woman who has chosen an unconventional lifestyle. Military women over the years have forged new territory and evolved beyond traditional female roles and occupations. Today women successfully serve in our armed forces and have attained high levels of responsibility and respect. They deserve a sense of reassurance that they will be well cared for physically and mentally when performing duties that may put them in harm's way. This sense of reassurance will hopefully lead to a sense of emotional calm that will decrease stressors and assure a healthier position on the health-disease continuum.

CHAPTER 3: METHODOLOGY

The purpose of this study was to evaluate the relationships among total injury severity score (ISS), age, rank, social support, number of deployments, service branch, environment of care, treatment facility type, and military occupation with the presence of mental health diagnoses in military women within one year of suffering combat-related injury. Quality of life (QOL) outcomes were also observed in this population. In applying the TTSC to the proposed research on injured female military members, direct relationships between appraisal and adaptation to a health threat were studied. Other relationships within the TTSC were not addressed in this current effort. Figure 3 identifies the personal predictor variables that were measured and shows how they link to the cognitive appraisal process within the TTSC, enabling the individual to cope with the threat and adapt in a positive or negative manner. Positive adaptation of the health threat was represented by the absence of mental illness and high QOL scores. Four research questions identified in Chapter 1 guided the investigation. This chapter defines the methodology that was used.

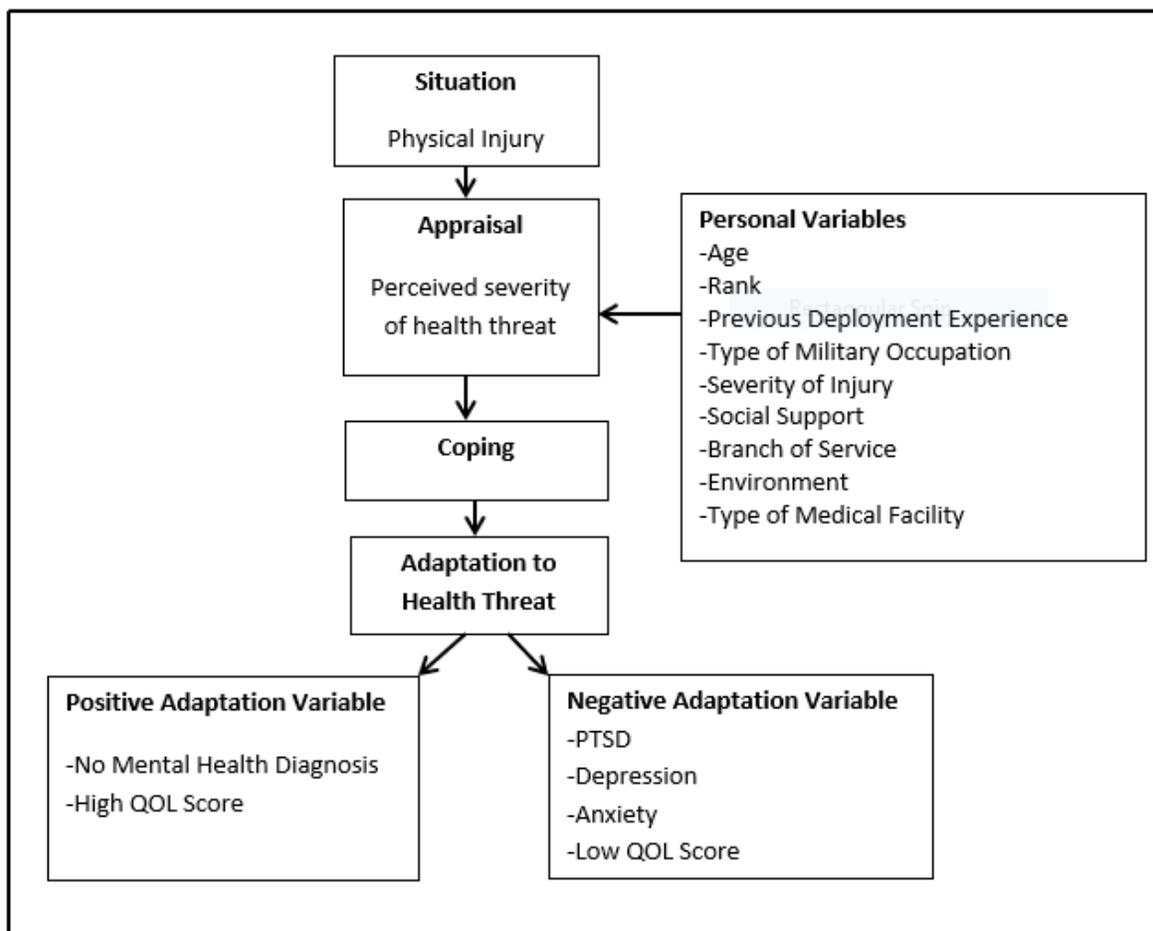


FIGURE 3. Linkage of Personal Variables to Concept of Appraisal in the TTSC

Research Design

This research sought to determine if certain factors found in injured trauma patients contributed to higher or lower incidence of mental health issues post-injury. For this research study a descriptive correlational design was used to describe what relationships exist while also determining the frequency that they occur (Spector, 1981).

Sample and Setting

Female military members who suffered combat-related injuries were identified from the Expeditionary Medical Encounter Database (EMED), which resides in San Diego, California at

the Naval Health Research Center (NHRC). The data contained in the EMED are abstracted from patient records completed by military providers in the combat zone working at forward-deployed medical facilities close to the point of injury. These records are then linked with in-patient and out-patient data from other military medical facilities in the chain of evacuation from the battlefield back to facilities in the United States. Once a clinical patient record is initiated in the EMED, additional clinical and administrative data are then added to the patient's profile (Figure 4). This ensures a complete characterization of injuries and precipitating events (Dye et al., 2016).

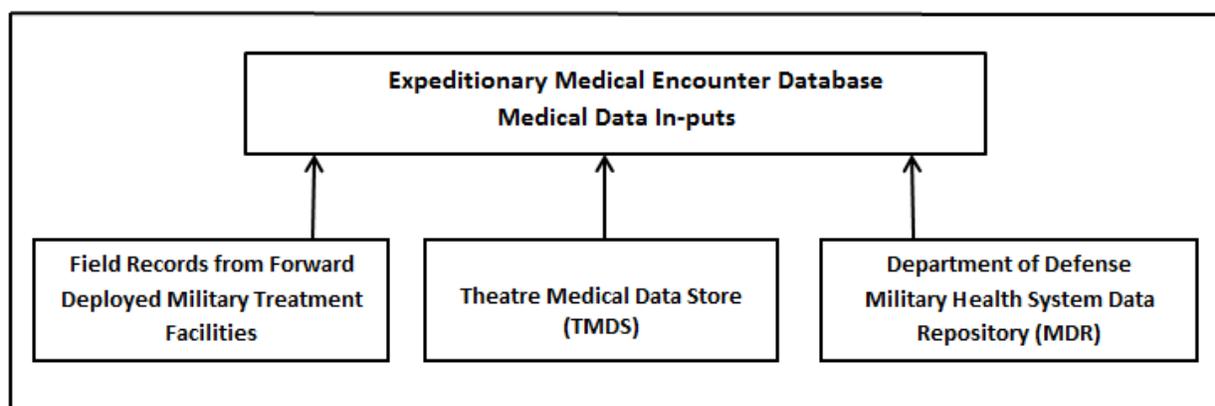


FIGURE 4. Medical Data Input Into the EMED

After a patient record is initiated by receiving a field record from a forward deployed medical treatment facility (MTF), nurse analysts at NHRC search the Theatre Medical Data Store (TMDS) and the Military Health System Data Repository (MDR) for additional clinical information. The TMDS contains information regarding the healthcare treatment that the individual received while deployed in support of a contingency operation such as the wars in Iraq and Afghanistan as well as treatment received during non-combat overseas military assignments such as humanitarian missions. The MDR is a larger data repository that captures and validates

health care data from the Department of Defense's worldwide network of healthcare facilities and includes in-patient and out-patient visits (Office of the Assistant Secretary of Defense for Health Affairs [OASD(HA)], 2012).

The EMED contains more than 57,000 records of injured military members of which 1275 are military women who suffered combat related injuries in OIF and OEF. Experienced nurse coders who assign diagnosis codes to each injury from the International Classification of Diseases (9th Revision) (ICD-9) have reviewed each of the records of injured military members as well as AIS injury severity codes in order to calculate a total ISS. As mentioned in Chapter 1, the ISS is a comprehensive measure of injury severity, which derives from the AIS values, from the three most severely injured body regions. The ISS calculated on patients in the EMED can be categorized into three levels of severity: mild or moderate (1-8), serious (9-15) and severe (≥ 16) (Copes et al., 1998).

Criteria for Inclusion

The study sample is comprised of any female military member who suffered a combat-related injury between 2003 and 2015 while deployed in support of OIF or OEF. Female military members who died because of wounds sustained in combat were excluded from the study. Injuries that occurred in OIF, the Iraqi campaign, were categorized using a date range of 2003 through 2011. Dates for women injured in OEF, the war in Afghanistan, ranged from 2007 to 2015. All women had at least one injury documented and survived greater than 30-days post-injury. To confirm that injuries occurred during dates of deployment to Iraq or Afghanistan, the Defense Eligibility Reporting System (DEERS), a database that tracks the status of military members, was queried.

Human Subjects Protection

Although highly sensitive in nature, medical data retrieved from databases can easily be de-identified, creating minimal risk by preserving the privacy of the patient or subject through a unique person identifier or record linkage that is not traceable back to the actual person. Due to this capability of de-identifying personal information, Institutional Review Boards (IRBs) may exempt the study or allow for expedited review for the protection of human subjects (Al-Rawajfah, Aloush, & Hewitt, 2015).

This study underwent initial review by the IRB at Naval Health Research Center (NHRC) (Appendix A). As the study posed minimal risks to study subjects, and all patient identifiers were stripped before analysis, it received expedited review and an exempt status as previous studies utilizing EMED data have been assigned. The University of Arizona IRB determined that the research did not involve human subjects and therefore did not require further review (Appendix A). Both institutions required the researcher to maintain current certification of the Collaborative Institutional Training Initiative (CITI) human subject's research curriculum exam. NHRC additionally required annual Health Insurance Portability and Accountability Act (HIPAA) refresher training for any researcher accessing medical data.

Data Collection

When performing research studies whether they are descriptive or utilize an experimental design, the question of generalizability to a particular population should be asked in order to support external validity of the research. Using information from a large medical database such as the EMED can assist the researcher in supporting this type of validity as it can provide observational data on large numbers of patients across a wide variety of geographical locations.

Querying a large database also may defray some expenses that may be associated with generating original data and researcher time constraints may also be overcome as information from multiple sites can be collected simultaneously (Lange & Jacox, 1993).

Care must be taken to preserve internal and external validity of research when performing data queries. For instance, if a researcher proposes a specific question and then looks for a data set that answers the question, external validity may be threatened as the data set accessed may not adequately represent the target population that the question pertains to most. Conversely, if a data set is obtained, and then the researcher proposes a question, the data set may not have the robustness needed for that particular question and internal validity could be threatened (Magee, Lee, Giuliano, & Munro, 2006). In respect to sample size, the researcher needs to be aware that with very large sample sizes there is a possibility of artificially inflating the significance of the results. When results from a large database study are reported, significance values should be cautiously interpreted and a Bonferroni correction or Tukey test should be performed in order to prevent a Type I error (Magee et al., 2006).

Data Management

Study data were requested from NHRC using a User Request (UR) to obtain the patient data from the EMED. All clinical patient information was stored on a secure drive located at NHRC. Computer workstations at NHRC require login through the use of a Common Access Card (CAC), which is the standard identification for active duty uniformed service personnel, Selected Reserve, DoD civilian employees, and eligible contractor personnel. Any electronic patient information that is stored on the secure drive is password protected and was only

accessed by the researcher. Hard copy data were stored in locked, fireproof cabinets. Prior to aggregation and analysis, all patient identifiers were removed.

Personal Variables

Personal variables were identified and collected to investigate whether or not they contributed to predicting an individual's ability to appraise a traumatic event and react by coping in a positive manner and adapting to the stressful situation. The collected variables were: age at time of injury, previous experience from other deployments, branch of service, type of military occupation, severity of injuries, social support in the form of marriage, geographical location of injury occurrence, rank at time of injury, and type of initial medical treatment facility. This section will present how these variables link with individual appraisal within the TTSC.

