ABSTRACT

Coping Styles as a Mediator between Neuropsychological Functioning and Quality of Life Outcomes in OEF/OIF Veterans

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Veterans have returned from the OEF/OIF combat theatre with a multitude of physical and psychological problems that affect neuropsychological functioning and quality of life (QOL). Often, neuropsychological function is difficult to remedy in treatment, thus a more efficacious treatment would focus on a mediation factor to improve QOL. This study set out to determine whether coping mediated the relationship between neuropsychological functioning and QOL outcomes in Veterans. Participants were 136 men and women enrolled in an ongoing study of returning war Veterans. Results indicated that an active coping style was a full mediator between long-term verbal memory and QOL outcome. Attention and short-term verbal memory were good predictors of quality of life, but were not mediated by coping style. Treatments that include action-focused coping skills may be beneficial, however, cognitive deficits should be accounted for in treatment planning to improve QOL in Veterans.

Coping Styles as a Mediator between Neuropsychological Functioning and Quality of Life Outcomes in OEF/OIF Veterans

by

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A Thesis

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LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
ANAM	Automated Neuropsychological Assessments Metrics
AVLT	Auditory Verbal Learning Task
CAPS	Clinician-Administered PTSD Scale
CFA	Confirmatory Factor Analysis
COWA	Controlled Oral Word Association
CPT	Continuous Performance Task
CVLT	California Verbal Learning Test
DSB	Digit Span Backward
DSF	Digit Span Forward
DV	Dependent Variable
HCV	Hepatitis C Virus
IADL	Instrumental Activities of Daily Living
IQ	Intelligence Quotient
IQOL	International Quality of Life Assessment Project
IV	Independent Variable
M	Mean
MS	Multiple Sclerosis
N	Sample Population
OEF	Operation Enduring Freedom

OIF	Operation Iraqi Freedom
PASAT	Paced Auditory Serial Addition Task
PD	Parkinson's Disease
PCA	Principal Components Analysis
PTSD	Posttraumatic Stress Disorder
QOL	Quality of Life
QOLS	Quality of Life Scale
SCWT	Stroop Color and Word Test
SD	Standard Deviation
SF-36	Short Form Health Survey
SUD	Substance Use Disorder
TBI	Traumatic Brain Injury
TMT	Trail Making Test
VA	Veterans Association
WAIS	Wechsler Adult Intelligence Scale
WCST	Wisconsin Card Sorting Test
WMS	Wechsler Memory Scale
WRAT	Wide-Range Achievement Test

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CHAPTER ONE

Introduction and Background

Introduction

Many Veterans returning from the OEF/OIF combat theatre experience a multitude of psychological problems that have a profound impact on their perceived quality of life (QOL) including difficulties with mood, anxiety, and neuropsychological functioning (Hoge et al., 2004). Disorders characterized by these symptoms that a significant minority of OEF/OIF Veterans are often diagnosed with include, but are not limited to, posttraumatic stress disorder (PTSD), traumatic brain injury (TBI), depression, and substance use disorders (SUDs), all of which can have a negative impact on neuropsychological functioning (Porter, Bourke, & Gallagher, 2007; Vanderploeg, Curtiss, & Belanger, 2005; Vasterling et al., 2002; Verdejo-García, López-Torrecillas, Aguilar de Arcos, & Pérez-García, 2005). This is important because studies have found that patients with a variety of disorders that have concomitant neuropsychological deficits tend to have a self-reported lower QOL, including patients receiving chemotherapy (Reid-Amdt, Hsieh, & Perry, 2010), patients infected with Hepatitis C virus (HCV; Forton et al., 2005; Forton, Taylor-Robinson, & Thomas, 2002); patients with neurological disorders such as multiple sclerosis (MS; Goretti, Portaccio, Zipoli, Razzolini, & Amato, 2010; Rabinowitz & Arnett, 2009), focal epilepsy (Meneses, Pais-Ribeiro, da Silva, & Giovagnoli, 2009), and stroke (Nys et al., 2006); and patients with schizophrenia (Matsui, Sumiyoshi, Arai, Higuchi, & Kurachi, 2008; Meyer, 2001).

Germane to the present study, there is strong evidence that Veterans across all theatres also have self-reported lower QOL following combat exposure (Bookwala, Frieze, & Grote, 1994; Forman-Hoffman et al., 2005; Ikin et al., 2009; King-Adams, 2008; Lunney & Schnurr, 2007; Mowad, 2004; Schnurr, Lunney, Bovin, & Marx, 2009; Zatzick, Marmar, et al., 1997; Zatzick, Weiss, et al., 1997). Taken together, these findings suggest that there may be a link between neuropsychological functioning and QOL in OEF/OIF Veterans.

Quality of Life in Veterans

There is no single manner to measure QOL, nor is there universal agreement upon the definition. Despite these discrepancies, it is important to note that there are two general approaches to QOL; health QOL, which focuses on physical well-being, and person-centered QOL, which can be generally described as a multidimensional construct in which an individual perceives the extent to which their physical, material, emotional and social well-being needs are met (Murrell, 1999). This study focuses on the latter.

There are numerous scales used to measure QOL including health-based measures, scales based on a specific disorder, as well as measures that family members or others close to the patient complete (Murrell, 1999). The scale used largely depends on a few factors, which include patient's cognitive functioning, communication ability, structural damage to the central nervous system, as well as emotional state. The presence or combination of mental and/or physical illness complicates measurement, due to difficulty of determining the validity of responses, especially from the patients' perspective. For example, pain tolerance may differ between patients with similar injuries, in that some may be more tolerant and report a lower subjective pain rating than

those that are less tolerant, when objective rating would be the same. Considering this, one of the most important factors in a QOL scale is sensitivity to change due to the dynamic nature of perceived QOL (Murrell, 1999). QOL is affected in a variety of ways by countless sources, including physical illness, isolation, cognitive functioning, and unemployment, among others. In Veterans, major sources of poor QOL include diagnoses such as PTSD, TBI, depression, deployment stress, as well as physical health problems, which will be discussed below. As mentioned previously, there are many facets that contribute to a working definition of QOL, which will be covered in this section within the context of the Flanagan Quality of Life Scale (Burckhardt & Anderson, 2003; Flanagan, 1978, 1982). While Veterans are likely affected by all aspects of QOL as described by Flanagan (1978, 1982), only a few categories, as they relate to this study will be reviewed.

Flanagan (1978, 1982) defined QOL as consisting of five categories including material and physical well-being, relationships with other people, social and community activities, personal development and fulfillment, as well as recreation. All five of these categories are influenced by factors that affect many Veterans. For example, in the first category of material and physical well-being, how a Veteran rates his/her financial security and access to disposable income are essential factors (Flanagan, 1978, 1982). Applicable to this category, many Veterans experience homelessness, which leads to risk factors related to physical well-being including lack of shelter, exposure to the elements, poor nutrition, and increased risk for physical assault (Sullivan, Burnam, Koegel, & Hollenberg, 2000). In 2009, it was estimated that on any given day 106,558 Veterans, from any combat theatre are homeless (Perl, 2011). Additionally, in 2009 the U.S.

Department of Veterans Affairs (VA) reported that nearly 2,300 OEF/OIF Veterans had been assessed for its Health Care for Homeless Veterans Program (Perl, 2011; Tanielian & Jaycox, 2009). The issue of unemployed Veterans, often closely related to homelessness, has been linked to a variety of causes, similar to the risk factors for homelessness, including PTSD, which will be discussed further below (Zatzick, Marmar, et al., 1997). Additionally, many Veterans also experience a multitude of health problems after returning from combat, including mental and physical health and exposure to drugs and alcohol that affect many components of QOL (Goldstein, Luther, Haas, Appelt, & Gordon, 2010; Goldstein, Luther, Haas, Gordon, & Appelt, 2009).

Relationships with others are also important in maintaining healthy QOL. Due to many factors, relationships that Veterans have with family or friends can become strained and problematic. Symptoms of disorders including PTSD, TBI, depression, and adjustment disorder have been known to interfere with emotional intimacy, especially difficulties in relating to others, and have even shown to increase the risk of intimate partner violence (Tanielian & Jaycox, 2009). In addition to this, the stress of caregiver burden, the high level of physical, emotional, and financial stress experienced by someone caring for another, can also interfere with a relationship dynamic, further decreasing perceived QOL.

In a final, and important facet of QOL, many Veterans find themselves with decreased ability or desire to participate in recreational activities, whether the impairment is caused by a physical ailment, such as a missing limb or illness, or a psychological impairment. Common impairments include reduced attention and disinterest, which is often seen in Veterans diagnosed with PTSD and/or Depression. It is important to note

that disinterest or reduced attention can also affect the ability to relate with others, which can cause additional difficulty in the "relationships with others" category of QOL.

All of the facets discussed that relate to QOL can be affected by similar events, such as impaired neuropsychological performance, which is of great concern with Veterans returning from combat with a variety of diagnosed, or undiagnosed, disorders.

Common Neuropsychological Problems in OEF/OIF Veterans

The OEF/OIF combat theatres are creating a new generation of Veterans with injuries that have not been diagnosed as commonly before. This includes the incidence of mild TBI, which is increasingly seen, largely due to improvements in protective armor and increased use of intermittent explosive devices (IED), as well as multiple deployments that also have shown to have negative effects on neuropsychological functioning and overall well-being (Belanger, Spiegel, & Vanderploeg, 2010; Jefferson, 2009; Moore & Jaffee, 2010; Taber, Warden, & Hurley, 2006; Vasterling et al., 2006; Vasterling, Verfaellie, & Sullivan, 2009). Interestingly, this theatre has brought attention to an old issue with renewed vigor: the dual diagnosis of mild TBI and PTSD. There are a number of factors that can affect neuropsychological functioning in Veterans, which in turn affect all categories of QOL, including deployment itself. Vasterling and colleagues (2006) found that the stress from deployment alone can have a negative impact on soldiers in general, including attention difficulties (CPT), verbal and visual memory difficulties (WMS-III) as well as reaction time enhancement on tasks (ANAM), which translates to hypervigilance. This suggests that a psychiatric diagnosis is not necessary in and of itself, as these neuropsychological deficits that are common among these diagnoses may cause substantial problems without a Veteran meeting criteria for a

psychological disorder. It is important to note, that while diagnoses may be common in returning Veterans, most are resilient, so psychological disorders are seen in a significant minority of Soldiers returning from combat.