Age

Situational control appraisals denote to what extent an individual believes that they can influence a demanding person-environment situation. These appraisals are produced by the individual's evaluation of the stressor as well as their coping resources (Lazarus & Folkman, 1984). There is some controversy whether the ability to cope with stressful situations changes from young adults to older individuals (Lazarus & Folkman, 1984). In Gutmann's (1984) research, it was suggested that as people age they transition from active mastery as younger adults when faced with stressful situations, to passive approaches when they are older, such as reliance on magical modes. In previous literature by Valliant, (1977) and Pfeiffer, (1977) it is professed that with increased age, coping becomes more realistic. In a younger population, both of these researchers found projection and acting out that may be labeled as immature and as older adults demonstrated greater use of mechanisms such as altruism and humor, which are viewed as

more mature. This research looked at age at time of injury and identified whether certain age groups appraised threat caused by physical injury differently.

Rank

The unique culture of the U. S. military is comprised of individuals from diverse backgrounds and distinctly differs from the civilian world (Hall, 2010). In the authoritarian structure that military members work in, there are two clearly defined subcultures, that of officer and enlisted members. To obtain a commission as an officer in the U.S. military, a bachelor's degree is the minimum educational requirement while an individual who enlists in the U.S. military must hold a high school diploma or equivalent. Researchers using data from the longitudinal Millennium Cohort study showed that PTSD is higher among enlisted personnel than among officers (Smith et al., 2008). Rank was collected on military women suffering from combat injuries to determine whether different ranks resulted in differences in mental health outcomes.

Previous Deployment

To support thoughts whether or not personal deployment experiences contribute to the development of individual appraisal and coping strategies leading to less mental health injuries, total number of previous deployments was collected. Larson, Highfill-McRoy and Booth-Kewley (2008, published on the concept of a "healthy warrior effect." In this research, they found that mental health issues in Marines were more frequently diagnosed at the beginning of recruit training and not after a combat deployment. The research also showed that in groups of Marines after the recruit training period, combat-deployed Marines had a significantly lower rate of mental health diagnoses, compared to Marines who had never deployed to combat (11.8% vs.

21.1%; $p < 0.05$). Additional research looking at factors that may buffer against depression in military reported that Air Force personnel identified low levels of depression after deployments due to a sense of belongingness (Bryan & Heron, 2015). In this study, the researchers present the concept of belonging that encompasses the sense that individuals are connected to others through group membership, shared commitments and common goals (Bryan & Heron, 2015).

Military Occupation

Military Occupation Specialty (MOS) was collected to identify whether certain subgroups of the military population uniquely appraised stressful situations, resulting in less adverse mental health outcomes and higher QOL scores. Within different MOS categories, job specific training and preparation will be different. In a qualitative study that investigated the occupational meanings and coping practices of rescue workers in an earthquake disaster, Stuhmiller (1994), used Lazarus and Folkman's (1984) framework to guide the investigation. In doing so the researcher strove to ascertain the experiences of the rescue workers while addressing the relationships between the rescuers and the environment. In this research work groups studied were firefighters, transportation workers, military pararescuers, and coroners. The investigator concluded that it was essential to identify what stressors were shared amongst different groups and which stressors will be more upsetting to specific groups based on their work in order to lessen negative consequences (Stuhmiller, 1994). By identifying individuals in different MOS groups it may become evident that certain job specialties react more negatively to stress recognized by differences in the outcome variables of mental health status and QOL.

Injury Severity

Physical illness can cause event uncertainty, a situational factor that may affect appraisal and subsequent coping leading to great potential for creating psychological stress (Lazarus & Folkman, 1984). Total ISS was collected on each combat-injured woman in the study to ascertain if greater or lesser severity of injuries contributed to negative or positive adaptation as evidenced by presence or lack of a mental health diagnosis after injury. A study investigating the relationship between ISS and mental health outcomes showed that minor injured patients, ISS of 1-8, were 2.60 times more likely to have a hospitalization for a mental health diagnosis post-injury compared to a non-injured group. Moderately injured patients, ISS of 9-15, were 3.14 times more likely and severely injured patients, ISS of >16 were 3.86 times more likely to have been seen for mental health issues than a non-injured cohort (Cameron, Purdie, Kliwer, & McClure, 2006).

Social Support

Although living in a social environment may cause stress on an individual, it can also provide resources that individuals can draw from to flourish and survive (Lazarus & Folkman, 1984). Pearlin and Johnson (1977) observed groups of married and unmarried individuals and learned that marriage could act as a protective barrier against distressing consequences when external threats arose. A more recent study aimed to look at the buffering power of socially supportive behaviors of the significant others of a group of individuals suffering from PTSD. In this study, the researchers observed that heart rate decreased when overtly supportive behaviors were demonstrated by the significant others of group members with PTSD. This supported the hypothesis that supportive behavior from a significant other will correlate with decreasing the

heart rate of an anxious individual by buffering the stressor (Guay, Nachar, Lavoie, Marchand, & O'Connor, 2016). For this research, social support was identified through the DEERS database noting whether the individual was married at the time of injury.

Environment

Military deployments to austere environments such as Iraq and Afghanistan can place physiologic demands on military members due to environmental extremes such as high-altitudes, hot climates and cold weather, which may contribute to declines in physical performance (Nindl et al., 2013). Historically documentation has been limited on the health-related outcomes from environmental exposures encountered during deployments (Nindl et al., 2013). By identifying geographic location and date of injury through data obtained in the EMED, this research also ascertained whether mental health outcomes differed in deployed women who suffered battle-injuries in specific locations that may be physically and mentally challenging due to environmental extremes.

Type of Treatment Facility

As the treatment of wounded combat troops has evolved into a sophisticated chain of evacuation from point of injury to definitive care in the United States, military medicine has developed a structure of five distinct levels or roles of military medical care (Bagg, Covey, & Powell, 2006). Role I care refers to immediate first aid provided at the front line often by combat medics or Navy corpsmen. At Role II, surgical capabilities exist in the form of trained trauma surgeons capable of performing damage control surgery. Basic lab and radiology capabilities are also present at a Role II facility. The highest medical capability in a combat zone exists at Role III. Here definitive surgical management is available along with surgical specialists such as

neurosurgeons, mental health, computerized tomography (CT), blood bank, and physical therapy (Bagg et al., 2006). During OIF and OEF, the sole Role IV facility was located in Landstuhl, Germany, where further assessment is made of injuries in a fixed facility with access to specialist care from the host country. At the end of the medical chain of evacuation, Role V care is provided at large MTFs in the continental United States (CONUS) once the wounded individual returns back to a facility close to their home (Bagg et al., 2006). As combat operations transitioned to Afghanistan, these levels of care were then referred to as roles of care. By identifying the initial level of care that the injured female military member was treated in, this research determined whether mental health outcomes were affected by type of care received in a deployed MTF.

Measurement Instruments

The primary measurement instruments used in this study were the AIS from which the ISS score was calculated and the Quality of Well Being Self-Administered (QWB-SA) scale from which the QOL score was derived. Mental health outcomes including depression, PTSD, and anxiety were also identified by provider assigned ICD-9 codes, although the QWB-SA also screens for depression and PTSD. This section will provide overview of these measures and discuss reliability and validity.

AIS

It was not until 1980 that the reliability and validity of the AIS injury-scoring system was addressed (MacKenzie, Shapiro, & Eastham, 1985). In order for a measurement tool such as the AIS scale to be found reliable, it must produce the same results repeatedly. Since measurements taken repeatedly may never be the same, there may always be some degree of unreliability in

measures. Because of this issue, researchers strive for consistency of results. The greater the consistency of results, the more reliable the instrument of measure is (Carmines & Zeller, 1979). NHRC employs a small cadre of certified nurse coders experienced in civilian and military trauma to perform AIS version 2005, ICD-9 and ICD-10 coding. Quality Assurance (QA) is performed on $\geq 10\%$ of the coded patient records to assure consistency of coding practices within the department. Of the records that undergo QA review, greater than 90% agreement exists between nurse coders. In the case of disagreement between coders, the patient record is discussed at monthly coder meetings and consensus is reached utilizing AIS coding rules and NHRC business rules to accurately characterize the injury profile.

A measurement tool can be considered valid if it measures what it was developed to measure. Several types of validity exist with the most basic being criterion and predictive validity, along with construct and content validity (Carmines & Zeller, 1979). Predictive validity is the correlation of one measure at a time point with another measure at a future point in time (Kazdin, 2003). In the case of the original AIS system, when age of the patient is also accounted for, the derived ISS score has been shown to correlate with and predict mortality, as well as hospital length of stay (MacKenzie et al., 1985). In this correlation, as the ISS increases, chances of poor patient outcomes such as disability and death increase. More recent literature examined the individual AIS scores from which the ISS is calculated and found a non-linear correlation between AIS severity and survival (Gennarelli & Wodzin, 2006). In this study, data on 474,025 patients from the National Trauma Data Base (NTDB) were examined that had been scored using an older version of AIS (1990-1998), a version that was based on consensus, not data driven. The investigators found that as the AIS severity score increases, variability of patient survival also

increased. Results showed that there was a non-linear correlation between AIS severity and survival. This non-linearity correlation showed that at lower severity levels, the component of mortality was not as important as at higher levels, as the AIS at lower levels is determined by variables other than survival. As AIS increased, survival variability increased as other factors involved with AIS values such as injury to organs may result in a high score, but the injury may still be survivable. The researchers concluded that although the AIS severity score provides a measure of mortality, mortality itself does not solely determine AIS severity (Gennarelli & Wodzin, 2006). Prior to this investigation there had been concerns that the older version of AIS was not specific enough as several different injuries may have the same severity score, but variations in injury types could produce different outcomes. Due to the need for modification and greater specificity, trauma specialists from around the world developed AIS 2005, which contained more precise injury descriptions (Gennarelli & Wodzin, 2006).

Construct validity has been described as a broad concept that identifies the relation of one measure to other measures and ascertains how well these measures reflect the concepts or domains of interest (Kazdin, 2003). Trochim, (2006) sheds more light on construct validity by describing it as the degree that inferences are made from theoretical constructs. In order to perform construct validation, the theoretical relationship that exists between concepts is initially assessed. Next, the empirical relationship that is present between concepts is identified. The empirical evidence then promotes understanding of the construct validity of the measure (Carmines & Zeller, 1979). When applying construct validity to the AIS scoring system, theoretical constructs identified by physician judgment should correlate to the indicators of severity (MacKenzie et al., 1985). As the AIS was originally developed by engineers to assign

ratings to blunt injuries occurring from motor vehicle accidents there may be some internal inconsistencies when it is applied to penetrating injuries. Although experts assigned the original severity scores, a '3' for one body region did not predict the same risk for death as a score of '3' in another body region (Champion, 2002). To address the need for greater specificity in injury descriptions and promote a scoring system that is usable for different injury causes, the AIS was revised in 2005 thus providing an updated system that responded to user's needs (Gennarelli & Wodzin, 2006).

Although not a formal evaluation of a measure, face validity has been applied to AIS scoring. For an instrument to demonstrate face validity, it must appear to demonstrate and assess the construct of interest (Kazdin, 2003). In AIS scoring, the system has been shown to be reasonable and intuitive to healthcare professionals such as physicians, nurses and emergency medicine personnel thus demonstrating face validity (MacKenzie et al., 1985).

Quality of Well Being Self-Administered (QWB-SA) Scale

The Wounded Warrior Recovery Project (WWRP), discussed in Chapter 1, measures QOL through the QWB-SA questionnaire, which evaluates the domains of physical functioning, mobility and social activity assigning a score for each of these three sub-categories as well as an overall score. The main survey is comprised of 132 questions. Follow-up surveys are comprised of 116 questions. Through self-report, these survey questionnaires assess symptoms producing a number which provides the overall score of well-being in which 0 = death and 1 = asymptomatic functioning or perfect health. In addition to the total score of well-being, a PTSD checklist (PCL) of 17 questions measures symptoms of PTSD and produces a total symptom severity score

between 17 and 85. Table 1 illustrates the suggested cut-points for scoring the PCL (Woodruff et al., 2014).

TABLE 1. *Suggested PTSD Checklist (PCL) Cut-Point Scores*

Cut-Point Score Estimated Prevalence of PTSD	
30-35	Below 15%
36-44	16-39%
45-50	Above 40%

Also included in the QWB-SA is a widely administered and validated depression scale from the Center for Epidemiologic Studies (CES), which produces a score between 0 to 60 (Woodruff et al., 2014). Table 2 identifies suggested ranges for depression outcomes after scoring the CES depression scale (Radloff, 1977).

TABLE 2. *Suggested Outcome Categories for the Center for Epidemiologic Studies (CES)*

CES Score	Suggested Outcome
0-9	No Depression
10-15	Mild Depression
16-24	Moderate Depression
>24	Severe Depression

The original QWB scale was developed in the 1970s as an instrument to calculate health outcomes expressed as Quality-Adjusted Life Years (QALYs) and became a standard measure of HR-QoL. The QWB tool was extensively validated and had psychometric properties that were well established (Kaplan, Anderson, & Ganiats, 1993). Unfortunately, use of the original tool was limited due to its difficulty to administer, and subsequently the QWB-SA was developed to address this limitation (Sieber, Groessler, David, Ganiats, & Kaplan, 2008). Test-retest correlations that were computed for each instrument showed greater stability for the updated QWB-SA ($r=.80, p<.001$) than the QWB ($r=.60, p<.001$) (Sieber et al., 2008). Both the QWB and QWB-SA have been shown to be valid in a variety of different disease populations (Kaplan, Ganiats,

Sieber, & Anderson, 1998). Researchers utilizing the QWB-SA have studied primarily civilian populations. Included in these cohorts are patients suffering from cardiovascular disease, asthma, cancer, as well as trauma. To a small degree, QOL has been studied in combat-injured individuals, usually in cross-sectional studies targeted at specific injury populations such as concussion or those suffering limb loss (Woodruff et al., 2014).

To summarize the instruments discussed in this chapter, Table 3 presents the scoring ranges for AIS, and the ISS which is derived from the AIS. The QWB-SA is also presented along with the PTSD and depression scales that reside within the QWB-SA tool.

TABLE 3. *Instrument Scoring Ranges*

Instrument	Scores Produced		
AIS	Scores each individual injury on a 6 point severity scale from 1-6		
	Mild to Moderate:	1-2	
	Moderate to Serious:	3-4	
	Severe:	5	
	Not Survivable:	6	
ISS	Total Injury Severity Score calculated from AIS scores		
	Mild:	1-3	
	Moderate:	4-8	
	Serious:	9-15	
	Severe:	>15	
QWB-SA	Overall Score	0-1	Ratio
- PTSD (PCL)	Overall Score	17-85	Ordinal
- Depression	Overall Score	0-60	Ratio

Mental Health Screening

For purposes of this study, clinician assigned diagnoses in the form of ICD-9 codes were utilized to identify injured women with mental health issues. Prior to providers assigning a mental health diagnosis, screening measures are frequently employed. A tool widely used in primary care settings to screen for mental health is the Patient Health Questionnaire (PHQ) and the shorter version, the PHQ-9 module, which focuses on depressive symptoms. This self-

administered scale is comprised of nine items that are based on Diagnostic and Statistical Manual of Mental Disorders (DSM) - IV diagnostic criteria (Maguen, Luxton, Skopp, & Madden, 2012). Once completed by the patient, a clinician reviews the responses, scores them using a diagnostic algorithm and assigns a diagnosis. A patient is diagnosed with major depression if five or more symptoms are present out of the nine criteria for more than half of the days in the previous two weeks. In relation to severity, the score of the PHQ-9 can range from 0 to 27 as the nine questions are scored from '0' (none) to '3' (almost every day). In order to determine reliability of the PHQ-9 questionnaire, researchers performed test-retest studies and reported reliability to be excellent with a Pearson's correlation of 0.84 with mean scores nearly equal (5.08 vs 5.03) (Kroenke, Spitzer, & Williams, 2001).

Validity of the PHQ-9 was assessed through construct and criterion validity. As criterion validity is the identification of how a measure correlates with another criterion, it was appropriate as a determinant of validity as it can be used when patient performance is measured and assessed relative to a disorder, in this case depression (Kazdin, 2003). In order to show criterion validity, likelihood ratios were examined which confirmed a considerable association between increasing PHQ-9 scores and the probability of major depression. A receiving operator characteristic (ROC) analysis identified that the area under the curve (AUC) for the PHQ-9 was 0.95, leading evaluators to believe that this test provides excellent discrimination between individuals with and without depression. Construct validity of the PHQ-9 was demonstrated by increased PHQ-9 scores and increased disability days, health-care utilization and difficulties in personal relationships due to depressive symptoms (Kroenke et al., 2001).

PTSD Screening

A measure to assess PTSD symptoms is the Primary Care PTSD Screen (PC-PTSD), a four item self-report tool that uses a dichotomous format (yes/no) for the four items of hyperarousal, avoidance, emotional numbing, and re-experiencing (Maguen et al., 2012). In 2004, this screening instrument was included in the Department of Defense's Post-Deployment Health Assessment (PDHA) program, which all service members returning from Iraq and Afghanistan participate in (Bliese, Wright, Cabrera, Castro, & Hoge, 2008). Mental health providers review all PDHA responses, and if a positive response is noted, the service member undergoes additional evaluation by a provider who would then document a diagnosis. Veterans Affairs (VA) literature reports that results of the PC-PTSD screening tool should be considered positive if there are three yes answers by a patient to any of the four items (United States Department of Veterans Affairs, n.d.).

Even though the PC-PTSD tool was developed in a Veterans Administration (VA) setting and introduced into the PDHA program in 2004, it was not validated on a military population until 2008. At this time researchers performed reliability studies where participants completed the screening tool and then were administered the tool a second time as part of structured interviews. Each of the interviewers was observed multiple times to assure consistency. Interrater reliability was computed using Cohen's Kappa, which was reported at 1.00 for a total of 18 cross-validated interviews. A limitation of this result is that it was noted by the researchers that the perfect Kappa score could have been a result of the restricted amount of 18 interviews (Bliese, Wright, Cabrera, Castro, & Hoge, 2008). Using the same group of participants, validity of the PC-PTSD was determined by having the participants complete the PC-PTSD as well as the

Posttraumatic Stress Disorder Checklist (PCL), a 17-item instrument used to assess PTSD.

Sensitivity and specificity were then examined through ROC curves. The AUC of the PC-PTSD was 0.87 with a 95% confidence interval of 0.79 to 0.92. The PCL showed an AUC of 0.88 with a 95% confidence interval of 0.80 to 0.93 (Bliese et al., 2008).

Procedures

After the total population of combat injured women from OIF and OEF was identified in the EMED, the demographic variables of age and branch of service were collected along with ISS. Military occupation specialty (MOS) and number of previous deployments at time of injury were also identified from EMED data. Presence of a mental health diagnosis including PTSD, depression, and anxiety in the form of ICD-9 and ICD-10 codes one year post-injury were collected through the DoD Standard Inpatient Data Record (SIDR) and Standard Ambulatory Data Record (SADR) of which the EMED also accesses data. Social Security numbers (SSNs) were initially used when accessing patient information from databases by the informatics staff. The SSNs were then replaced with a unique study subject identifier that could not be linked to the actual patient record once the data points were collected. The primary investigator did not have access to actual patient identifiers and the documents that linked them with the study subject identifier. These de-identified documents were stored in a password protected file on a secure computer drive at the NHRC offices.

Information regarding QOL outcomes of injured women were obtained from data collected from the WWRP, which also feeds questionnaire responses and QWB-SA scores into the EMED. As participation in the on-going longitudinal WWRP effort is voluntary, not all

battle-injured women had QOL data available for review and analysis, so a subset of the total number of battle-injured women were studied for this portion of the research.

Data Limitations

Although healthcare data may be accessible to researchers through permissions and data requests, the researcher must be aware that there may be issues with data quality, missing information, or data that have not been correctly coded. Data are entered into a healthcare database by a variety of personnel such as nurses, providers, clerks, ancillary personnel and administrators. Information for data entry may be collected at a patient encounter, and later transcribed into the Electronic Health Record (EHR), which feeds into the larger database. Busy providers could easily enter an erroneous ICD-9 code in an EHR where error checking is not part of the data entry system. The issue of recording bias can also occur when hospital or clinic reimbursements require the use of certain diagnostic codes and severity levels to cover visits or qualify patients for services (Nail & Lange, 1996). This type of bias has also been termed “code creep” when the coding decision favors reimbursement to the institution. Another concern with codes such as ICD-9s is that the use of a broad non-specific code may hide important clinical subgroups that would be visible if a more specific code was used (Al-Rawajfah et al., 2015).

In 2014, VA researchers were concerned with the accuracy of medical information residing in their electronic databases since administrative planning judgements as well as policy decisions were frequently made from data extracted from these databases. In order to determine the accuracy of diagnosis codes residing in the medical database, researchers examined the degree to which the PTSD diagnosis in the database aligned with the PTSD status after a diagnostic interview (Holowka et al., 2014). After interviewing 1,649 veterans from OIF and

OEF using a standard PTSD module of the structured clinical interview for DSM-IV (SCID), the VA database was queried to see if clinical diagnosis matched diagnostic codes in the VA healthcare database. Results showed that concordance between SCID diagnosis and the database diagnosis was 72.3%. After reviewing these results, the researchers suggested that greater efforts are needed to increase the accuracy of diagnoses in electronic medical databases with mandatory minimum standards instituted by healthcare systems (Holowka et al., 2014).

Data Analysis

Data analysis was performed using SPSS Version 25. Descriptive statistics were calculated for the scores on the instruments, and to describe the continuous variables of age, number of deployments, and ISS. Absolute numbers along with percentages were reported for the categorical variables of branch of service, and ISS categories. In the case of missing data, a default setting was used in SPSS of pairwise deletion. Stepwise data entry was used to isolate predictor variables and to determine the contribution of each predictor (Field, 2009). The following section addresses each of the four research questions and the analysis that was performed.

1. *In military women who have sustained combat related injuries, what types of mental health issues manifest within one year post-injury?*

Descriptive analysis was performed to identify the incidence of mental health issues in combat injured women. Frequencies of different diagnoses are reported in percentages.

2. *Do increased injury severity, age, rank, branch of service, number of deployments, military occupation, social support, environment where injury occurred and type of treatment*

facility in women who have sustained combat related injuries correlate with higher incidence of mental health diagnoses?

Logistic regression was used to examine the relationships among the variables of injury severity, age, number of deployments, and the military occupation specialties (MOS) of the combat injured women, and the binary yes/no values assigned to the mental health diagnoses identified through ICD-9 codes.

3. Is Quality of Life (QOL) in combat injured service women affected by injury severity, age at time of injury, rank, branch of service, number of deployments, military occupation, social support, environment where injury occurred and type of initial treatment facility?

Linear regression was used to identify the relationships between the variables of injury severity, age, number of deployments, and MOS and the continuous outcome variable of QOL scores.

4. How does QOL differ in combat injured women with diagnosed mental health issues compared to those women injured in combat without mental health issues?

An Independent t-test was performed to determine differences between mean QOL scores in the two groups, combat injured women with mental health diagnoses, and combat injured women without a mental health diagnosis.

Summary

This chapter has presented the methodology used for this research and provided in-depth descriptions of the variables that were utilized in the logistic and linear regression models along with rationales for their inclusion. The next chapter will present the characteristics of the sample and detailed results of the four study questions.

CHAPTER 4: RESULTS

This chapter will present the results of the study including a description of the cohort of combat injured military women relating to the variables of: age, branch of service, rank, injury severity, geographical location of care while deployed, type of initial treatment facility, number of deployments and social support (Table 4). Further analysis will identify the types of mental health diagnoses that manifest within one year post-injury. Results of logistic and linear regression analysis will be presented identifying if mental health outcomes and QOL correlate with any of the variables listed above. Finally, a comparison of QOL scores between combat injured women with and without post-injury mental health conditions will be reported.

Sample Characteristics

Sample Size and Deleted Cases

The EMED was queried for the entire population of military women who had been physically injured in combat related events in Iraq and Afghanistan. Women who died of their injuries or were killed in action were excluded from the sample. After deleting cases that had inadequate medical records to accurately characterize injury profiles, 1023 separate injury episodes remained for analysis. Within this group were 1012 women, 11 who had been in two separate combat-related events resulting in physical injury. Deployment dates when injuries occurred were verified through DEERs and demographic data for the cohort of injured women were then obtained from the EMED. Mental health diagnosis codes were requested from the MDR, and QOL scores were matched on combat-injured women who were also participating in the longitudinal study, WWRP.

Demographics

Age at time of injury episode ranged from 17-55. The mean age was 26.57 ($SD = 6.69$), with a median of 24 and a mode of 21. Social support in the form of marital status at time of injury was collected and showed half of combat injured women to have never been married ($n = 512, 50\%$). Married women comprised over one third of the sample ($n = 384, 37.5\%$), and women who had been through an annulment, divorce, or were legally separated made up a smaller portion of the sample ($n = 122, 11.93\%$). No social support data were available for five women (0.5%).

The ISS per episode ranged from 1-33. Minor injury profiles with an ISS range of 1-3 accounted for the majority of episodes ($n = 760, 74.3\%$). Moderate injury profiles ranging from an ISS of 4-8 comprised the second largest group ($n = 148, 14.5\%$). Serious injury profiles with an ISS of 9-15 dropped to less than 90 ($n = 81, 7.9\%$) and severe injury profiles with an ISS >15 were only suffered by a small number of women ($n = 34, 3.3\%$).