In addition to lasting effects of stress from deployment, active duty military personnel returning from combat frequently meet diagnostic criteria for a number of disorders that have neuropsychological sequelae. These include PTSD, which occurs following a traumatic event, during which an extreme stress reaction occurs. Psychological symptoms include hyperarousal, avoidance of stimuli that remind the patient of the traumatic event, and re-experiencing of the traumatic event (American Psychological Association [APA], 2000). Another disorder, TBI, can be categorized into three types - mild, moderate, and severe. Each diagnosis increases in severity of symptomatology from mild with no loss of consciousness with 30-100% likelihood of remission of symptoms within months, to severe, where a patient may be rendered comatose (French, Spector, Stiers, & Kane, 2010; Hicks, Fertig, Desrocher, Koroshetz, & Pancrazio, 2010; Keltner & Cooke, 2007; Kwok, Lee, Leung, & Poon, 2008; Moore & Jaffee, 2010). There is also a high incidence of alcohol and other drug use in active duty military, especially following return home from combat (with current use rates in one study reported at 45.7-60.5% for alcohol, 2.4-5.7% for cannabis, and 0-2.4% for cocaine use; Graham & Cardon, 2008). In addition to high rates following return home, there is a high incidence of SUD comorbid with Axis I diagnoses (Brady, 1997; Graham & Cardon, 2008). Finally, depression is commonly diagnosed in returning combat Veterans, and is often comorbid with PTSD and anxiety (Ginzburg, Ein-Dor, & Solomon, 2010). What

complicates these diagnoses further is a common and strong comorbidity, as well as symptom overlap, often seen between all of them.

As mentioned previously, all of these disorders negatively affect QOL outcome, partially by their impact on neuropsychological functioning. PTSD is often accompanied by neuropsychological sequelae that cause difficulties for Veterans in their instrumental activities of daily living (IADLs). These generally include attention difficulties, memory impairments, and executive functioning deficits, which many daily life tasks are dependent upon, including tasks such as taking medication correctly and remembering what items to purchase at the grocery store (Vasterling & Brailey, 2005). It is of note that research has indicated that memory deficits seen in Veterans may be due to poor attention because of difficulties with initial acquisition of information (Vasterling, Brailey, Constans, & Sutker, 1998). In TBI, there are many conflicting results as to specific neuropsychological findings in Veterans; however, the most consistent deficits seen include memory, attention and executive function when compared to normal controls (Vanderploeg, et al., 2005; Vasterling, Constans, & Hanna-Pladdy, 2000; Vasterling, et al., 2009). As with PTSD, these impairments can negatively affect Veterans by interfering with daily tasks that may ultimately lead to an inability to function without the aid of a caregiver, or at least cause some difficulty in their IADLs (Hawthorne, Kaye, Gruen, Houseman, & Bauer, 2011).

In regards to SUDs, different drugs affect users differently and it is difficult to briefly review specific neuropsychological findings by drug of choice (Fernández-Serrano, Pérez-García, Río-Valle, & Verdejo-García, 2010). Additionally, patients are often classified as polysubstance users, complicating effects further. In the general

population, studies have found that there are common deficits of executive function, especially in the planning and set-shifting domains as well as deficits in short-term memory and verbal skills (Medina, Shear, & Schafer, 2006; Paraherakis, Charney, & Gill, 2001; Rosselli & Ardila, 1996; Vik, Cellucci, Jarchow, & Hedt, 2004). SUDs cross a variety of diagnoses and present unique problems that are beyond the scope of this study. However, the negative effects that SUDs have on the patient and their family can lead to isolation and unemployment along with many other repercussions that negatively impact QOL.

Finally, in patients diagnosed with depression, common neuropsychological deficits include low verbal fluency scores, poor set-shifting ability and planning, as well as increased perseveration errors on tasks (Elliott, 1998; Henry & Crawford, 2005; Porter, et al., 2007), all of which can be categorized as executive functions. The problems that these deficits cause Veterans can interfere profoundly by rendering them unable to obtain and maintain a job, even beyond the difficulty caused by the cognitive problems themselves. For example, inflexibility and irritability can lead to job difficulties, as well as interpersonal problems that go beyond job performance and relationships with others.

As will be discussed later, neuropsychological functioning has been related to QOL in other studies; however, the mechanism by which these may be related has yet to be explored.

Neuropsychology and Quality of Life

Often, neuropsychological difficulties are reported indirectly and are only inferred to affect QOL outcomes. However, of the few studies that have explored the impact

indicate that a positive relationship exists between neuropsychological deficits and reduced perceived QOL (Anderson, Brown, Newitt, & Hoile, 2011; Wallin et al., 2009). For example, in children who sustained a TBI, QOL in adulthood has been found to be related to severity of TBI sustained, indicating that lower IQ, measured by the WAIS-III, is predictive of poorer subjective QOL in adults (Anderson, et al., 2011). This study also determined that, even though overall IQ was within the normal range, many of the participants, when children, did require assistance in school. It is of note that QOL outcome was related to intellectual functioning, as well as injury severity. In other words, the lower the IQ as well as severity of the injury predicted poorer QOL outcome. Although lower IQ predicted poorer QOL outcome, there may be an intervening mediator variable, such as coping, which would indicate that persons with a lower IQ may adopt less efficacious coping styles, and therefore have a reduced QOL outcome.

Interestingly, in a longitudinal study comparing individuals across age groups, researchers found that perceived forgetfulness was related to lowered QOL satisfaction with young to middle-aged participants, but not in elderly individuals (Mol, van Boxtel, Willems, Verhey, & Jolles, 2009). This was likely due to an increase in symptoms of depression and anxiety about their subjective memory difficulties. In breast cancer survivors, researchers found that subjective cognitive complaints as well as objective neuropsychological test performance, including immediate memory (WMS- III, AVLT), delayed memory (WMS-III, AVLT), processing speed (TMT), and verbal fluency (COWA), is associated with self-reported emotional well-being 12 months post-chemotherapy (Reid-Amdt, et al., 2010). Similarly, in a sample of patients with focal epilepsy, researchers found that Verbal Fluency (Semantic Fluency), overall IQ (I.A.

Test), and Attention (Attentive Matrices) were the best neuropsychological indicators of QOL outcome, measured by the Portuguese version of the Short Form Health Survey (SF-36), a measure used as part of the International Quality of Life Assessment Project (IQOLA; Meneses, et al., 2009). It is also of note that memory deficits were associated with lower QOL scores in every domain, with the exception of mental health functioning.

In a Dutch, United Nations peace-keeping mission Veteran cohort, researchers determined that cognitive functioning had a direct relationship with social and occupational functioning (Geuze, Vermetten, De Kloet, Hijman, & Westenberg, 2009). Geuze and colleagues (2009) obtained a cohort of 25 Veterans with and 25 Veterans without PTSD diagnoses. Participants were given a neuropsychological battery consisting of Dutch version measures of verbal learning (AVLT), verbal memory (CVLT), logical memory (WMS-R), as well as visual memory (WMS-R). Social and occupational functioning were measured using selected items from the Clinician-Administered PTSD Scale (CAPS) and the SF-36. Overall, results indicated that Veterans with a diagnosis of PTSD has significantly poorer performance on measures of learning, and immediate and delayed recall in all types of verbal material they were tested with, than those without PTSD. Additionally, patients with both PTSD and emotional problems reported more difficulty in social and occupational functioning (if they were employed) or greater impairment in other areas of functioning if they were not employed. Of note, Veterans with PTSD were less likely to be working than Veterans without PTSD in the study. In conjunction with this study, another study found that symptoms of many Axis I disorders, including Dysthymic Disorder, have also been found to affect

psychosocial functioning in returning OEF/OIF Veterans (Pietrzak, Goldstein, Malley, Rivers, & Southwick, 2010).

These results are not surprising. Of specific concern to impact on QOL are the cognitive effects of many disorders that affect Veterans, because a relationship between neuropsychological functioning and social functioning has been established (Geuze, et al., 2009).

Coping Styles and Quality of Life

Coping can be defined generally as cognitive and behavioral methods for lessening negative feelings associated with stress and are used for one of two purposes: 1) to regulate emotional states, or 2) for problem solving functions (Folkman & Lazarus, 1980). There are two categories of coping styles that this study focuses on; action-focused coping (also referred to as active, problem-focused and positive coping strategies), which include active coping behaviors targeted at changing the source of a stressor, and emotion-focused coping (also sometimes referred to as avoidant coping and negative coping) which is used to regulate emotional response to a stressor (Folkman & Lazarus, 1980). As with other components of this study mentioned previously, there is a small pool of literature to draw upon that looks specifically at coping styles and QOL outcome.

One relevant study that utilized a cohort of patients with Parkinson's disease (PD) found that patients who used diversion as well as emotional coping strategies, tended to have a poorer QOL outcome (Montel, Bonnet, & Bungener, 2009). Because there are a number of neuropsychological symptoms associated with PD, it is likely that that

neuropsychological dysfunction is also likely to be involved in the relationship between type of coping style adopted and QOL outcome.

On the other hand, Wallin and colleagues (2009) found that Gulf War Veterans that achieved test scores within a normal range, still reported experiencing negative symptoms and tended to report lower QOL. Their extensive neuropsychological battery included reading level (WRAT-III), processing speed (WAIS-III), vigilance (CPT), working memory (WAIS-III, PASAT), learning (CVLT-II), memory (CVLT-II), verbal fluency (Thurstone fluency), problem solving (WAIS-III, WCST), cognitive flexibility (TMT), and motor functioning (Grooved Pegboard). These findings may relate to the above study by Vasterling and colleagues (2006) that indicated deployment itself may have a negative impact on cognitive functioning. Even though Wallin et al. (2009) indicated that their sample had normal scores on the neuropsychological battery were within the normal range, that is not to say that the scores may be lower than their pre-combat functioning, still causing subjective lowered QOL functioning. This is similar to Vasterling and colleagues (2006) who found that, while psychological symptoms may not reach diagnostic levels, they can still have a negative impact on Veterans.