Military Status

The majority of injured women were serving in the Army ($n = 874, 85.4\%$), followed by the Air Force ($n = 66, 6.5\%$), Marine Corps ($n = 65, 6.4\%$) and Navy ($n = 18, 1.8\%$). Women in the study were categorized into officer and enlisted ranks. Officer ranks range from O1 to O10 and Enlisted ranks range from E1 to E10. Officers who hold the ranks between O1 and O4 are considered junior officers; O5 and O6 are considered senior officers. The ranks of O7 through O10 are flag officers or admirals, in the Navy, Coast Guard and Public Health Service. In the Army, Marine Corps, and Air Force, the ranks of O7 through O10 hold the rank of generals. In all services, enlisted members with ranks of E1-E3 are junior, the ranks of E4-E6 are considered

non-commissioned officer, and E7 through E10 are senior enlisted leaders in all services. An additional classification of officers is Warrant Officers with ranks of W1 through W5. In the combat injured population, rank at time of injury episode ranged from E1-O6 including 10 women who held the rank of Warrant Officer. No female Flag or General Officers (>O7) were injured. Less than one quarter of the injury episodes occurred in women who held the ranks of E1-E3 ($n = 229$, 22.4%). The majority of injury episodes occurred in women who held the ranks of E4-E6 ($n = 634$, 62%). A smaller number of episodes occurred in senior enlisted women holding the ranks of E7-E9 ($n = 36$, 3.5%). Commissioned officers comprised 12.1% ($n = 124$) of the injury episodes.

Deployment Status

The number of deployments to Iraq or Afghanistan ranged from 1-5 for military women who sustained combat injury. The majority of combat injury episodes occurred on the first deployment ($n = 693$, 67.7%), followed by the second deployment ($n = 231$, 22.6%). Only 66 (6.5%) combat injury episodes occurred on a third deployment, with 17 (1.7%) episodes on a fourth deployment and only two (0.20%) occurring on a fifth deployment.

Injuries reflected in these results occurred during OIF (Iraq), OEF (Afghanistan) and Operation New Dawn (OND) an operation that occurred in Iraq after the cease of combat operations and the peacekeeping mission began, although combat related events and injuries still occurred. OIF had the greatest number of combat-injury episodes ($n = 522$, 51%), followed by OEF ($n = 473$, 46.2%). Iraq remained a dangerous place as evidenced by the continuance of combat-related injuries in OND ($n = 28$, 2.7%).

Data were able to be collected on the initial medical treatment facility (MTF) and location where care was first rendered for 669 (65.3%) of the injury episodes. MTF location documentation was inadequate for the remaining group of 355 (34.6%) episodes. Out of the 1023 injury episodes, 369 (36.0%), had documented initial care at a Role III facility. Initial care was documented at a Role II facility for 203 injured women (19.8%). The remaining 96 women (9.3%) with documentation of their primary level of care were seen at facilities designated as Role I, which provides basic care and no surgical capability.

TABLE 4. *Demographics at Time of Injury Episode*

Characteristic	Total Number (n=1023)	%
<i>Demographics</i>		
Age (mean \pm S.D.)	26.6 (6.7)	
<i>Rank</i>		
E1-E3	229	22.4
E4-E6	634	61.9
E7-E9	36	3.5
Officer/WO	124	12.1
<i>Service</i>		
Army	874	85.4
Air Force	66	6.5
Marine	65	6.4
Navy	18	1.8
<i>Social Support</i>		
Never Married	512	50.0
Married	384	37.5
Divorces/Separated	122	11.9
Unknown	5	.05
<i>Injury Severity Score</i>		
Minor (1-3)	760	74.3
Moderate (4-8)	148	14.5
Serious (9-15)	81	7.9
Severe (>15)	34	3.3
<i>Geographical Location</i>		
Iraq	550	53.7
Afghanistan	473	46.0

TABLE 4. – *Continued*

Characteristic	Total Number (n=1023)	%
<i>Initial Treatment Facility Type</i>		
Role 3	369	36.0
Role 2	203	19.8
Role 1	96	9.3
Unknown	355	34.7
<i>Number of Deployments</i>		
1	693	67.7
2	231	22.6
3	66	6.5
4	17	1.7
5	2	0.2

Women injured in combat episodes filled numerous military occupational specialties directly in support of combat operations. The greatest number of women worked in jobs related to transportation ($n = 216$, 21.3%), followed by healthcare workers ($n = 172$, 16.9%), and communication specialists ($n = 164$, 16.2%). A detailed list of military occupation categories filled by combat injured women is listed in Table 5.

TABLE 5. *Military Occupation Specialties in Combat-Injured Women*

Occupation	Total (n = 1012)	%
Transportation	216	21.3
Healthcare	172	16.9
Communication	165	16.3
Administrative	62	6.1
Logistics	51	5.0
Aviation	48	4.7
Supply	44	4.3
Security	43	4.2
Combat Support/Weapons	40	4
Equipment Operator/Repair	28	2.8
Intelligence	28	2.8
Food Service	27	2.7
Engineer	22	2.2
Technical Support	14	1.4
Public Affairs	11	1.1
Trade Worker	11	1.1

TABLE 5. – *Continued*

Occupation	Total (<i>n</i> = 1012)	%
Legal	8	0.8
Plans/Operations	5	0.5
Veterinary	5	0.5
Command Staff	3	0.3
Other	9	0.9

Research Question Results

The first research question was, in military women who have sustained combat related injuries, what types of mental health issues manifest within one year post-injury? After consultation with a military mental health provider to determine mental health diagnosis code categories appropriate for the population of combat-injured women, the ICD-9 and ICD-10 code categories listed in Table 6 were queried for matches with the study cohort. Alcohol and drug dependency disorders were included, but nicotine addiction was excluded, as were personality disorders, and dementias.

TABLE 6. *Mental Health Diagnosis Categories*

Category	ICD-9	ICD-10
Alcohol/Drug-Induced Disorders	291-292.9	F10.1-F10.99
Transient Disorders	293-294.9	F03-F06.2
Mood Disorders	296-298.9	F06.3, F30-F39
Anxiety/Dissociative Disorders	300-300.9	F06.4
Alcohol/Drug Disorders	303-305.9	F10-F19.99
Eating Disturbances	307, 307.5	F50
Sleep Disorders	307.4-307.49	F51
Reaction to Stress/Adjustment Disorder	308-309.9	F43-F43.9
Post-Traumatic Stress Disorder	309.81	F43.1
Depressive Disorders	311	F32-F33.9
Psychosis	298.9	F28, F29

Out of 1012 women 404 (40%) were diagnosed with a mental health condition within the first year of injury. The most common mental health disorders recorded were PTSD (*n* = 203,

20%), depressive disorders ($n = 123$, 12.1%), adjustment disorders ($n = 92$, 9.0%), and anxiety disorders ($n = 81$, 8.0%). Results are presented in Table 7.

TABLE 7. *Types of Mental Health Diagnoses One Year Post Combat-Related Injury*

Category	Total ($n = 1012$)	%
Post-Traumatic Stress Disorder	203	20.0
Depressive Disorders	123	12.1
Adjustment Disorders	92	9.0
Anxiety Disorders	81	8.0
Sleep Disorders	29	2.8
Acute Reaction to Stress	16	1.5
Psychoses	9	0.80
Alcohol/Drug Disorders	4	0.30
Other	4	0.30

Within the group of 404 women with mental health occurrences, 127 (31.4%) had multiple mental health diagnoses. The most common combinations of disorders were PTSD/depression, PTSD/anxiety, PTSD/depression/anxiety, and depression/anxiety. Although adjustment disorders accounted for 9% of mental health diagnoses, total combinations of adjustment disorder and other reported diagnoses were small ($n=14$) representing only 1% of mental health occurrences in the total population of injured women. Table 8 outlines the prevalence of mental health co-occurrences within the total group of injured women ($n = 1012$) and those with mental health diagnoses ($n = 404$).

TABLE 8. *Co-Occurring Mental Health Diagnoses*

Co-Occurring Diagnoses ($n = 127$)	All Combat Injured Women ($n = 1012$)		Injured Women with Mental Health Diagnosis ($n=404$)
	n	%	%
PTSD/Depression	41	4.0	10.1
PTSD/Anxiety	25	2.4	6.1
PTSD/Depression/Anxiety	23	2.2	5.6
Depression/Anxiety	14	1.3	3.4
Other combinations	24	2.3	5.9

The second research question was, ‘do increased injury severity, age, rank, number of deployments, branch of service, military occupation, social support, environment where injury occurred and type of treatment facility in women who have sustained combat related injuries correlate with higher incidence of mental health diagnoses?’ Due to the exploratory nature of this study, forward stepwise logistic regression was chosen to perform the analysis for this question (Field, 2009). Two separate analyses were performed using the variables of interest. The first model used all mental health diagnoses as the dependent variable and the second model was performed with only women who had diagnoses of either PTSD, depression or anxiety as the dependent variable.

Binomial logistic regression was performed to ascertain the effects of injury severity, age, rank, number of deployments, military occupation, social support, environment where injury occurred and type of treatment facility had on the likelihood of developing mental health issues after injury. The logistic regression model was statistically significant $X^2(11) = 105.28, p < .000$. The model explained 13.2% (Nagelkerke R^2) of the variance in mental health diagnosis and correctly classified 67.1% of the cases. Sensitivity was 39.5%, specificity was 85.5%, positive predictive value was 64.5% and negative predictive value was 67.87%. The model was shown to be statistically significant through Omnibus tests ($p = <.000$) while the Hosmer and Lemeshow test ($p = .690$) was not statistically significant thus showing a good fitting model (Field, 2009). No significant outliers in the form of residuals were noted in the analysis. Of the nine predictor variables, four were present in the final model, rank at time of injury, military occupation, environment of care and injury severity score.

A second binomial logistic regression was performed using the same covariates but only evaluating effects on developing PTSD, depression, and anxiety in the same cohort of combat injured women. The model was also statistically significant $X^2(5) = 73.32, p < .000$. This model explained 10% (Nagelkerke R^2) of the variance and correctly classified 73.3% of the cases. Sensitivity was 17.4%, specificity was 94.5%, positive predictive value was 54.44% and negative predictive value was 75.13%. The model was shown to be statistically significant through Omnibus tests ($p = <.000$) while the Hosmer and Lemeshow test ($p = .814$) was not statistically significant also showing a good fitting model (Field, 2009). No outliers were found in this regression analysis. In this second analysis investigating predictors of PTSD, depression and anxiety, of the nine predictor variables only two primary categories were statistically significant, injury severity, and environment of care or theatre of operation. Table 9 presents the results of these two analyses.

TABLE 9. *Logistic Regression Predicting Likelihood of Mental Health Issues in Combat Injured Women*

Variable	Diagnosis					
	Any Mental Health Outcome			PTSD/Depression/Anxiety		
	B	OR (95% CI)	P	B	OR (95% CI)	P
Injury Severity						
Minor	-1.91	.148 (.066, .328)	.000	-1.31	.269 (.133, .546)	.000
Moderate	-1.20	.301 (.129, .705)	.006			
Serious	-.346	.707 (.284, 1.764)	.457			
Environment						
OIF	.017	1.017 (.422, 2.45)	.969	-.650	.522 (.390, .699)	.000
OEF	.726	2.066 (.859, 4.97)	.105			
Rank						
Enlisted	.544	1.722 (1.123, 2.64)	.013			
Occupation						
Admin	-1.28	.324 (.102, 1.03)	.057			
Combat Support	-1.20	.300 (.095, .945)	.040			
Communication	-.237	.290 (.093, .909)	.034			
Healthcare	-.695	.499 (.158, 1.58)	.237			

TABLE 9. – *Continued*

Variable	Diagnosis					
	Any Mental Health Outcome			PTSD/Depression/Anxiety		
	B	OR (95% CI)	P	B	OR (95% CI)	P
Transportation	-.968	.380 (.121, 1.19)	.098			
Constant	1.418	4.129	.090	.340	1.405	.349

Note. OR, odds ratio; CI, confidence interval

The third research question was, ‘is Quality of Life (QOL) in combat injured service women affected by injury severity, age at time of injury, rank, number of deployments, military occupation, social support, environment where injury occurred and type of initial treatment facility’? The sample of military women with documented QOL scores after combat injury was comprised of 204 participants. All data were self-reported through on-line (e-mail) and U.S Postal Service mailed questionnaires. The age of the group ranged from 18-53 with an average age of 27.13. Injury severity score ranged between 1-33 with an average of 3.39 (minor). Number of deployments ranged from one to four with an average of 1.43. QOL scores were all from the initial surveys and ranged from 0.165 to 0.934 with an average of .50.

A linear regression was performed to determine possible effects of the independent variables, age, and rank, number of deployments, military occupation, social support, environment and initial treatment facility on QOL scores. Prior to running the final analysis, the categorical variables of social support, branch of service, occupation specialty, environment, paygrade, and type of treatment facility were converted into dummy or indicator variables.

Assumptions of the model were checked so that any conclusions drawn from the results could be generalized to a wider population (Field, 2009). Fortunately multicollinearity in the model was not demonstrated as there were no substantial correlations ($r > .9$) between the predictor variables along with Variance Inflation Factor (VIF) values that were all below 10 and

tolerance statistics all above 0.2 (Field, 2009). The analysis produced 11 studentized residuals, with two having values > 2.5 . Cook's distances were less than one for each residual and a Durbin-Watson statistic of 1.706 was produced showing independence of residuals (Field, 2009). DFBeta statistics were also performed and showed no values >1 . These results identified that none of the residual cases had large influences on the model (Field, 2009) so no residuals were removed from the model as outliers. Visual inspection of a probability plot showed observed values on the diagonal of the plot indicating that the residuals were normally distributed (Field, 2009).

The model was statistically significant $F(15, 192) = 1.802, p < .05$ and accounted for approximately 12.3% of the variance of QOL score when correlated with the variables ($R^2 = .123$, Adjusted $R^2 = .055$). The model did not exclude any variables. Results showed that injured women who were officers had higher QOL than enlisted women, and women serving in the Air Force had higher QOL than women serving in the Army, Marine Corps or Navy. Results are shown in Table 10.

TABLE 10. *Linear Regression Relationships in Predicting Quality of Life*

Model	B	SE-B	β	<i>t</i>	Sig.	95%CI
Constant	.556	.044		12.518	.000	(.468-.643)
Rank						
Enlisted/Officer	.055	.026	.158	2.149	.033	(.005-.183)
Service						
Air Force	.119	.033	.256	3.661	.000	(.055-.183)
Injury Severity	-.004	.002	-.126	-1.766	.079	(-.009-.000)

Note. CI, confidence interval

Additional analysis was performed through an Independent Samples T-test to compare QOL scores between enlisted women and those who were officers. The test showed a significant difference in mean scores between the two groups. On average females injured in combat who

were officers had higher QOL ($N = 33$, $M = .541$, $SE = .024$) compared to enlisted women who had been wounded ($N = 171$, $M = .492$, $SE = .010$). This difference was significant $t(204) = -1.99$, $p = .048$ and represented a medium-sized effect $r = .17$. Results are shown in Table 11.

TABLE 11. *Quality of Life Differences in Combat Injured Enlisted and Officer Females*

Group	No.	Mean QOL	SD	t	p
Enlisted	171	.492	.128	-1.99	.048
Officer	33	.541	.140		
Combined Groups	204	.500	.131		

The fourth research question was, how does Quality Of Life (QOL) differ in combat injured women with diagnosed mental health issues compared to those women injured in combat without mental health issues? An Independent Samples T-test was performed and showed on average, military women who did not have a mental health diagnosis within one year of combat-related injury experienced higher QOL scores ($N = 123$, $M = .525$, $SE = .011$), compared to women who were diagnosed with a mental health issue within one year of combat related injury ($N = 81$, $M = .462$, $SE = .015$). This difference was significant $t(204) = 3.457$, $p = .001$ and represented a medium-sized effect $r = .25$ (Table 12). This suggests that women who have been diagnosed with mental health issues after combat-related injury have significantly lower QOL than women who have not been diagnosed with mental health issues after injury.

TABLE 12. *Quality of Life Differences in Combat Injured Women With and Without Mental Health Diagnoses*

Group	No.	Mean QOL	SD	t	p
Without MH Diagnosis	123	.525	.124	3.457	.001
With MH Diagnosis	81	.462	.133		
Combined Groups	204	.50	.131		

Summary

This chapter has described the characteristics of the population of injured service-women and presented the results of the four research questions. Common post-injury mental health diagnoses were reported and predictor variables for mental health diagnoses and QOL were presented from the final logistic and linear regression models along with their statistical significance. Differences in QOL between injured women with and without mental health conditions were highlighted in the results of a t-test. The next chapter will present the discussion of study results and provide concluding comments.

CHAPTER 5: DISCUSSION

Discussion of study findings along with conclusions drawn from the results are presented in this chapter. Research strategies utilized, study strengths and limitations, along with current and future implications for military leaders and healthcare providers will be discussed. Finally, thoughts for future research efforts will be provided along with concluding remarks.

Specific Sample Characteristics

The demographic variable of age at the time of injury was collected by matching date of injury and medical record information on all combat injured women. Mean age for the cohort was 26.6 ($SD = 6.7$) which did not differ significantly from the mean age of women suffering from mental health issues after injury which was 26.7. It may be of interest that injured women on average were slightly older than military men sustaining combat injury. In a study on PTSD in combat injured men, MacGregor et al. (2009), reported a mean age of 24.1 ($SD = 5.3$) in a population who were primarily Marines. In a blast injury study, Eskridge et al. (2012), reported 24.5 ($SD = 5.3$) as the average age of injured military males. More detailed review of age differences in injured men and women may provide insight as to whether the differences are meaningful.

As the Army is the largest military service with an active duty population of 487,366 (37.4%) out of 1,301,433 total active duty service members (DMDC, 2017), it was not unexpected that 85.4% ($n = 874$) of injured women belonged to the Army. It was interesting to see that almost identical numbers of Air Force women suffered injuries (66.65%, $n = 66$) as Marine Corps women (65.64%, $n = 65$). The obvious assumption would be that Marines would be more likely to suffer combat injuries due to their expeditionary mission types. However, the

Air Force as a service, comprises 23.6% of the military while the Marine Corps follows at 14.1% (DMDC, 2017).

The majority of the injuries experienced by the women in this study cohort occurred before the lifting of the combat occupation ban for women in 2013 (Barry, 2013). As expected, most of the documented military occupations for women were in supportive roles such as transportation and healthcare. Increased scrutiny into specific service branches and occupations may yield greater insight into specific jobs, which promote increased vulnerability for physical injury as well as subsequent mental health outcomes.

It was expected that the majority of women would have injury severities that fall into the categories of minor or moderate ($n = 908$, 89.7%). Studies on male injury cohorts report slightly fewer in the minor or moderate ISS categories as evidenced in work by Eskridge et al., (2012) who reported 85.4%. This could be a reflection of men having higher injury severity scores due to their direct combat roles. In this current study, the highest ISS recorded in the group of injured women was 33, which was the severity score assigned for three of the women. Interestingly none of these women had documented PTSD but two did have mental health diagnoses. Only one of the three was currently participating in WWRP with a baseline QOL score of .315, which not surprisingly is low on the scale of 0-1.

Types of Mental Health Outcomes

The first question asked by this study answered what types of mental health diagnoses occurred in combat injured women within one year of injury. In the investigation of the 1012 injured women, 404 (40%) were diagnosed with a mental health condition in the first year post-injury. This is a higher statistic than was found in combat injured men by MacGregor et al.

(2009) who identified a prevalence of 31.3% mental health diagnoses in a cohort spanning a longer time frame that went to 729 days post-injury. In the same study by MacGregor et al. (2009), the research team identified that 17% of the male cohort had a diagnosis of PTSD which is a closer alignment with this current study's findings in the female cohort in which 20% of combat injured were diagnosed with PTSD.

The current findings correlate with previous literature in which PTSD, depression and anxiety comprise the primary mental health diagnoses found in a post-combat deployed population (Hoge et al., 2008). Interestingly adjustment disorder as a diagnosis was evident in 9% of the women in this study slightly exceeding anxiety disorders as a single diagnosis (8%). This prevalence of an adjustment disorder diagnosis in the cohort was unique as it was not noted in previous studies that were reviewed which consisted primarily of males. It could be that this diagnosis is more prevalent in females, or it may be speculated that providers used this diagnosis as a proxy for other diagnoses such as depression and PTSD, which could be perceived as negatively impacting a member's career once documented in the medical record. It should be noted that adjustment disorder symptoms should resolve after a period of six months once the stressor is no longer present (Casey, 2014).

Co-occurring mental health diagnoses were also identified, the most prevalent being, PTSD and depression, which occurred in 4.0% of the total combat-injured cohort and in 10.1% of the injured women with subsequent mental health issues. PTSD and anxiety followed in prevalence in 2.4 % of the total injured female sample and in 6.1% of those with mental health diagnoses. These findings correlate with a previously referenced study in Chapter Two in which

Sayer (2012) noted that depression appeared as a common comorbidity with PTSD along with anxiety in a combat injured military population suffering from TBI.

Factors that Predict Mental Health

This research is novel in that it is the primary study that has looked into predicting what factors, if any, contribute to mental health issues in military women exposed to combat and sustain subsequent physical injury. The factors chosen for this investigation have all been documented in literature as potential predictors of mental health, although not all previous literature referenced these factors in relationship to coping with physical injury.

The second research question sought to answer through logistic regression, do increased injury severity, age, rank, branch of service, number of deployments, military occupation, social support, environment where injury occurred, and type of treatment facility in women who have sustained combat related injuries correlate with higher incidence of mental health diagnoses? In the final regression model in this analysis using any mental health diagnosis as the dependent variable, four predictor variables were present, rank at time of injury, military occupation, environment of care, and ISS. The final model showed that women who had minor or moderate injuries had less chance of mental health outcomes. Interestingly significance was not shown that higher ISS in the severe or serious categories contributed to increased or decreased incidence of any mental health diagnosis in the injured women. This finding is not consistent with a previous study on combat injured men that showed injury severity significantly associated with any mental health diagnoses and identifying a 2-6 fold increase in the moderate, serious or severe injury categories (MacGregor et al., 2009).

Environment of care whether it be Iraq (OIF, OND) or Afghanistan (OEF) did not contribute to mental health outcomes. Perhaps this is due to the organizational culture of military treatment facilities contributing to patient experiences through shared values, characteristics and behaviors of military medical providers and military patients (Braithwaite, Herkes, Ludlow, Testa, & Lamprell, 2017). It also can be surmised that treatment by military healthcare providers while far from home may promote a sense of comfort and belongingness despite the stress of injury. It has been presented in research literature that belongingness and cohesion within military groups may protect from depression (Bryan & Heron, 2015).

Being an enlisted member contributed to increased risk of mental health issues post-injury. This finding has also been documented from the Millennium Cohort study where PTSD was higher in enlisted personnel than among the officer ranks (Smith et al., 2008). As officers entering the service must have at least a Bachelor's degree and enlisted members joining the military are only required to have a high-school education or equivalent, it would be logical to assume that increased educational level and college experiences contribute to positive coping after injury.

To analyze military occupation, similar job categories were collapsed into the broader groups of Administration, Combat Support, Communications, Healthcare, Transportation, and Other. Combat Support and Communications significantly contributed to less mental health diagnoses along with Administration, which was close to significance at $p = .057$. The categories of Healthcare and Transportation were not significant at predicting mental health outcomes. It may be notable that these two occupations neither promoted or protected from mental health issues post-injury. In a wartime setting, healthcare workers such as female medics and nurses are

exposed to severely injured service members in emergency rooms while transportation workers such as female convoy drivers live with the threats of IEDs along their routes (Mattocks et al., 2012). It would not be difficult in future studies on this cohort to determine if the injuries took place while riding in a vehicle or not, as those data are collected at every combat event through situational reports.

This study did not compare percentage rates of mental health outcomes and QOL between occupation types, which if performed, may illuminate other trends. Focused efforts could scrutinize occupation types in their more detailed categories attempting to identify whether certain personality types self-select to certain specialties, as well as looking at length of time spent in certain jobs, which may allow for the acquisition of hardiness or resiliency that develops over time.

Using the same predictor variables, a second logistic regression was performed with any diagnosis of PTSD, depression, or anxiety as the dependent variable. In this model only injury severity and environment of care showed any significance. A negative association was seen in the presence of PTSD, depression, and anxiety if the woman was injured in Iraq, while injuries occurring in Afghanistan were not associated with these diagnoses. Similar to the analyses performed on the any mental health group, injured women who suffered minor injuries had less chance of a mental health diagnosis. Being severely injured (ISS >15) did not predict mental health outcomes, which is contrary to what would be assumed. There is ongoing research at NHRC that is investigating serious and severely injured combat-injured military members and the positive effects of pain medications such as ketamine given early post-injury on preventing mental health outcomes such as PTSD (Melcer et al., 2017). An earlier study reported findings in

a cohort comprised of 99% men that morphine given early in trauma care in a combat setting may reduce subsequent PTSD after serious injuries (Holbrook et al., 2010). Most of the severely injured women in this study most likely had narcotics given soon after injury occurred. This lack of mental health issues in general, or of PTSD in the severely injured population, may be represented by this phenomenon as well.