In sum, studies have shown that increased use of active, problem-focused coping strategies and decreased use of emotion-focused coping strategies lead to long-term improvement in QOL overall (Wolters, Stapert, Brands, & Van Heugten, 2010).

Neuropsychology and Coping Styles

Studies that focus on coping strategies have found that patients with neuropsychological deficits, specifically in substance abuse treatment settings, tend to have greater difficulty utilizing coping styles that assist in the maintenance of sobriety

following treatment. This likely leads to increased likelihood and severity of relapse as compared to others with no neuropsychological deficits (Cooney, Kadden, Litt, & Getter, 1991; Kadden, Cooney, Getter, & Litt, 1989; Tapert, Ozyurt, Myers, & Brown, 2004). One particular study that looked at the effects of overall IQ on acquisiton of coping skills found that, regardless of treatment received, participants who scored above the median of the sample saw more improvement in quality of coping styles than those who scored below the sample median (Kiluk, Nich, & Carroll, 2011). Furthermore, studies have consistently found that patients who perform poorly on sustained attention and executive functioning tasks tend to develop more maladaptive, emotion-focused coping strategies (Goretti, et al., 2010; Krpan, Levine, Stuss, & Dawson, 2007). Considering the effects that the aforementioned "common" disorders Veterans are diagnosed with have on neuropsychological functioning, this paradigm translates well to a Veteran population.

It has been established that neuropsychological abilities, such as memory, can affect how someone learns, adopts, and ultimately utilizes different coping strategies. Although there is very little available research done on the *direct* effects of neuropsychological dysfunction and the adoption of specific types of coping strategies, and is virtually nonexistent in Veterans, there is evidence that a relationship exists. For example, in one cohort of MS patients, patients with deficits in the domains of attention and executive functioning were less likely to adopt action-focused coping strategies, and therefore, more likely to adopt emotion-focused coping strategies (Goretti, Portaccio, & Zipoli, 2009; Goretti, et al., 2010). In conjunction with the findings of Goretti and colleagues (2010), other studies have shown that in patients with TBI, executive functioning, which includes planning, working memory, and utilization of strategy,

contributes to the use of action-focused coping (Krpan, et al., 2007). It is of note that Krpan and colleagues (2007) only found this relationship to be evident in a group of TBI patients; the control group demonstrated no relationship between executive functioning and coping styles adopted. Both of these studies suggest that, in patients with neuropsychological dysfunction, level of cognitive functioning plays a role in the quality of coping style used.

Coping Styles as a Mediator

Taken with the information presented above, neuropsychological deficits may only have an indirect impact on QOL by affecting type of coping styles used, which would then be considered a mediator of the relationship. There has been very little research performed exploring coping styles as mediators of neuropsychological function and QOL outcomes. However, this meditational model has been tested, and supported, in a cohort of patients with MS. Rabinowitz and Arnett (2009) suggested that action-focused coping strategies protected patients with MS from developing depression (QOL outcome variable) related to cognitive deficits, however, when patients used emotion-focused coping strategies, any type of cognitive dysfunction evident increased the risk of depression.

It is of note that, in an MS population, there is an added component of physical disability, which significantly impairs many areas of life functioning including ability to maintain employment and other daily living and social activities which undoubtedly affects QOL. However, this does not discount the effect of neuropsychological impairment.

This specific paradigm, coping styles moderating the relationship between neuropsychological function and QOL outcome, has never been tested in a Veteran population. However, the previously reviewed studies have provided evidence that cognitive functioning affects coping styles used, and, because coping styles can aid or inhibit the management of symptoms, QOL is ultimately affected.

Primary Investigative Goal

The relationship between neuropsychological functioning and QOL outcomes has been established in a variety of patient groups, as discussed previously. However, the knowledge that neuropsychological functioning is difficult to rehabilitate once it is lost has also been well established in the literature (Halligan & Wade, 2005; Sohlberg & Mateer, 2001). Because of this, many treatments that focus on cognitive rehabilitation may be insufficient for a variety of reasons, including length of time needed for rehabilitation as well as the looming knowledge that cognitive abilities may never be restored to premorbid functioning. In an MS patient group, research indicated that coping styles may act as a mediator between neuropsychological functioning and QOL outcome, which indicates that treatment may be more efficacious if it is focused on the acquisition of effective coping styles (Rabinowitz & Arnett, 2009). In other words, if adaptive and efficacious coping styles are in use, neuropsychological functioning may have little impact on improvement of QOL outcome. Therefore, a patient may benefit by treatment focusing on the acquisition of an efficacious coping style as a primary goal, cognitive rehabilitation as a secondary goal, and improved QOL outcome as an ultimate goal.

Both mediation and a moderation models were tested with each of the neuropsychological functions and coping styles. It is important to look at both since they may produce different statistical and conceptual relationships between the variables, and other studies have found both mediation and moderation models to illustrate the relationship between neuropsychological deficits and QOL outcome with coping styles affecting the relationship. For instance, moderation results from Rabinowitz and Arnett (2009) suggested that the relationship between cognitive dysfunction and depression, which was used as a QOL indicator, was dependent on coping style, in that adaptive coping likely protected patients from experiencing depression related to cognitive deficits. This is different from mediation, which would suggest that neuropsychological impairment leads to maladaptive coping, which then leads to poorer QOL.

It was expected that, because of the neuropsychological symptom overlap seen in both MS patients and many Veterans, the use of action-focused coping styles by OEF/OIF Veterans would lead to improved QOL outcome when neuropsychological deficits, regardless of how they were acquired (e.g., TBI, PTSD, SUD, etc.), are present. Alternatively, it was also hypothesized that emotion-focused coping styles in Veterans would lead to poorer QOL outcome when neuropsychological deficits are present.

CHAPTER TWO

Methods and Measures

Participants

Participants were 21 (14.7%) women and 115 (80.4%) men ages 22 to 66 (M = 37.54, SD = 10.57), who are OEF/OIF Veterans currently enrolled in Project Study Evaluating Returning Veteran's Experiences (SERVE) at the Central Texas Veterans Health Care System. A variety of races were represented, as well as varying levels of education (M_{years} = 14.14, SD = 2.51) and all branches of military service ($M_{deployments}$ = 2.16, SD = 1.34), as illustrated in Table 1.

Additionally, there were varying percentages of participants that performed at a level considered to be impaired, 1.5 standard deviations below the mean, on neuropsychological measures, as illustrated in Table 2.

Finally, several participants met criteria for one or more psychological disorder, which is illustrated in Table 3. Global Axis of Functioning (GAF) Scores in the sample ranged from 35 to 95 (M = 57.05, SD = 13.78).

Instruments

Premorbid Intellectual Functioning

Word Reading - Wide Range Achievement Test – fourth Edition (WRAT-4; Jastak & Jastak, 2006): The Word Reading subtest of the WRAT-4 is a brief, 2-minute test of reading achievement. Participants are given a list of words and asked to read them. It is widely used as a measure of premorbid intellectual functioning as it has been

Table 1
Race, Education, and Branch of Service Sample Demographics

Demographic	N	% of Participants
Race		
White/Caucasian	85	63.4
Hispanic – Cuban	2	1.4
Hispanic – Mexican	21	14.7
Hispanic – Puerto Rican	8	5.6
Hispanic – Spanish/Basque	2	1.4
Hispanic – Other	5	3.5
American Indian/Alaska Native	3	2.2
Asian/Asian American	5	3.7
Black/African American	26	19.4
Hawaiian/Pacific-Islander	1	.07
Other	14	10.4
Education		
High School Diploma/GED	21	14.7
Some College, No Degree	55	38.5
Technical School Certification	3	2.1
Bachelor's Degree	19	13.3
Some Graduate School	2	1.4
Graduate Degree	18	12.6
Branch of Service		
Air Force	6	4.3
Army	111	79.9
Marine Corps	11	7.9
National Guard	20	14.4
Navy	9	6.5
Current Reserve Status	60	43.2

found to remain stable over the lifetime, and is highly resilient to psychiatric problems and traumatic brain injury (Orme, Johnstone, Hanks, & Novack, 2004). Word Reading was used as a covariate for premorbid intellectual functioning. The word reading standard score was used to represent premorbid intellectual functioning in data analysis.

Neuropsychological Functioning

Verbal Fluency was measured using the Controlled Oral Word Association Test (COWA; Benton & Hamsher, 1989; Lezak, Howieson, & Loring, 2004): The COWA is a

Table 2
Neuropsychological Measure Means and Impairment Percentages

Neuropsychological Measure	*M*	*SD*	% Impaired
Word Reading			
Standard Score	96.93	11.58	0.6
COWA			
Total Words Correct	36.20	10.03	5.0
CVLT-II			
Long Delay Free Recall – Scaled Score	9.74	3.18	5.8
Digit Span Forward			
Scaled Score	8.94	2.64	10.4
Digit Span Backward			
Scaled Score	9.20	2.27	3.1
SCWT			
Interference Score	54.66	17.09	10.1

Note: Standard Scores have a mean of 100 and standard deviation of 15 and Scaled Scores have a mean of 10 with a standard deviation of 3.

test of verbal fluency, which is the speed and ease of verbal production. The COWA consists of three word-naming trials. Participants are asked to say as many words as they can think of that begin with a specified letter of the alphabet excluding proper nouns, numbers, and a word they have already said with a different suffix within 60 seconds. Verbal fluency is sensitive to many different conditions, including diffuse axonal injury (Vilkki, Holst, Öhman, Servo, & Heiskanen, 1992) and frontal lobe injury (Butler, Rorsman, Hill, & Tuma, 1993). Total words correct number was used to represent verbal fluency in data analysis.

Verbal Memory was measured using the California Verbal Learning Test – Second Edition (CVLT-II; Delis, Kramer, Kaplan, & Ober, 2000): The CVLT-II assesses the use of semantic associations as a strategy for learning words. Sixteen words that correspond to four different categories, including animals, furniture, methods of transportation, and vegetables, are presented. Category items are read in a randomized

Table 3
Current and Lifetime Psychiatric and TBI Diagnoses

Diagnosis	Current/Lifetime	N	% Participants
Acute Stress Disorder	Lifetime	2	1.4
Adjustment Disorder	Lifetime	7	4.8
Agoraphobia	Lifetime	9	6.2
Anxiety Disorder NOS	Current	9	6.2
	Lifetime	23	15.9
Bipolar I Disorder	Lifetime	3	2.1
Bipolar II Disorder	Lifetime	1	.7
Major Depressive Disorder	Current	3	2.1
	Lifetime	73	50.3
Obsessive Compulsive Disorder	Lifetime	7	4.8
Other Disorder - Unspecified	Lifetime	4	2.8
Panic Disorder	Lifetime	11	7.6
Posttraumatic Stress Disorder	Current	59	44
	Lifetime	89	66.3
Psychotic Disorder	Lifetime	1	.7
Social Phobia	Lifetime	10	6.9
Specific Phobia	Lifetime	6	4.1
Alcohol Use Disorder	Current	32	22.1
	Lifetime	71	49.0
Cannabis Abuse	Current	2	1.4
	Lifetime	14	9.7
Cocaine Abuse	Current	1	.7
	Lifetime	2	1.4
Cocaine Dependence	Lifetime	3	2.1
Hallucinogen Abuse	Current	0	0
	Lifetime	2	1.4
Hallucinogen Dependence	Lifetime	6	4.1
Opioid Abuse	Current	0	0
	Lifetime	1	.7
Opioid Dependence	Lifetime	2	1.4
Sedative Abuse	Current	1	.7
	Lifetime	1	.7
Sedative Dependence	Lifetime	1	.7
Stimulant Abuse	Current	0	0
	Lifetime	9	6.2
Stimulant Dependence	Lifetime	2	1.4
Traumatic Brain Injury	Lifetime	67	48.2

order by the examiner with 1 second in between words. Participants are then asked to recall the words in any order, which assesses the use of semantic associations. Following five immediate recall trials, a distractor trial is presented in the same manner. The participant is then asked to recall all words they can remember from the first list in a short-term memory trial, and then recall all words from the first list in separate categories. This is then separated by a 20-minute break, where they are asked to do the same in a long-term recall trial. There is also a recognition and optional forced-choice trial. Both the short-term and long-term total recall trials were used as variables. The CVLT-II tends to be resilient to most brain disorders, however, has been found to be sensitive to frontal lobe injuries (Baldo, Delis, Kramer, & Shimamura, 2002). The number of words correct from the short- and long-delay free recall portions represented short- and long-term verbal memory in data analysis.

Attention was measured using Digit Span Forward (DSF; WAIS-IV; Wechsler, 2008): Digit Span Forward (DSF) is a task in which a sequence of numbers, in increasing length, is read to a participant whose task is to repeat each sequence exactly as it is given. When a sequence is repeated correctly, the examiner reads the next longer number sequence and continues until the participant fails a pair of sequences or repeats the highest. DSF is closely related to the efficiency of attention and is converted from raw scores into standard scores. A DSF of six or more is considered normal, five is marginal to normal, four is borderline, and three or less is deficient. DSF has been found to be resilient to many brain disorders, however has been found to be sensitive to multiple traumatic brain injuries (Matser, Kessels, Lezak, Jordan, & Troost, 1999). The DSF scaled score was used in data analysis.

Working Memory was measured using Digit Span Backward (DSB; WAIS-IV; Wechsler, 2008): Digit Span Backward (DSB) is a task in which a sequence of numbers, in increasing length, is read to a participant whose task is to repeat each sequence in exactly reversed order. When a sequence is repeated backwards correctly, the examiner reads the next longer sequence and continues until the participant fails a pair of sequences or completes the highest. A DSB of four to five is considered normal, and three or less is borderline impaired or impaired, depending on level of education completed. The task requires mental double-tracking, because both memory and reversing operations have to be conducted simultaneously. DSB is sensitive to many different disorders, and tends to be worse with increasing severity of damage (Leininger, Gramling, Farrell, Kreutzer, & Peck, 1990). The standardized score for digits backwards represented working memory in data analysis.

Processing Speed was measured using the Trail Making Test (TMT; Reitan, 1958): The TMT is a test of scanning and visuomotor tracking, divided attention and cognitive flexibility. It is given in two parts: A and B. For part A, the participant is asked to draw lines that connect consecutively numbered circles on one work sheet and is encouraged to work as quickly as they can without lifting their writing utensil from the sheet of paper. For part B, the participant is asked to connect the same number of consecutively numbered and lettered circles, alternating between the two sequences, on one worksheet. The TMT has been found to be sensitive to TBI (Larson, Kaufman, & Perlstein, 2009) and PTSD (Moradi, Neshat-Doost, Taghavi, Yule, & Dalgleish, 1999). The ratio score of Time B/Time A was used to represent processing speed.

Inhibition was measured using The Stroop Color and Word Test (SCWT; Golden, 1978; Stroop, 1935): The SCWT is considered a test of response inhibition, selective attention, and/or response conflict (Zajano & Gorman, 1986). The Golden (1978) version of the SCWT presents participants with 3 trials; one, where the participant is asked to read a list of 100 names of colors, written in black ink, a second in which the participant is asked to name 100 printed colors, and a final trial in which the participant is asked to read 100 color words printed in ink of different colors. The SCWT has been found to be sensitive to closed head injury, with good recovery within two to five years following injury (Larson, et al., 2009), as well as frontal lobe injury (Hyafil, Summerfield, & Koechlin, 2009). Inhibition was measured by the SCWT interference score in analysis, obtained by subtracting the time of trial one from the time of trial three.

Mediation Measure

Brief COPE (Carver, 1997): The Brief COPE is a 28-item self-report inventory that assesses 15 behavioral and cognitive coping strategies, including self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame. It is rated on a four-point likert scale, ranging from "I haven't been doing this at all," scored as 1 to "I have been doing this a lot," scored as 4. The Brief COPE has been found to have good reliability with correlations ranging from $r = .58$ to .72 within subscales, as well as good internal consistency with α of .72-.85 in each subscale (Cooper, Katona, & Livingston, 2008). A principal components analysis (PCA) and confirmatory factor analysis (CFA) were conducted to determine second-order factor structure of the Brief COPE, as will be discussed below.

Outcome Measure

Quality of Life Scale (QOLS; Burckhardt & Anderson, 2003): The QOLS is a 16 item self-report inventory that asks how satisfied people are in regards to 5 areas distinct from health status based on the domains of QOL described by Flanagan (1978, 1982). These domains include: material and physical well-being, which takes into account material comforts and conveniences, financial security, as well as good health and personal safety; relationships with other people, including relationship with spouse, friends, colleagues, and ability to parent; social, community, and civic activities are activities that are related to helping others and activities that are related to local or national government; personal development and fulfillment refers to intellectual development, personal understanding, having an occupation, creativity and personal growth, as well as socializing, and; recreation which includes involvement in passive and observational activities as well as active and participatory activities (Flanagan, 1978, 1982).

The QOLS is rated on a seven-point likert scale, ranging from "Terrible," rated as 1, to "Delighted," rated as 7, and is scored from a range of 16 to 112. It has been found to have good reliability and validity from the perspective of a patient, with an internal consistency of (α = .82 to .92) with high test-retest reliability over 3 weeks (r = 0.78 to r = 0 .84) and has been shown to be sensitive to change (Burckhardt & Anderson, 2003; Burckhardt, Woods, Schultz, & Ziebarth, 1989). Total score on the QOLS (M = 73.20, SD = 19.20) was used in data analysis for the outcome variable. It is of note that the range on the QOLS in this sample was 32-109.

Data Analysis

Factor Analysis of the Brief COPE

PCA was used to determine higher-order factor structure of the Brief COPE. Other studies have determined a higher-order factor structure for the original 60-item COPE, however, this has not been reported for the Brief COPE (Hasking & Oei, 2002). PCA was used to determine the number of factors as well as the correlated variables within the factor structure. CFA was used to test the fit of the model indicated by PCA. Because this sample size was under 200 and the factors were not nested, utilizing the chi-square statistic was contraindicated (Kline, 2005). However, Akaike information criterion (AIC) values can be used to compare non-hierarchical models, with lower values indicating a better fit (Akaike, 1974, 1987).

Mediation Analysis

Outcomes were assessed using a statistical mediation analysis, as described by Baron and Kenny (1986), in which regression is used (Baron & Kenny, 1986; Fairchild & MacKinnon, 2009). In steps 1-3 a zero-order relationship is established between variables. If one or more of the relationships are not significant, it is concluded that mediation is not likely. Step 1 involves simple regression analysis with neuropsychological function (X) predicting QOL (Y) to test for path c; Step 2 is done by performing a simple regression analysis with IV predicting the mediator, coping style (M) to test for path a, and; Step 3 involves simple regression analysis with M predicting Y to test for path b. If there are significant relationships in steps 1-3, step 4 is performed which is a multiple regression analysis with X and M predicting Y (c′).

A mediation effect is supported if the effect of M is significant after controlling for X. If X is no longer supported when M is controlled, the findings support a full mediation. If X is still significant when M is controlled the finding supports partial mediation.