Factors that Predict Quality of Life

Within the cohort of 1012 women, 204 were currently participating in WWRP and had baseline QOL scores. In a linear regression model, the baseline QOL score was the dependent variable and the same predictor variables were entered as previously used in the logistic regression model. A trend emerged from this model as it showed that Officers had higher QOL post-injury than enlisted women after injury, which correlated with Enlisted women having more mental health concerns post-injury than Officers in the logistic regression results. To further investigate this result, the QOL scores for Enlisted women and Officers were analyzed through an independent t-test showing significant differences between the means (.492 vs. .541, $p < .05$).

Interestingly women serving in the Air Force had higher QOL than those serving in the Army, Marines, or Navy. This could be related to the types of occupation specialties these women held, or due to the culture of the Air Force. Whether true or not, within military circles the Air Force has frequently been reputed to have better lifestyles than the sister services. Figure 4 highlights the differences in mean QOL scores between each service.

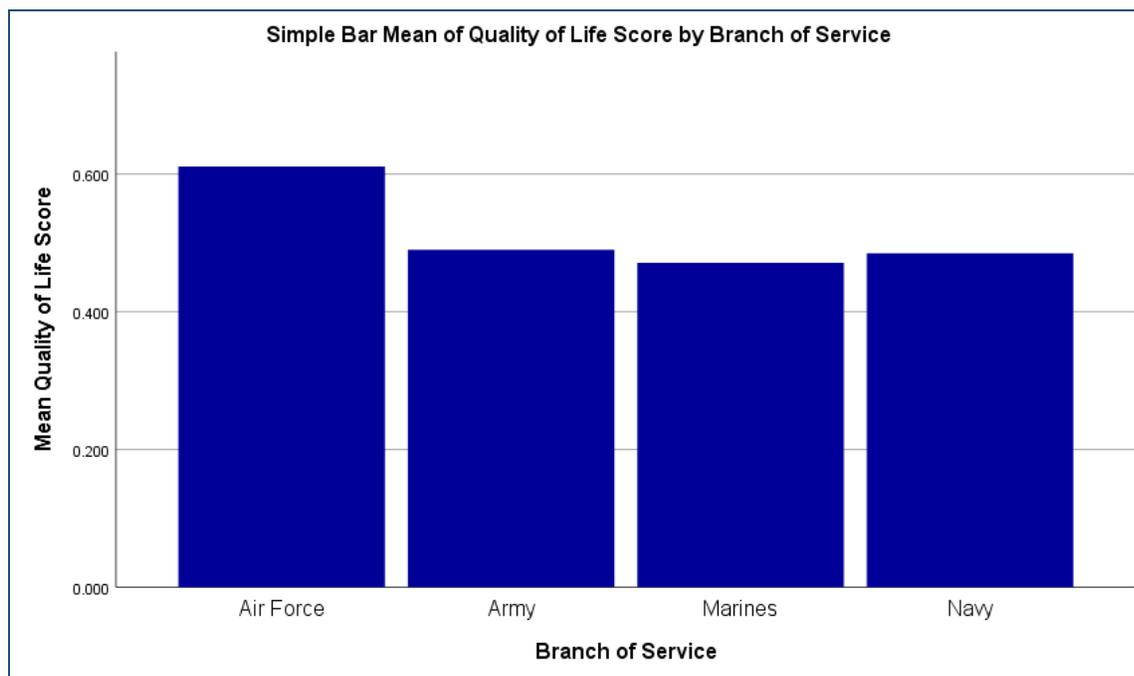


FIGURE 5. Mean Difference Values between Service Branches

ISS was entered as a continuous variable into the linear model and was not found to be a significant predictor of QOL ($p < .079$). This is consistent with earlier work on civilian trauma patients that found women with significantly poorer QOL than men after physical trauma, independent of injury severity (Holbrook & Hoyt, 2004).

Comparing Quality of Life

An important component of this research was to identify differences in QOL between combat injured women with and without mental health diagnoses. The hypothesized prediction was that QOL in the group with mental health diagnoses would be lower than in the group with no mental health issues post-injury. There is no recommended cut-point for QOL scores obtained through the QWB-SA tool, but the results of QOL scores reported in this study seemed low, as the scale for scores as measured by the QWB-SA ranges from 0 to 1, and the mean score in the combined groups was .50. A national study previously conducted did seek to obtain age-by-

gender norms for adults aged 35-89 on several HRQOL indexes. The researchers reported a mean QWB-SA score of 0.66 in uninjured females aged 35-44 (Frybeck et al., 2007), which is higher than the mean of .50 found in this current study of combat injured women.

Not all injured women studied have participated in the on-going WWRP QOL study so scores for this research effort were only available from 204 injured women, representing 20% of the total sample of combat injured women studied ($n = 1012$). When means were compared between injured women without and with mental health diagnoses, women with mental health diagnoses were found to have significantly lower QOL scores compared to those without mental health diagnoses (.462 vs. .525, $p < .05$). Although QOL studies have been limited on military personnel prior to 2014 (Woodruff et al., 2014), findings in this study confirm research done by Fang et al. (2015), who found significant decreases in HRQOL in service members suffering from PTSD with similar results between genders, although this study was not performed on an injured population.

As the WWRP study continues on, further research should capture a larger number of QOL scores of injured women as more female participants are enrolled. This current study captured baseline QOL scores as women entered the WWRP, but did not identify how long from the injury the QOL score was collected. As participant responses to the WWRP are collected and QOL scores documented, responses are date stamped, so this would not be difficult to add as a data point. It will also be interesting to see how QOL changes in this population as the study progresses and elapsed time from the original injury increases.

Study Strengths and Limitations

The primary strength of this study was the ability to collect data on the majority of combat injured women from recent conflicts in Iraq and Afghanistan and identify the prevalence and types of mental health issues that they suffered. Through the capture of demographic information and mental health outcomes from large DOD databases a clear picture is accurately presented through provider assigned medical diagnosis codes and demographic data. Utilization of the EMED was key in identifying the battle injured female cohort along with the high quality injury scoring that was available to characterize the injury profiles and severity of wounds.

Limitations of this research may occur from lack of medical documentation in a far-forward battlefield setting due to increased operational tempo. Seriously and severely injured women are well characterized due to enhanced electronic health record documentation as they travelled through advanced levels of care back to CONUS. But injury information on women who were treated for minor injuries at aid stations and then released back to duty may be limited. This study deleted 43 injured women from the final analysis due to incomplete medical records from the point of injury. All of the women were in documented combat-related traumatic events with a subsequent injury, but non-medical personnel performed the injury documentation so these records were removed from the analyzed cohort.

Another limitation was the lack of baseline mental health data prior to the deployment. It is possible that women in this cohort had pre-existing mental health concerns, although in a military setting, several mental health conditions prohibit deployment. Future efforts exploring post-injury mental health should control for previous mental health diagnoses.

Implications for Healthcare Clinicians and Military Leadership

Through this research, PTSD, depression, and anxiety were identified as prevalent mental health concerns along with adjustment disorders occurring after women were injured in combat. Although these results may not be surprising, this provides up to date information to the military community regarding the occurrence of these issues. Groups that care for these women whether it be a military facility, the VA, or a civilian provider can now be provided the awareness of specific mental health issues that may be unique to the injured female military population.

The findings clearly identified that enlisted women had greater mental health concerns and poorer QOL after injury. This important result informs healthcare providers and military leaders of the need to provide focused interventions tailored for enlisted women across the service branches.

It is also evident from these results that QOL is significantly diminished in service women who have been diagnosed with a mental health condition post-combat injury. Many women return to roles as spouses and mothers once home from deployment after recovering from injuries while concurrently returning to the workforce, whether it be on active military duty or back to a civilian job. An assumption can be made that poor QOL can affect family dynamics and how women perform professionally. Increasing awareness of how mental health affects QOL can provide necessary information to veteran's advocates leading to enhanced post-deployment care through policy changes and by increasing provider knowledge and enabling referral to appropriate follow-up care.

Future Research

As this study broadly described the cohort of injured women through demographics and mental health conditions and QOL after injury, future efforts can take this acquired information and begin to investigate a myriad of other questions that may be answered to assist injured women veterans. By reassessing the individual predictive categories that were chosen for this study and identifying new variables of interest, hopefully other trends can be recognized that were not evident in this work.

Collected in this effort were the demographic variables of rank, branch of service, occupation, and social support along with injury and deployment specific details such as ISS and geographical location. It would also be helpful to identify whether or not the injured women belonged to the Reserves or National Guard. More attention has come to these sub-groups during these conflicts as it became evident that once they return home to their civilian lives after mobilization to active duty and combat deployment, they may have little interaction with other military members who have shared experiences (Kelley, Berkel, & Nilsson, 2014). This can possibly lead to feelings of isolation and depression.

This study focused on mental health outcomes in women, hoping to aid clinical practice in identifying specific issues unique to that population. Obviously more research needs to be performed looking specifically to see if gender differences exist in how women and men react to stress brought about by physical injury. Furthermore, it is critical to continue to search for ways to develop resiliency and hardiness that assist in positive coping resulting in fewer mental health consequences and increased QOL.

It has been suggested by one study that deployment to a combat zone does not affect women differently than men concerning the development of PTSD, albeit in a non-injured population (Macera et al., 2014). To identify specific gender differences, future studies should compare like cohorts of military men and women with similar injury profiles, investigating differences in mental health outcomes post-injury along with QOL. Other comparisons can also be performed between women who sustain combat injury, women who sustain non-combat injuries, and women who sustain no injuries during deployment to a combat zone.

As discussed previously, research has identified that morphine given in the immediate post-injury phase may protect from PTSD. Further investigation is needed on the timing of narcotics given in the immediate post-injury period along with type of medication and dosage in injured women, identifying if there are any effects on post-injury mental health outcomes.

Although this study looked to identify predictors for mental health diagnoses and QOL, another opportunity for military female research is that of investigating posttraumatic growth (PTG). There is evidence that stressful events such as combat trauma can allow individuals to grow in a positive manner developing greater self-reliance and empathy for others along with deeper appreciation for life and loved ones (Bush, Skopp, McCann, & Luxton, 2011). It was shown in a sample comprised of 89% male Army veterans with combat experience, those who reported increased levels of PTG, also reported less suicidal ideation (Bush et al., 2011). As the injured female cohort has now been identified, future efforts investigating PTG can continue in this population.

A key element in this research was the application of the TTSC to the cohort of injured military women. By utilizing the framework of the TTSC, it allowed a clear vision of how

personal variables that may be either innate or developed through experience may assist with positive adaptation and coping in a population dealing with physical injury. Direction for future studies should also explore the application of resiliency theories to populations such as the women studied in this research. One theory that has been utilized in adolescents and young adults with cancer is the Resilience in Illness Model (RIM). This theory aims to increase the understanding of factors such as family environment and social interaction in the provision of protective factors for positive health, (Haase, Kintner, Monahan & Robb, 2014).

Conclusion

As the roles of women in the military continue to evolve it is important to have baseline data to guide the care of this population as they face new career challenges and are placed more frequently in harm's way in future military conflicts and events. Since few studies have been published regarding post-injury mental health outcomes in military women, disseminating the results of this research is a priority. The information gained from this study can inform healthcare as well as military and government leaders of current issues our service women are experiencing, in turn motivating new inquiries and innovative programs. It is hoped that the results of this research will lead to the development of enhanced and meaningful care leading to positive outcomes for this vulnerable population.

APPENDIX A:
IRB APPROVALS



Research
Office for Research & Discovery

Human Subjects
Protection Program

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Date:	March 02, 2017
Principal Investigator:	Judy Lynn Dye
Protocol Number:	1703249331
Protocol Title:	Factors that contribute to mental health in combat injured military women
Determination:	Human Subjects Review not Required

The project listed above does not require oversight by the University of Arizona because the project does not meet the definition of 'research' and/or 'human subject'.

- **Not Research as defined by 45 CFR 46.102(d):** As presented, the activities described above do not meet the definition of research as cited in the regulations issued by the U.S. Department of Health and Human Services which state that "research means a systematic investigation, including research development, testing and evaluation, designed to contribute to generalizable knowledge".
- **Not Human Subjects Research as defined by 45 CFR 46.102(f):** As presented, the activities described above do not meet the definition of research involving human subjects as cited in the regulations issued by the U.S. Department of Health and Human Services which state that "human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains data through intervention *or* interaction with the individual, or identifiable private information".