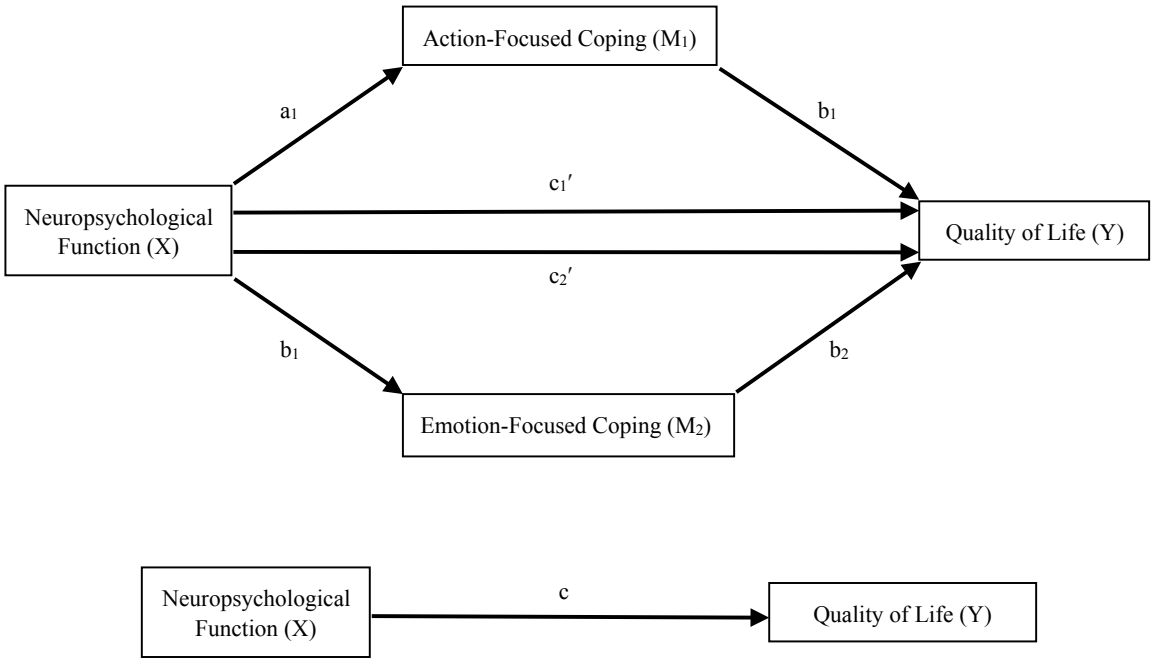

Figure 1. Mediation model with coping styles acting as a mediator for the relationship between neuropsychological functioning and QOL outcome.

Indirect effects were tested using a nonparametric bootstrapping procedure recommended by MacKinnon (MacKinnon, 2000; MacKinnon, Fairchild, & Fritz, 2007), that Preacher and Hayes have expanded upon further and developed a macro for use in SPSS. This procedure is used to estimate the sampling distribution of the indirect effect by taking *k* samples of size *N* (the original sample size) from observed data, with replacement and then calculating the indirect effect on each sample (Biesanz, Falk, & Savalei, 2010; Preacher & Hayes, 2004, 2008). If the confidence interval does not

include 0, then the p-value is deemed to be less than or equal to 0.05, and the effect is said to be significant. A multiple mediation model was not supported, and thus not tested, since action-focused and emotion-focused coping strategies were determined in the exploratory factor analysis to be unrelated (r = -.06, *ns*), and therefore any effect of one over and above the other would not be supported.

Moderation Analysis

Moderation was tested using the methods recommended by Aiken and West (1991) for all variables that had a significant mediated relationship. Moderation assesses whether the strength of a relationship between two variables is dependent on a third variable.

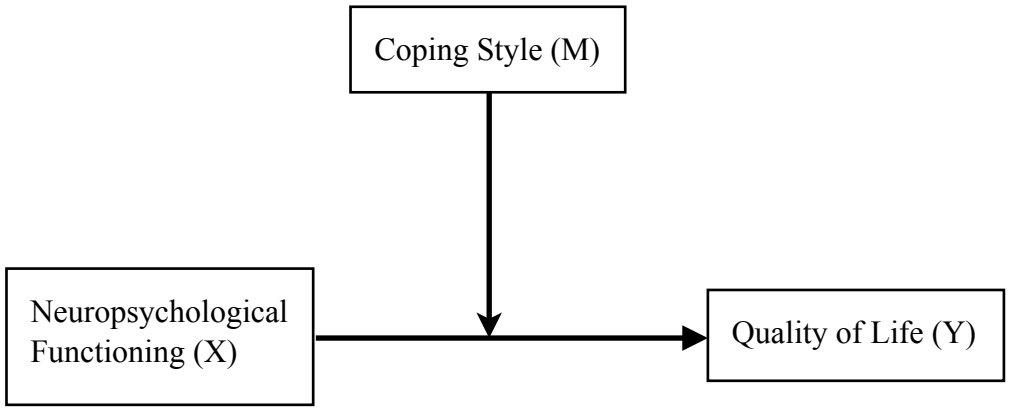

Figure 2. Moderation model with coping style as a moderator for the relationship between neuropsychological functioning and QOL outcome.

In a moderation model, the variables are centered by subtracting the mean of each variable, and then the centered variables are entered into a hierarchical regression equation as follows; independent variable, moderation variable, and then a final interaction variable, independent variables multiplied by the moderator. The model is

considered to be fully moderated if the initial equation becomes nonsignificant when the interaction variable is included. Analysis was done using SPSS, and interaction terms were to be interpreted using ModGraph, which is a program that computes cell means for the graphic display of moderation analyses (Jose, 2008).

CHAPTER THREE

Results

Factor Analysis of the Brief COPE

In almost all cases, the 14-factor model has shown to be superior to both 3-factor and 4-factor models. For simplicity in the data analysis, a second-order factor model was adopted. PCA indicated a 3-factor solution for the Brief COPE, which is congruent with research performed with an alcohol dependent sample using second-order factors of the original 60-item COPE (Hasking & Oei, 2002). However, only one of the original 14-factors (Humor; $r = .43$) loaded onto the third factor, but loaded similarly onto the first factor ($r = .41$) thus a two-factor model was adopted for data analysis, which were categorized as action-focused coping and emotion-focused coping (see Table 4).

CFA was used to test the fit of the model indicated by PCA. Because this sample size was under 200 and the factors were not nested, using the chi-square statistic from confirmatory factor analysis was contraindicated (Kline, 2005). However, as mentioned previously, the AIC is a measure of the relative goodness of fit of a statistical model and can be used to compare non-hierarchical models, with lower values indicating a better fit (Akaike, 1974, 1987; Burnham & Anderson, 2004). As hypothesized, the AIC was lower for the two-factor hypothesized model (AIC = 4072.74) than it was for the comparison single-factor model (AIC = 4122.78). Therefore, the two-factor model was adopted. Notably, modification indices signified that significant chi-square was due to high internal consistency between factors that were related within the constructs including

Table 4
Principal Components Analysis of the Brief COPE

	Component 1	Component 2
Active Coping	.80	.10
Planning	.78	.01
Positive Reframing	.82	-.03
Acceptance	.66	.07
Humor	.41	-.05
Religion	.53	.05
Emotional Support	.72	-.02
Instrumental Support	.72	.19
Self-Distraction	.42	.09
Denial	-.18	.61
Venting	.32	.67
Substance Use	-.01	.42
Behavioral Disengagement	-.34	.72
Self-Blame	-.17	.72

Planning and Active Coping, Humor and Acceptance, Emotional Support and Religion, Instrumental Support and Emotional Support as well as Venting and Denial. Because the use of the chi-square statistic was inappropriate due to a sample size under 200, the AIC indicator was used and denoted a better fit of the hypothesized model to a single-factor model.

Mediation Analysis

Once it was established that there are two second-order factors of coping styles in this sample, and that the mediation factors were not significantly related to one another (r = -.06, *ns*), mediation analyses were run. Both of the proposed mediators were examined individually in a test for simple mediation using Baron and Kenny's (1986) causal steps strategy (using paths described in Figure 1). Six types of neuropsychological function as

well as a neuropsychological composite score were not significantly related to QOL outcome, and therefore simple mediation for these measures was not supported. These measures included Verbal Fluency (COWA), Working Memory (DSB), Processing Speed (TMT), Inhibition (SCWT), Attention (DSF), Short-Term Verbal Memory (CVLT-II) as well as the Neuropsychological composite score. It is also of note that age was not related to any neuropsychological function, either action-focused or emotion-focused coping, or QOL outcome. Gender was not reliably related to coping style or QOL outcome. However, there were differences found in neuropsychological functioning including the COWA (t [82] = -2.27, $p < .05$) where men ($M = 35.09$) achieved lower scores than women in the sample ($M = 41.53$), as well as the CVLT-II long-delay free recall (t [131] = -3.12, $p < .01$), where women ($M = 6.15$) also reliably outperformed the men ($M = 3.83$).

Additionally, the WRAT reading score, intended to measure premorbid functioning, was normally distributed ($M = 96.93$, $SD = 11.58$) and not significantly related to any measure of neuropsychological function, coping style, or QOL outcome. Thus, it was not included as a covariate in mediation analyses.

Long-term verbal memory was significantly related to QOL outcome (path c; $\beta = 1.20$, $p < .05$), as well as action-focused coping (path a_1; $\beta = .29$, $p < .05$). Long-term verbal memory did not predict the use of emotion-focused coping (path a_2; $\beta = -.04$, *ns*). The effect of long-term verbal memory of QOL outcome was nonsignificant after the effects of action-focused coping were controlled (path c_1'; $\beta = .72$, *ns*), which supports full mediation.

Indirect effects were tested using Preacher and Hayes (2008) bootstrapping methodology for indirect effects based on 5,000 bootstrap resamples to describe the confidence intervals of indirect effects. Interpretation is performed by determining whether zero is included within the 95% confidence intervals. Results indicated that both action-focused coping and emotion-focused coping were appropriate as simple mediators for the results above.

Notably, both active ($\beta = .09$, $p < .01$) and emotion-focused ($\beta = -.25$, $p < .01$) coping were significant predictors of QOL outcome, as were attention ($\beta = .18$, $p < .05$) and short-term verbal memory ($\beta = .09$, $p < .05$). However, the relationship between attention and short-term verbal memory and either action-focused or emotion-focused coping styles was not significant, therefore, mediation was not feasible.

Moderation Analysis

Moderation analyses were performed to determine the moderating effects of coping on the relationship between neuropsychological functioning and QOL in Veterans. Moderation analyses indicated that there were no interaction effects between coping and any neuropsychological function on QOL outcome. Therefore, moderation was not supported, and moderated mediation was not explored.

CHAPTER FOUR

Discussion

Discussion

Overall, results indicated that action-focused coping fully mediated the relationship between long-term verbal memory and QOL outcome. This indicates that long-term verbal memory affected QOL through its effects on action-focused coping. That is, patients with better long-term verbal memory have better access to positive coping skills, which relates to better self-reported QOL. The results of this study differed from those in patients with MS where this paradigm has been tested previously (Goretti, et al., 2010). In the previous study, patients with deficits in sustained attention and executive functioning tasks, similar to deficits seen in PTSD, tended to adopt emotion-focused coping strategies and experienced a lowered perceived QOL. The present study indicated that better long-term verbal memory functioning led to action-focused coping, which then led to improved QOL outcomes, but did not find that long-term memory deficits were related to emotion-focused coping. Additionally, in this study, no moderation effect was found, which indicates that the relationship between neuropsychological functioning and QOL did not differ as a result of type of coping style used at baseline. It is important to reiterate that both action-focused coping and emotion-focused coping styles were found to be good predictors of higher perceived QOL outcome and lower perceived QOL outcome, respectively.

Results also indicated that, while they were not partially or fully mediated by either action-focused or emotion-focused coping styles, attention and short-term verbal

memory were found to be significant predictors of reported QOL outcome. This is partially congruent with previous literature that indicated attention, overall IQ, and verbal fluency were the best neuropsychological predictors of QOL in patients with focal epilepsy (Meneses, et al., 2009). Although overall IQ and verbal fluency were not related to QOL outcome in this sample, attention was related to QOL, but not mediated by coping styles.

What was surprising is that verbal memory, but not verbal fluency, as found in previous studies (Meneses, et al., 2009), was a significant predictor of QOL. This could be due to a number of reasons, including a different cohort (focal epilepsy) as well as a smaller sample size ($N = 121$) for this measure than others (COWA was obtained in only a subsample of Project SERVE Veteran research participants). Furthermore, studies have consistently indicated that patients who perform poorly on sustained attention and executive functioning tasks tend to develop more maladaptive, emotion-focused coping strategies (Goretti, et al., 2010; Krpan, et al., 2007). Again, while this was not supported in this project, it is important to note that specific domains of neuropsychological functioning were related to action-focused, but not emotion-focused, coping. In general terms, this tells us that Veterans with neuropsychological functioning in the normal range tend to use action-focused coping, which improves QOL. However, Veterans that have poor neuropsychological functioning do not necessarily adopt emotion-focused coping styles, and therefore have poorer QOL outcome.

The second-order factor analysis of the Brief COPE also indicated that there might be an underlying two to three factor structure to the measure. What was interesting were how the components loaded onto the two factors, as illustrated in Table 4, which

has many implications for treatment. For instance, Venting loading onto emotion-focused coping indicates that this coping skill may contribute to poor QOL outcome in patients, and venting sometimes used as a technique to alleviate anxiety in some interventions. In other words, because this treatment utilizes venting, it may harm QOL in the long-term.

Overall, these findings have a variety of implications for the treatment, care, and rehabilitation of Veterans with neuropsychological problems. In order to improve QOL outcomes for Veterans, the results from this study indicate that attention, short-term, and long-term verbal memory should be a major focus in neuropsychological rehabilitation, as compared to the other neuropsychological domains assessed in order to improve perceived QOL outcome. This would suggest that neuropsychological rehabilitation may not be a primary concern, and that QOL can be improved upon by solely focusing on the acquisition of action-focused coping styles. Additionally, this study indicated that coping styles are related to QOL outcome, but that only the action-focused coping style was significantly related to neuropsychological functioning. Therefore, if a neuropsychological deficit is present, the less likely a patient is to use action-focused coping, however, this does not provide any information about the likelihood of adopting an emotion-focused coping style.

Limitations

This study had several limitations. To begin, this was a secondary analysis utilizing information from a study that was not designed solely for the purposes of testing the meditational relationship of coping styles between neuropsychological functioning and QOL outcome. Had the original study been specifically designed for this purpose, it

is possible that different measures could have been used, for example use of the Paced Auditory Serial Addition Task (PASAT) would have allowed for comparison with previous studies (Rabinowitz & Arnett, 2009), and the use of supplementary tests would have allowed for the exploration of additional neuropsychological functions, such as set-shifting and planning. In addition, while the sample size was adequate, it did not provide the power necessary to perform the optimal data analyses. Specifically affected by this, the verbal fluency data came from a subset of the Veterans from Project SERVE who were concurrently enrolled in Project PREDICT, a smaller, related study utilizing some participants from Project SERVE. With a larger sample size, it is likely that the data would have indicated a significant mediation relationship between verbal fluency and QOL, with coping styles acting as a mediator.

Because this was a cross-sectional study, any preexisting neuropsychological dysfunction was unable to be determined. Even though we were able to utilize the Word Reading subtest of the WRAT-4 as a measure of premorbid intellectual functioning, other types of neuropsychological dysfunction, whether assessed in this study or not, may have been present previous to combat exposure. In conjunction with this, we were also unable to determine preexisting coping style preferences of Veterans. If this data were available, premorbid neuropsychological functioning and coping styles could have been used as covariates to determine specific effects of deployment on the changes seen in neuropsychological functioning and coping styles. However, because the primary focus of this project was on the effects of neuropsychological impairment, regardless of timeline or consequences surrounding the acquisition of the impairment or development of coping styles, the project was not negatively impacted.

There were also a larger number of men (80.4%) compared to women (14.7%) in this sample. This decreases the generalizability considerably, however, is representative of a Veteran cohort, as the national percentage of women in the military in fiscal year 2009 was approximately 16.5% (Department of Defense [DOD], 2009). While the ratio of men to women was high, it is important to reiterate that there were only small differences found between men and women on scores of verbal fluency and long-term verbal memory, and no differences on coping styles or QOL outcome.

The QOLS and Brief COPE are self-report measures. If there is severe neuropsychological impairment, the validity of the information of these measures can be brought into question. In regards to this, it is important to note that up to 10.4% of Veterans in this sample had at least mild to moderate impairment in domains tested, defined as 1.5 standard deviations below the normative mean. However, this is not surprising also due to the high number of Veterans that have been diagnosed with PTSD currently or in their lifetime, which includes deficits in attention, inhibition and memory. Baseline intellectual ability, as measured by word reading (WRAT-4) was normal in all but one participant, suggesting that, although self-report measures were used as mediator, moderator, and outcome variables, reading ability was normal and should not have affected the validity of the instruments.

Future Directions

Considering the results of this study, there are a few directions this research could take. Action-focused coping acted as a mediator in this study, and was comprised of nine components, all of which may not be equally efficacious. Additionally, this project did not explore the level or frequency, and efficacy of these coping skills. Future studies

may benefit from including analyses on how specific components affect the relationship between neuropsychological functioning and QOL, and additionally the level or frequency of use of these coping styles, and their perceived efficacy.

Additionally, this analysis included participants who had lifetime and/or current psychological diagnoses that may affect neuropsychological functioning differently. An analysis of patient groups alone may also contribute a great deal of knowledge to the treatment of specific disorders.

Overall, the results from this study show that coping may act as a mediating factor between certain types of neuropsychological functioning and QOL outcome in Veterans. Specifically, this relationship was only supported with long-term verbal memory and action-focused coping. This indicates that patients with better long-term memory functioning may be able to call on and remember more positive, efficacious coping skills to use in stressful situations. With the use of better coping skills, their QOL is likely to increase because they can cope with stressful situations in a more efficacious manner. Alternatively, patients with poor long-term memory functioning are likely to not call on action-focused coping strategies, and have an increased chance of reporting poorer QOL outcome. Of note, the relationship between poor long-term verbal memory and emotion-focused coping was not supported. This study also established a relationship between short-term memory and attention and QOL, indicating that patients with better short-term memory and attention report better QOL outcomes than those with poor short-term memory and attention functioning. More research is indicated, with larger sample sizes and possibly with differing measures for neuropsychological function, coping styles, and QOL.

REFERENCES

Aiken, L. S., & West, S. G. (1991). *Multiple Regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control, 19*(6), 716-723.

Akaike, H. (1987). Factor analysis and AIC. *Psychometrika, 52*(3), 317-332.

Anderson, V., Brown, S., Newitt, H., & Hoile, H. (2011). Long-term outcome from childhood traumatic brain injury: Intellectual ability, personality, and quality of life. *Neuropsychology*, 1-8.

American Psychological Association [APA]. (2000). *Diagnostic and statistical manual of mental disorders* (Revised 4th ed.). Washington, D.C.: American Psychiatric Association.

Baldo, J. V., Delis, D. C., Kramer, J. H., & Shimamura, A. P. (2002). Memory performance on the California Verbal Learning Test–II: Findings from patients with focal frontal lesions. *Journal of the International Neuropsychological Society, 8*, 539-546.

Baron, R. M., & Kenny, D. A. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Belanger, H. G., Spiegel, E., & Vanderploeg, R. D. (2010). Neuropsychological performance following a history of multiple self-reported concussions: A meta-analysis. *Journal of the International Neuropsychological Society, 16*(2), 262-267.

Benton, A. L., & Hamsher, K. d. (1989). *Multilingual Aphasia Examination*. Iowa City: AJA Associates.

Biesanz, J. C., Falk, C. F., & Savalei, V. (2010). Assessing mediational models: Testing and interval estimation for indirect effects. *Multivariate Behavioral Research, 45*(4), 661-701.

Bookwala, J., Frieze, I. H., & Grote, N. (1994). The long-term effects of military service on quality of life: The Vietnam experience. *Journal of Applied Social Psychology, 24*(6), 529-545.

Brady, K. T. (1997). Posttraumatic stress disorder and comorbidity: Recognizing the many faces of PTSD. *Journal of Clinical Psychiatry, 58*(Suppl 9), 12-15.

Burckhardt, C. S., & Anderson, K. L. (2003). The Quality of Life Scale (QOLS): Reliability, Validity, and Utilization. *Health and Quality of Life Outcomes, 1*(60), 1-7.