Note: Modifications to projects not requiring human subjects review that change the nature of the project should be submitted to the Human Subjects Protection Program (HSPP) for a new determination (e.g. addition of research with children, specimen collection, participant observation, prospective collection of data when the study was previously retrospective in nature, and broadening the scope or nature of the research question). Please contact the HSPP to consult on whether the proposed changes need further review.

The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).



Dye, Mental Health in Combat Injured Women, NHRC.2017.0003

INSTITUTIONAL REVIEW BOARD RECOMMENDATION

INITIAL REVIEW

Date of Review: 28 February 2016 Protocol Number: NHRC.2017.0003

Protocol Title: Factors that Contribute to Mental Health in Combat Injured Military Women

NHRC Principal Investigator: Michael Galarneau, MS
University of Arizona Co-I: Judy Dye, MS

Work Unit: Expeditionary Medical Encounter Database, 60808;
JON: 7UM1A3

This protocol was submitted for initial review. The study aims to: 1) identify types of mental health issues that manifest in military women within one year of combat-related injury; 2) evaluate the relationship between several variables (including total Injury Severity Score (ISS), age, rank, number of deployments, military occupation, social support, environment, and type of treatment facility) to mental health diagnoses in military women within one year of combat-related injury; 3) investigate quality of life (QOL) in combat-injured women; and 4) compare the QOL outcomes for combat-injured women with diagnosed mental health issues to combat-injured women without diagnosed mental health issues. Up to 2,000 records from combat-injured women who suffered a combat-related injury between 2003 and 2015 while deployed in support of Operation Enduring Freedom (OEF) or Operation Iraqi Freedom (OIF) will be studied for this effort. Records will be accessed from the Tri-service Emergency Medical Encounter Database (NHRC-EMED), which contains data from the Military Health System Data Repository (MDR), the Theatre Medical Data Store (TMDS), and the Defense Manpower Data Center (DMDC). Data will be de-identified before being sent to the co-investigator while on-site at NHRC. No identifiable information will be transferred to University of Arizona. This effort is intended to be carried out in support of a doctoral program at University of Arizona.

This research is a medical records study effort and no contact with any record holders takes place. Informed consent for this records research was waived in accordance with 32 CFR § 219.116(d) in that this study is classified as minimal risk; the requirement to obtain informed consent from the record holders is impractical in that the personnel are numerous and geographically dispersed; and the decision to waive informed consent will not adversely affect the rights and welfare of the record holders of this study population. Further, in accordance with 45 CFR § 164.512(i)(2), the need for written authorization to use protected health information (PHI) in this minimal risk research was waived after finding that: 1) the research could not be conducted without the PHI, 2) the protocol presents a plan to protect sensitive data from inadvertent disclosure, 3) the waiver will not adversely affect the rights or privacy of the record holders, 4) failure to obtain a waiver would make this research impracticable to conduct due to the number of and inaccessibility of record holders, 5) the privacy risks are reasonable in relation to the importance of the knowledge that may be gained, 6) the identifiers will be retained only as long as they are needed for the research purposes, and 7) protected health information will be



Dye, Mental Health in Combat Injured Women, NHRC.2017.0003

maintained at NHRC only, there will be no further disclosure, and data files will be destroyed upon completion of the study.

The NHRC IRB Chair reviewed this submission under the expedited review authority and permitted under 32 CFR §219.110(b)(1), Federal Register expedited review category 5. The 32 CFR §219.111 criteria for the approval of research have been met. The NHRC Chair recommends approval of this research.

The IRB approval period will expire on 1 March 2018.

W. J. BECKER, Ph.D.
Chair, NHRC IRB

WJ Becker
Signature

03/03/2017
Date

REFERENCES

- Al-Rawajfah, O. M., Aloush, S., & Hewitt, J. B. (2015). Use of electronic health-related datasets in nursing and health-related research. *Western Journal of Nursing Research, 37*(7), 952-983. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/25421544>
doi:10.1177/0193945914558426
- Antonovsky, A. (1987). *Unraveling the mystery of health* (pp. 1-33). San Francisco, CA: Jossey Bass.
- Bagg, M. R., Covey, D. C., & Powell, E. T. (2006). Levels of medical care in the global war on terrorism. *Journal of the American Academy of Orthopedic Surgery, 14*, S7-S9.
- Barry, B. (2013). Women in combat. *Survival: Global Politics and Strategy, 55*(2), 19-30.
- Bliese, P. D., Wright, K. M., Cabrera, O., Castro, C. A., & Hoge, C. W. (2008). Validating the primary care posttraumatic stress disorder screen and the posttraumatic stress disorder checklist with soldiers returning home from combat. *Journal of Consulting and Clinical Psychology, 76*(2), 272-281.
- Bush, N. E., Skopp, N. A., McCann, R., Luxton, D. D. (2011). Posttraumatic growth as protection against suicidal ideation after deployment and combat exposure. *Military Medicine, 176*(11), 1215-1222.
- Braithwaite, J., Herkes, J., Ludlow, K., Testa, L., Lamprell, G. (2017). Association between organisational and workplace cultures, and patient outcomes: systematic review. *BMJ Open 7*, 1-9. <http://dx.doi.org/10.1136/bmjopen-2017-017708>
- Bryan, C. J. & Heron, E. A. (2015). Belonging protects against post deployment depression in military personnel. *Depression and Anxiety, 32*, 349-355.
- Cameron, C. M., Purdie, D. M., Kliwer, E. V., & McClure, R. J. (2006). Mental health: a cause or consequence of injury? A population-based matched cohort study. *BMC Public Health, 6*, 114. <http://dx.doi.org/10.1186/1471-2458-6-114>
- Carlson, B. E., Stromwall, L. K., & Lietz, C. A. (2013). Mental health issues in recently returning women veterans: implications for practice. *Social Work, 58*(2), 105-114.
- Carmines, E. G. & Zeller, R. A. (1979). *Reliability and validity assessment*. Thousand Oaks, CA: Sage.
- Casey, P. (2014). Adjustment disorder: new developments. *Curr Psychiatry Rep, 16*, 451. Retrieved from <https://link.springer.com/article/10.1007/s11920-014-0451-2>

- Chaffee, M. W. & McNeill, M. M. (2007). A model of nursing as a complex adaptive system. *Nursing Outlook*, 55, 232-241.
- Champion, H. R. (2002). Trauma scoring. *Scandinavian Journal of Surgery*, 91, 12-22.
- Copes, W. S., Champion, H. R., Sacco, W. J., Lawnick, M. M., Keast, S. L., & Bain, L. W. (1998). The injury severity score revisited. *Journal of Trauma*, 28(1), 69-77.
- Defense Casualty Analysis System. (2015). *Conflict casualties* (DCAS 2.1.00). Retrieved from <https://www.dmdc.osd.mil/dcas/pages/casualties.xhtml>
- Defense Manpower Data Center (2017). *Statistics and reports* (DMDC). Retrieved from https://www.dmdc.osd.mil/appj/dwp/stats_reports.jsp
- Dolan, C. A. & Adler, A. B. (2008). Military hardiness as a buffer of psychological health on return from deployment. *Journal of Special Operations Medicine*, 8, 110-115.
- Dutra, L., Grubbs, K., Greene, C., Trego, L. L., McCartin, T. L., & Kloezeman, K. (2011). Women at war: implications for mental health. *Journal of Trauma & Dissociation*, 12, 25-37. <http://dx.doi.org/10.1080/15299732.2010.496141>
- Dye, J. L., Eskridge, S. L., Tepe, V., Clouser, M. C., & Galarneau, M. R. (2016). Characterization and comparison of combat-related injuries in women during OIF and OEF [Special issue]. *Military Medicine*, 181(1S), 92-98.
- Eskridge, S. L., Macera, C. A., Galarneau, M. R., Holbrook, T. L., Woodruff, S. I., MacGregor, A. J., ... Shaffer, R. A. (2012). Injuries from combat explosions in Iraq: injury type, location, and severity. *Injury*, 43(10), 1678-1682.
- Fang, S. C., Schnurr, P. P., Kulish, A. L., Holowka, D. W., Marx, B. P., Keane, T. M., & Rosen, R. (2015). Psychosocial functioning and health-related quality of life associated with posttraumatic stress disorder in male and female Iraq and Afghanistan war veterans: the VALOR registry. *Journal of Women's Health*, 1-9. <http://dx.doi.org/10.1089/jwh.2014.5096>
- Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). London, England: Sage.
- Fischer, H. (2014, November 20, 2014). *A guide to U.S. military casualty statistics: Operation Inherent Resolve, Operation New Dawn, Operation Iraqi Freedom, and Operation Enduring Freedom* [Press release]. Washington, DC: Congressional Research Service.
- Fitts, J. (2009). Female soldiers protecting convoys in Iraq. *Army News*. Retrieved from <http://www.usmilitary.about.com>
- Folkman, S. (1984). Personal control and stress and coping processes: a theoretical analysis. *Journal of Personality and Social Psychology*, 46, 839-852.

- Fryback, D. G., Dunham, N. C., Palta, M., Hanmer, J., Buechner, J., Cherepanov, D., ...Kind, P. (2007). U.S. norms for six generic health-related quality-of-life indexes from the national health measurement study. *Med Care*, *45*(12), 1162-1170. doi:10.1097/MLR.0b013e31814848f1.
- Gennarelli, T. A. & Wodzin, E. (2006). AIS 2005: a contemporary injury scale. *Injury*, *37*, 1083-1091.
- Gibbons, S. W., Shafer, M., Hickling, E. J., & Ramsey, G. (2013). How do deployed health care providers experience moral injury? *Narrative Inquiry in Bioethics*, *3.3*, 247-259.
- Graham, L. J. (2015). Integration of the interaction model of client health behavior and transactional model of stress and coping as a tool for understanding retention in HIV care across the lifespan. *Journal of the Association of Nurses in AIDS Care*, *26*(2), 100-109.
- Grieger, T. A., Cozza, S. J., Ursano, R. J., Hoge, C., Martinez, P. E., Engel, C. C., & Wain, H. J. (2006). Posttraumatic stress disorder and depression in battle-injured soldiers. *American Journal of Psychiatry*, *163*(10), 1777-1783.
- Guay, S., Nachar, N., Lavoie, M. E., Marchand, A., & O'Connor, K. P. (2016). The buffering power of overt socially supportive and unsupportive behaviors from the significant other on posttraumatic stress disorder individuals' emotional state. *Anxiety, Stress, & Coping*, 1-14. <http://dx.doi.org/10.1080/10615806.2016.1194400>
- Gureje, O. (2008). Comorbidity of pain and anxiety disorders. *Current Psychiatry Reports*, *10*, 318-322.
- Haase, J. E., Kintner, E. K., Monahan, P. O., & Robb, S. L. (2014). The resilience in illness model: exploratory evaluation in adolescents and young adults with cancer. *Cancer Nurs*, *37*(3), E1-E12.
- Hall, L. K. (2010). The importance of understanding military culture. *Social Work in Health Care*, *50*, 4-18.
- 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. *Journal of the American Medical Association*, *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.

- Hoge, C. W., Clark, J. C., & Castro, C. A. (2007). Commentary: women in combat and the risk of post-traumatic stress disorder and depression. *International Journal of Epidemiology*, *36*, 327-329.
- Holbrook, T. L. & Hoyt, D. B. (2004). The impact of major trauma: quality-of-life outcomes are worse in women than in men, independent of mechanism and injury severity. *Journal of Trauma-Injury Infection & Critical Care* *56*(2), 284-290.
- Holbrook, T. L., Hoyt, D. B., Stein, M. B., & Sieber, W. J. (2002). Gender differences in long-term posttraumatic stress disorder outcomes after major trauma: women are at higher risk of adverse outcomes than men. *Journal of Trauma*, *53*, 882-888.
- Holbrook, T. L., Galarneau, M. R., Dye, J. L., Quinn, K, Dougherty, A. L. 2010. Morphine use after combat injury in Iraq and post-traumatic stress disorder. *The New England Journal of Medicine*, *362*(2), 110-117.
- Holowka, D. W., Marx, B. P., Litman, M. A., Ranganathan, G., Rosen, R. C., & Keane, T. M. (2014). PTSD diagnostic validity in Veterans Affairs electronic health records of Iraq and Afghanistan veterans. *Journal of Consulting Clinical Psychology*, *82*, 569-579.
- Institute of Medicine. (2010). *Returning home from Iraq and Afghanistan: preliminary assessment of readjustment needs of veterans, service members, and their families*. Retrieved from The National Academies Press: <http://iom.nationalacademies.org/Reports.aspx>
- Iverson, K. M., Pogoda, T. K., Gradus, J. L., & Street, A. E. (2013). Deployment-related traumatic brain injury among Operation Enduring Freedom/Operation Iraqi Freedom veterans: associations with mental and physical health by gender. *Journal of Women's Health*, *22*, 267-273.
- Jones, P. S. (1991). Adaptability: a personal resource for health. *Scholarly Inquiry for Nursing Practice: An International Journal*, *5*(2), 95-108.
- Kaplan, R. M., Anderson, J. P., & Ganiats, T. G. (1993). The quality of well-being scale: rationale for a single quality of life index. In S. R. Walker, & R. M. Rosser (Eds.), *Quality of life assessment: key issues in the 1990s* (pp. 65-94). London: Kluwer Academic Publishers.
- Kaplan, R. M., Ganiats, T. G., Sieber, W. J., & Anderson, J. P. (1998). The quality of well-being scale: critical similarities and differences with SF-36. *International Journal for Quality in Health Care*, *10*(6), 509-520.
- Kazdin, A. E. (2003). *Research design in clinical psychology* (4th ed.). Boston, MA: Allyn & Bacon.