Burckhardt, C. S., Woods, S. L., Schultz, A. A., & Ziebarth, D. M. (1989). Quality of life of adults with chronic illness: A psychometric study. *Research in Nursing and Health, 12*, 347-354.

Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods and Research, 33*, 261-304.

Butler, R. W., Rorsman, I., Hill, J. M., & Tuma, R. (1993). The effects of frontal brain impairment on fluency: Simple and complex paradigms. *Neuropsychology, 7*(4), 519-529.

Carver, C. S. (1997). You want to Measure Coping But Your Protocol's Too Long: Consider the Brief COPE. *International Journal of Behavioral Medicine, 4*(1), 92.

Cooney, N. L., Kadden, R. M., Litt, M. D., & Getter, H. (1991). Matching alcoholics to coping skills or interactional therapies: two-year follow-up results. *Journal of Consulting & Clinical Psychology, 59*(4), 598-601.

Cooper, C., Katona, C., & Livingston, G. (2008). Validity and Reliability of the Brief COPE in Carers of People With Dementia: The LASER-AD Study. *The Journal Of Nervous And Mental Disease, 196*(11), 838-843.

Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, B. A. (2000). The California Verbal Learning Test: Second Edition *CVLT-II*. San Antonio, TX: The Psychological Corporation.

Department of Defense [DOD]. (2009). *Population Representation in the Military Services Fiscal Year 2009 Report*. Office of the Assistant Secretary of Defense for Personnel and Readiness.

Elliott, R. (1998). The neuropsychological profile in unipolar depression. *Trends In Cognitive Sciences, 2*(11), 447-454.

Fairchild, A. J., & MacKinnon, D. P. (2009). A general model for testing mediation and moderation effects. *Prevention Science, 10*(2), 87-99.

Fernández-Serrano, M. J., Pérez-García, M., Río-Valle, J. S., & Verdejo-García, A. (2010). Neuropsychological consequences of alcohol and drug abuse on different components of executive functions. *Journal of Psychopharmacology, 24*(9), 1317-1332.

Flanagan, J. C. (1978). A research approach to improving our quality of life. *American Psychologist, 33*, 138-147.

Flanagan, J. C. (1982). Measurement of the quality of life: Current state of the art. *Archives of Physical Medicine & Rehabilitation, 63*, 56-59.

Folkman, S., & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health & Social Behavior, 21*, 219-239.

Forman-Hoffman, V. L., Carney, C. P., Sampson, T. R., Peloso, P. M., Woolson, R. F., Black, D. W., & Doebbeling, B. N. (2005). Mental health comorbidity patterns and impact on quality of life among veterans serving during the first Gulf War. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation, 14*(10), 2303-2314.

Forton, D. M., Allsop, J. M., Cox, I. J., Hamilton, G., Wesnes, K., Thomas, H. C., & Taylor-Robinson, S. D. (2005). A review of cognitive impairment and cerebral metabolite abnormalities in patients with hepatitis C infection. *AIDS, 19*, S53-S60.

Forton, D. M., Taylor-Robinson, S. D., & Thomas, H. C. (2002). Reduced quality of life in hepatitis C--is it all in the head? *Journal Of Hepatology, 36*(3), 435-438.

French, L. M., Spector, J., Stiers, W., & Kane, R. L. (2010). Blast injury and traumatic brain injury. In C. H. Kennedy & J. L. Moore (Eds.), *Military neuropsychology* (pp. 101-125). New York, NY US: Springer Publishing Co.

Geuze, E., Vermetten, E., De Kloet, C. S., Hijman, R., & Westenberg, H. G. M. (2009). Neuropsychological performance is related to current social and occupational functioning in veterans with posttraumatic stress disorder. *Depression & Anxiety, 26*(1), 7-15.

Ginzburg, K., Ein-Dor, T., & Solomon, Z. (2010). Comorbidity of posttraumatic stress disorder, anxiety and depression: A 20-year longitudinal study of war veterans. *Journal of Affective Disorders, 123*(1-3), 249-257.

Golden, C. J. (1978). Stroop Color and Word Test *SCWT*. Chicago, IL: Stoelting.

Goldstein, G., Luther, J. F., Haas, G. L., Appelt, C. J., & Gordon, A. J. (2010). Factor structure and risk factors for the health status of homeless veterans. *Psychiatric Quarterly, 81*(4), 311-323.

Goldstein, G., Luther, J. F., Haas, G. L., Gordon, A. J., & Appelt, C. (2009). Comorbidity between psychiatric and general medical disorders in homeless veterans. *Psychiatric Quarterly, 80*(4), 199-212.

Goretti, B., Portaccio, E., & Zipoli, V. (2009). Coping strategies, psychological variables and their relationship with quality of life in multiple sclerosis. *Neurological Sciences, 30*, 15-20.

Goretti, B., Portaccio, E., Zipoli, V., Razzolini, L., & Amato, M. (2010). Coping strategies, cognitive impairment, psychological variables and their relationship with quality of life in multiple sclerosis. *Neurological Sciences, 31*, 227-230.

Graham, D. P., & Cardon, A. L. (2008). An update on substance use and treatment following traumatic brain injury. In G. R. Uhl (Ed.), *Addiction reviews* (pp. 148-162). Malden: Blackwell Publishing.

Halligan, P. W., & Wade, D. T. (2005). *The effectiveness of rehabilitation for cognitive deficits*. New York, NY: Oxford University Press.

Hasking, P. A., & Oei, T. P. S. (2002). Confirmatory factor analysis of the COPE questionnaire on community drinkers and an alcohol-dependent sample. *Journal of Studies on Alcohol, 63*, 631-640.

Hawthorne, G., Kaye, A. H., Gruen, R., Houseman, D., & Bauer, I. (2011). Traumatic brain injury and quality of life: Initial Australian validation of the QOLIBRI. *Journal of Clinical Neuroscience, 18*(2), 197-202.

Henry, J. D., & Crawford, J. R. (2005). A Meta-Analytic Review of Verbal Fluency Deficits in Depression. *Journal of Clinical and Experimental Neuropsychology, 27*(1), 78-101.

Hicks, R. R., Fertig, S. J., Desrocher, R. E., Koroshetz, W. J., & Pancrazio, J. J. (2010). Neurological Effects of Blast Injury. *The Journal of Trauma, 68*(5), 1257-1263.

Hoge, C. W., Castro, C. A., Messer, S. C., McGurk, D., Cotting, D. I., & Koffman, R. L. (2004). Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care. *New England Journal of Medicine, 351*(1), 13-22.

Hyafil, A., Summerfield, C., & Koechlin, E. (2009). Two Mechanisms for Task Switching in the Prefrontal Cortex. *Journal of Neuroscience, 29*(16), 5135-5142.

Ikin, J. F., Sim, M. R., McKenzie, D. P., Horsley, K. W. A., Wilson, E. J., Harrex, W. K., . . . Henderson, S. (2009). Life satisfaction and quality in Korean War veterans five decades after the war. *Journal of Epidemiology and Community Health, 63*(5), 359-365.

Jastak, J. F., & Jastak, S. (2006). *Wide Range Achievement Test*. Lutz, FL: PAR Psychological Assessment Resources, Inc.

Jefferson, M. L. (2009). *Mild Traumatic Brain Injury: A Signature Injury of the Iraq Conflict*. Paper presented at the Exposure Concerns of Veterans Returning from Iraq and Afghanistan.

Jose, P. E. (2008). ModGraph-I: A programme to compute cell means for the graphical display of moderational analyses: The internet version, Version 2.0. Wellington, New Zealand: Victoria University of Wellington.

Kadden, R. M., Cooney, N. L., Getter, H., & Litt, M. D. (1989). Matching alcoholics to coping skills or interactional therapies: posttreatment results. *Journal of Consulting & Clinical Psychology, 57*, 698-704.

Keltner, N. L., & Cooke, B. B. (2007). Traumatic brain injury--War related. *Perspectives in Psychiatric Care, 43*(4), 223-226.

Kiluk, B. D., Nich, C., & Carroll, K. M. (2011). Relationship of cognitive function and the acquisition of coping skills in computer assisted treatment for substance use disorders. *Drug and Alcohol Dependence, 114*(2-3), 169-176.

King-Adams, K. R. (2008). *A comparison of individuals with long-term, short-term, and nondiagnosed PTSD on symptom manifestation, coping resources, and quality of life*. Doctor of Psychology in Clinical Psychology, Alliant International University, Fresno.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2 ed.). New York: Guilford Press.

Krpan, K. M., Levine, B., Stuss, D. T., & Dawson, D. R. (2007). Executive function and coping at one-year post traumatic brain injury. *Journal of Clinical & Experimental Neuropsychology, 29*(1), 36-46.

Kwok, F. Y., Lee, T. M. C., Leung, C. H. S., & Poon, W. S. (2008). Changes of cognitive functioning following mild traumatic brain injury over a 3-month period. *Brain Injury, 22*(10), 740-751.

Larson, M. J., Kaufman, D. A. S., & Perlstein, W. M. (2009). Conflict adaptation and cognitive control adjustments following traumatic brain injury. *Journal of the International Neuropsychological Society, 15*(6), 927-937.

Leininger, B. E., Gramling, S. E., Farrell, A. D., Kreutzer, J. S., & Peck, I., E. A. (1990). Neuropsychological deficits in symptomatic minor head injury patients after concussion and mild concussion. *Journal of Neurology, Neurosurgery & Psychiatry, 53*(4), 293-296.

Lezak, M. D., Howieson, D. B., & Loring, D. W. (2004). *Neuropsychological Assessment* (4 ed.). New York, NY: Oxford University Press.

Lunney, C. A., & Schnurr, P. P. (2007). Domains of quality of life and symptoms in male veterans treated for posttraumatic stress disorder. *Journal Of Traumatic Stress, 20*(6), 955-964.

MacKinnon, D. P. (2000). Contrasts in multiple mediator models. In J. Rose, L. Chassin, C. C. Presson & S. J. Sherman (Eds.), *Multivariate Applications in Substance Use Research: New Methods for New Questions* (pp. 141-160). Mahwah, NJ: Lawrence Erlbaum.

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation Analysis. *Annual Review of Psychology, 58*, 593-614.

Matser, J. T., Kessels, A. G. H., Lezak, M. D., Jordan, B. D., & Troost, J. (1999). Neuropsychological Impairment in Amateur Soccer Players. *JAMA: Journal of the American Medical Association, 282*, 971-973.

Matsui, M., Sumiyoshi, T., Arai, H., Higuchi, Y., & Kurachi, M. (2008). Cognitive functioning related to quality of life in schizophrenia. *Progress in Neuro-Psychopharmacology & Biological Psychiatry, 32*(1), 280-287.

Medina, K. L., Shear, P. K., & Schafer, J. (2006). Memory functioning in polysubstance dependent women. *Drug and Alcohol Dependence, 84*(3), 248-255.

Meneses, R. F., Pais-Ribeiro, J. L., da Silva, A. M., & Giovagnoli, A. R. (2009). Neuropsychological predictors of quality of life in focal epilepsy. *Seizure, 18*(5), 313-319.

Meyer, B. (2001). Coping with severe mental illness: Relations of the Brief COPE with symptoms, functioning, and well-being. *Journal of Psychopathology and Behavioral Assessment, 23*(4), 265-277.

Mol, M. E. M., van Boxtel, M. P. J., Willems, D., Verhey, F. R. J., & Jolles, J. (2009). Subjective forgetfulness is associated with lower quality of life in middle-aged and young-old individuals: A 9-year follow-up in older participants from the Maastricht Aging Study. *Aging & Mental Health, 13*(5), 699-705.

Montel, S., Bonnet, A.-M., & Bungener, C. (2009). Quality of life in relation to mood, coping strategies, and dyskinesia in Parkinson's disease. *Journal of Geriatric Psychiatry and Neurology, 22*(2), 95-102.

Moore, D. F., & Jaffee, M. S. (2010). Military traumatic brain injury and blast. *NeuroRehabilitation, 26*(3), 179-181.

Moradi, A. R., Neshat-Doost, H. T., Taghavi, R., Yule, W., & Dalgleish, T. (1999). Performance of Children of Adults with PTSD on the Stroop Color-Naming Task: A Preliminary Study. *Journal Of Traumatic Stress, 12*(4), 663.

Mowad, L. (2004). Correlates of Quality of Life in Older Adult Veterans. *Western Journal of Nursing Research, 26*(3), 293-306.

Murrell, R. (1999). Quality of life and neurological illness: A review of the literature. *Neuropsychology Review, 9*(4), 209-229.

Nys, G. M. S., van Zandvoort, M. J. E., van der Worp, H. B., de Haan, E. H. F., de Kort, P. L. M., Jansen, B. P. W., & Kappelle, L. J. (2006). Early cognitive impairment predicts long-term depressive symptoms and quality of life after stroke. *Journal of the Neurological Sciences, 247*(2), 149-156.

Orme, D. R., Johnstone, B., Hanks, R., & Novack, T. (2004). The WRAT-3 Reading Subtest as a Measure of Premorbid Intelligence Among Persons With Brain Injury. *Rehabilitation Psychology, 49*(3), 250-253.

Paraherakis, A., Charney, D. A., & Gill, K. (2001). Neuropsychological functioning in substance-dependent patients. *Substance Use & Misuse, 36*(3), 257-271.

Pietrzak, R. H., Goldstein, M. B., Malley, J. C., Rivers, A. J., & Southwick, S. M. (2010). Structure of posttraumatic stress disorder symptoms and psychosocial functioning in Veterans of Operations Enduring Freedom and Iraqi Freedom. *Psychiatry Research, 178*(2), 323-329.

Porter, R. J., Bourke, C., & Gallagher, P. (2007). Neuropsychological impairment in major depression: Its nature, origin, and clinical significance. *Australian and New Zealand Journal of Psychiatry, 41*(2), 115-128.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments & Computers, 36*(4), 717-731.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891.

Rabinowitz, A. R., & Arnett, P. A. (2009). A longitudinal analysis of cognitive dysfunction, coping, and depression in multiple sclerosis. *Neuropsychology, 23*, 581-591.

Reid-Amdt, S. A., Hsieh, C., & Perry, M. C. (2010). Neuropsychological functioning and quality of life during the first year after completing chemotherapy for breast cancer. *Psycho-Oncology, 19*(5), 535-544.

Reitan, R. M. (1958). Validity of the Trail Making test as an indicator of organic brain damage. *Perceptual & Motor Skills, 8*, 271-276.

Rosselli, M., & Ardila, A. (1996). Cognitive effects of cocaine and polydrug abuse. *Journal of Clinical and Experimental Neuropsychology, 18*(1), 122-135.

Schnurr, P. P., Lunney, C. A., Bovin, M. J., & Marx, B. P. (2009). Posttraumatic stress disorder and quality of life: Extension of findings to veterans of the wars in Iraq and Afghanistan. *Clinical Psychology Review, 29*, 727-735.

Sohlberg, M. M., & Mateer, C. A. (2001). *Cognitive Rehabilitation: An integrative neuropsychological approach*. New York, NY: Guildford Press.

Stroop, J. R. (1935). Studies of interference in serial verbal reaction. *Journal of Experimental Psychology: General, 18*, 643-662.

Sullivan, G., Burnam, A., Koegel, P., & Hollenberg, J. (2000). Quality of life of homeless persons with mental illness: Results from the course-of-homelessness study. *Psychiatric Services, 51*(9), 1135-1141.

Taber, K. H., Warden, D. L., & Hurley, R. A. (2006). Blast-Related Traumatic Brain Injury: What Is Known? *Journal of Neuropsychiatry and Clinical Neuroscience, 18*(2), 141-145.

Tanielian, T., & Jaycox, L. H. (Eds.). (2009). *Invisible wounds of war: Psychological and cognitive injuries, their consequences, and services to assist recovery*. CA: RAND.

Tapert, S. F., Ozyurt, S. S., Myers, M. G., & Brown, S. A. (2004). Neurocognitive ability in adults coping with alcohol and drug relapse temptations. *The American Journal of Drug and Alcohol Abuse, 30*(2), 445-460.

Vanderploeg, R. D., Curtiss, G., & Belanger, H. G. (2005). Long-term neuropsychological outcomes following mild traumatic brain injury. *Journal of the International Neuropsychological Society, 11*(3), 228-236.

Vasterling, J. J., & Brailey, K. (2005). Neuropsychological Findings in Adults with PTSD. In J. J. Vasterling & C. R. Brewin (Eds.), *Neuropsychology of PTSD: Biological, cognitive, and clinical perspectives*. (pp. 178-207). New York, NY US: Guilford Press.

Vasterling, J. J., Brailey, K., Constans, J. I., & Sutker, P. B. (1998). Attention and memory dysfunction in posttraumatic stress disorder. *Neuropsychology, 12*, 125-133.

Vasterling, J. J., Constans, J. I., & Hanna-Pladdy, B. (2000). Head injury as a predictor of psychological outcome in combat veterans. *Journal Of Traumatic Stress, 13*(3), 441-451.

Vasterling, J. J., Duke, L. M., Brailey, K., Constans, J. I., Allain, A. N., & Sutker, P. B. (2002). Attention, learning, and memory performances and intellectual resources in Vietnam veterans: PTSD and no disorder comparisons. *Neuropsychology, 16*(1), 5-14.

Vasterling, J. J., Proctor, S. P., Amoroso, P., Kane, R., Heeren, T., & White, R. F. (2006). Neuropsychological Outcomes of Army Personnel Following Deployment to the Iraq War. *JAMA: Journal of the American Medical Association, 296*(5), 519-529.

Vasterling, J. J., Verfaellie, M., & Sullivan, K. D. (2009). Mild traumatic brain injury and posttraumatic stress disorder in returning veterans: Perspectives from cognitive neuroscience. *Clinical Psychology Review, 29*(8), 674-684.

Verdejo-García, A., López-Torrecillas, F., Aguilar de Arcos, F., & Pérez-García, M. (2005). Differential effects of MDMA, cocaine, and cannabis use severity on distinctive components of the executive functions in polysubstance users: A multiple regression analysis. *Addictive Behaviors, 30*(1), 89-101.

Vik, P. W., Cellucci, T., Jarchow, A., & Hedt, J. (2004). Cognitive Impairment in Substance Abuse. *Psychiatric Clinics of North America, 27*, 97-109.

Vilkki, J., Holst, P., Öhman, J., Servo, A., & Heiskanen, O. (1992). Cognitive test performances related to early and late computed tomography findings after closed-head injury. *Journal of Clinical & Experimental Neuropsychology, 14*(4), 518-532.

Wallin, M. T., Wilken, J., Alfaro, M. H., Rogers, C., Mahan, C., Chapman, J. C., . . . Kane, R. (2009). Neuropsychologic assessment of a population-based sample of Gulf War veterans. *Cognitive and Behavioral Neurology, 22*(3), 155-166.

Wechsler, D. (2008). Wechsler Adult Intelligence Scale—Fourth Edition *(WAIS-IV)*. San Antonio, TX: Pearson Education, Inc.

Wolters, G., Stapert, S., Brands, I., & Van Heugten, C. (2010). Coping styles in relation to cognitive rehabilitation and quality of life after brain injury. *Neuropsychological Rehabilitation, 20*(4), 587-600.

Zajano, M. J., & Gorman, A. (1986). Stroop interference as a function of percentage of congruent items. *Perceptual & Motor Skills, 63*, 1087-1096.

Zatzick, D. F., Marmar, C. R., Weiss, D. S., Browner, W. S., Metzler, T. J., Golding, J. M., . . . Wells, K. B. (1997). Posttraumatic stress disorder and functioning and quality of life outcomes in a nationally representative sample of male Vietnam veterans. *The American Journal of Psychiatry, 154*(12), 1690-1695.

Zatzick, D. F., Weiss, D. S., Marmar, C. R., Metzler, T. J., Wells, K., Golding, J. M., . . . Browner, W. S. (1997). Post-traumatic stress disorder and functioning and quality of life outcomes in female Vietnam veterans. *Military Medicine, 162*(10), 661-665.