- Kelly, P. J., Berkel, L. A., & Nilsson, J. E. (2014). Post deployment reintegration experiences of female soldiers from National Guard and Reserve units in the United States. *Nursing Research* 63(5), 346-356.
- Kelly, U. A., Skelton, K., Patel, M., & Bradley, B. (2011). More than military sexual trauma: interpersonal violence, PTSD, and mental health in women veterans. *Research in Nursing & Health*, 1-11.
- Kobasa, S. C. (1979). Stressful life events, personality and health: an inquiry into hardiness. *Journal of Personality and Social Psychology*, 37, 1-11.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16, 606-613.
- Lange, L., & Jacox, A. (1993). Using large databases in nursing and health policy research. *Journal of Professional Nursing*, 9(4), 204-211.
- Lazarus, R. S. & Folkman, S. (1984). *Stress, appraisal and coping*. NY: Springer Publishing.
- Lee, A. M. & Poole, G. (2005). An application of the transactional model to the analysis of chronic illness narratives. *Qualitative Health Research*, 15(3), 346-364.
- Litz, B. T., Stein, N., Delaney, E., Lebowitz, L., Nash, W. P., Silva, C., & Maguen, S. (2009). Moral injury and moral repair in war veterans: a preliminary model and intervention strategy. *Clinical Psychology Review*, 29, 695-706.
- Lyon, B. L. (2012). Stress, coping and health: a conceptual overview. In *Handbook of stress, coping and health: implications for nursing research, theory and practice* (2nd ed., pp. 1-19). Thousand Oaks, CA: Sage Publishers.
- MacGregor, A. J., Corson, K. S., Larson, G. E., Shaffer, R. A., Dougherty, A. L., Galarneau, M. R., ... Golomb, B. A. (2009). Injury-specific predictors of posttraumatic stress disorder. *Injury-International Journal of the Care of the Injured*, 40, 1004-1010.
- MacKenzie, E. J. (1984). Injury severity scales: overview and directions for future research. *American Journal of Emergency Medicine*, 2(6), 537-549.
- MacKenzie, E. J., Shapiro, S., & Eastham, J. N. (1985). The abbreviated injury scale and injury severity score: Levels of inter- and intrarater reliability. *Medical Care*, 23, 823-835.
- Macera, C. A., Aralis, H. J., Highfill-McCoy, R., & Rauh, M. J. (2014). Posttraumatic stress disorder after combat zone deployment among Navy and Marine Corps men and women. *Journal of Women's Health*, 23(6), 499-506.
- Mackay, M. (2009). Why nursing has not embraced the clinician-scientist role. *Nursing Philosophy*, 10, 287-296.

- Magee, T., Lee, S. M., Giuliano, K. K., & Munro, B. (2006). Generating new knowledge from existing data. *Nursing Research*, *55*(2), S50-S56.
- Maguen, S., & Burkman, K. (2013). Combat-related killings: expanding evidenced-based treatments for PTSD. *Cognitive and Behavioral Practice*, *20*, 476-479.
- Maguen, S. & Litz, B. (2012). Moral injury in veterans of war. *PTSD Research Quarterly*, *23*(1), 1-6.
- Maguen, S., Luxton, D. D., Skopp, N. A., & Madden, E. (2012). Gender differences in traumatic experiences and mental health in active duty soldiers redeployed from Iraq and Afghanistan. *Journal of Psychiatric Research*, *46*, 311-316.
- Mattocks, K. M., Haskell, S. G., Krebs, E. E., Justice, A. C., Yano, E. M., & Brandt, C. (2012). Women at war: understanding how women veterans cope with combat and military sexual trauma. *Social Science & Medicine*, *74*, 537-545.
- Melcer, T., Walker, G. J., Dye, J. L., Adams, M. D., MacGregor, A. J., & Galarneau, M. R. (2017). Early ketamine use and opioids following serious combat injury: use, injury characteristics, and posttraumatic stress disorder. Manuscript in progress.
- Mota, N. P., Medved, M., Wang, J., Asmundson, G. J., Whitney, D., & Sareen, J. (2012). Stress and mental disorders in female military personnel: comparisons between the sexes in a male dominated profession. *Journal of Psychiatric Research*, *46*, 159-167.
- Murdoch, M., Bradley, A., Mather, S., Klein, R., Turner, C., & Yano, E. (2006). Women and war: what physicians should know. *Journal of General Internal Medicine*, S5-10.
- Nail, L. M. & Lange, L. L. (1996). Using computerized clinical nursing data bases for nursing research. *Journal of Professional Nursing*, *12*(4), 197-206.
- Nindl, B. C., Castellani, J. W., Warr, B. J., Sharp, M. A., Henning, P. C., Spiering, B. A., & Scofield, D. E. (2013). Physiological employment standards III: physiological challenges and consequences encountered during international military deployments. *European Journal of Applied Physiology*, *113*, 2655-2672.
- Office of the Assistant Secretary of Defense for Health Affairs. (2012). *Guide for department of defense researchers using military health system data*. Retrieved from <http://www.tricare.mil/tma/privact/hrpp>
- PTSD Screening and referral: for health care providers. (n.d.). Retrieved from <http://www.ptsd.va.gov/professional/pages/screening-and-referral.asp>
- Pearlin, L. I. & Johnson, J. S. (1977). Marital status, life-strains and depression. *American Sociological Review*, *42*, 704-715.

- Pender, N., Murdaugh, C., & Parsons, M. (2011). *Health promotion in nursing practice* (6th ed.). Upper Saddle River, NJ: Pearson Education Inc.
- Pollock, S. E. (1989). The hardiness characteristic: a motivating factor in adaptation. *Advances in Nursing Science*, *11*(2), 53-62.
- Polusny, M. A., Kumpula, M. J., Meis, L. A., Erbes, C. R., Arbisi, P. A., Murdoch, M., ... Johnson, A. K. (2014). Gender differences in the effects of deployment-related stressors and pre-deployment risk factors on the development of PTSD symptoms in National Guard soldiers deployed to Iraq and Afghanistan. *Journal of Psychiatric Research*, *49*, 1-9.
- Provencher, H. L. (2007). Role of psychological factors in studying recovery from a transactional stress-coping approach: implications for mental health nursing practices. *International Journal of Mental Health Nursing*, *16*, 188-197.
- Reed, P. (2012). *Pam's notes on theory development and evaluation*, University of Arizona, College of Nursing. Tucson, AZ.
- Reed, P. G. & Crawford-Shearer, N. B. (2011). The spiral path of nursing knowledge. In M. Zuccarini (Ed.), *Nursing knowledge and theory innovation; advancing the science of practice* (pp. 1-35). New York, NY: Springer Publishing Company, LLC.
- Rivera, J. C., Hylden, C. M., & Johnson, A. E. (2015). Disability after deployment injury: are women and men service members different? *Clinical Orthopaedics and Related Research*, *473*, 2448-2454.
- Rivera, J. C., Krueger, C. A., & Johnson, A. E. (2015). Female combat amputees have higher rates of posttraumatic stress disorder disability. *The United States Army Medical Department Journal*, 64-69. Retrieved from http://www.cs.amedd.army.mil/amedd_journal.aspx
- Rodgers, B. L. (2005). The postmodern turn. In M. Zuccarini, M. Klim, & R. Hallowell (Eds.), *Developing nursing knowledge; philosophical traditions and influences* (pp. 131-144). Philadelphia, PA: Lippincott Williams & Wilkins.
- Rona, R. J., Fear, N. T., Hull, L., & Wessely, S. (2007). Women in novel occupational roles: mental health trends in the UK armed forces. *International Journal of Epidemiology*, *36*, 319-326.
- Sayer, N. A. (2012). Traumatic brain injury and its neuropsychiatric sequelae in war veterans. *Annual Review of Medicine*, *63*, 405-419.

- Seelig, A. D., Jacobsen, I. G., Smith, B., Hooper, T. I., Gackstetter, G. D., Ryan, M. A., ... Smith, T. C. (2012). Prospective evaluation of mental health and deployment experience among women in the US military. *American Journal of Epidemiology*, 176(2), 135-145.
<http://dx.doi.org/10.1093/AJE/KWR496>
- Sherbourne, C. D., Asch, S. M., Shugarman, L. R., Goebel, J. R., Lanto, A. B., Rubenstein, L. V., ... Lorenz, K. A. (2009). Early identification of co-occurring pain, depression and anxiety. *Journal of General Internal Medicine*, 24(5), 620-625.
- Sieber, W. J., Groessler, E. J., David, K. M., Ganiats, T. G., & Kaplan, R. M. (2008). Quality of well-being self-administered (QWB-SA) scale. In *User's manual* (pp. 1-42). San Diego: University of California
- Simoni, P. S. & Paterson, J. J. (1997). Hardiness, coping, and burnout in the nursing workplace. *Journal of Professional Nursing*, 13(3), 178-185.
- Smith, T. C., Ryan, M. A., Wingard, D. L., Slymen, D. J., Sallis, J. F., & Kritz-Silverstein, D. (2008). New onset and persistent symptoms of post-traumatic stress disorder self-reported after deployment and combat exposures: prospective population based US military cohort study. *British Medical Journal*, 336, 366-371.
<http://dx.doi.org/10.1136/bmj.39430.638241.AE>
- Spector, P. E. (1981). *Research designs*. Newbury Park, CA: Sage Publications.
- Street, A. E., Vogt, D., & Dutra, L. (2009). A new generation of women veterans: stressors faced by women deployed to Iraq and Afghanistan. *Clinical Psychology Review*, 29, 685-694.
- Trego, L., Wilson, C., & Steele, N. (2010). A call to action for evidenced-based military women's health care: developing a women's health research agenda that addresses sex and gender in health and illness. *Biological Research for Nursing*, 171-177.
- Van Egeren, L. (2000). Stress and coping and behavioral organization. *Psychosomatic Medicine*, 62, 451-460.
- Vincent, H. K., Horodyski, M., Vincent, K. R., Brisbane, S. T., & Sadasivan, K. K. (2015). Psychological distress after orthopedic trauma: prevalence in patients and implications for rehabilitation. *Physical Medicine and Rehabilitation*, 7(9), 978-989.
- Vogt, D. (2014). Research on gender differences in deployment stress and post deployment mental health: addressing conceptual and methodological challenges and expanding our research agenda. *Journal of Women's Health*, 23(6), 485-487.

- Vogt, D. S., Proctor, S. P., King, D. W., King, L. A., & Vasterling, J. J. (2008). Validation of scales from the deployment risk and resilience inventory in a sample of Operation Iraqi Freedom veterans. *Assessment, 15*, 391-403.
<http://dx.doi.org/doi:10.1177/1073191108316030>
- Vogt, D., Vaughn, R., Glickman, M. E., Schulz, M., Drainoni, M., Elwy, R., & Eisen, S. (2011). Gender differences in combat-related stressors and their association with post deployment mental health in a nationally representative sample of U.S. OEF/OIF veterans. *Journal of Abnormal Psychology, 120*(4), 797-806.
- Wilson, I. B. & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life. *Journal of the American Medical Association, 273*, 59-65.
- Woodruff, S. I., Galarneau, M. R., Luu, B. N., Sack, D., & Han, P. (2014). A study protocol for tracking quality of life among U.S. service members wounded in Iraq and Afghanistan: the wounded warrior recovery project. *Military Medicine, 179*(3), 265-271.
- Yehuda, R. (2002). Post-traumatic stress disorder. *New England Journal of Medicine, 346*(2), 108-114.
- Yen, M. & Lo, L. (2002). Examining test-retest reliability. *Nursing Research, 51*, 59-62.