Published in final edited form as:

Rehabil Psychol. 2016 August ; 61(3): 231–239. doi:10.1037/rep0000076.

Neuropsychological Functioning, Coping, and Quality of Life among Returning War Veterans

Sarah L. Martindale^{a,b,c,d}, Sandra B. Morissette^{b,e,f}, Nathan A. Kimbrel^{c,g,h}, Eric C. Meyer^{b,e}, Marc I. Kruse^{e,i}, Suzy B. Gulliver^{e,j}, and Sara L. Dolan^{a,b}

^a Baylor University, Waco, TX, USA

^b VA VISN 17 Center of Excellence for Research on Returning War Veterans, Central Texas Veterans Health Care System

^c W.G. "Bill" Hefner Veterans Affairs Medical Center, Salisbury, NC, USA

^d VA Mid-Atlantic Mental Illness Research, Education, and Clinical Center

^e Texas A&M Health Science Center, College of Medicine

^f University of Texas at San Antonio

^g Durham Veterans Affairs Medical Center, Durham, NC, USA

^h Duke University Medical Center, Durham, NC, USA

ⁱ Austin Fire Department, Austin-Travis County Emergency Medical Services

^j Warriors Research Institute, Baylor Scott and White Healthcare System

Abstract

Purpose—The present research tested the hypothesis that action- and emotion-focused coping strategies would mediate the relationship between neuropsychological functioning and quality of life among a sample of returning Iraq/Afghanistan veterans.

Method—Veterans ($N = 130$) who served as part of the wars in Iraq and Afghanistan, completed a diagnostic assessment of PTSD, a battery of questionnaires assessing coping style, traumatic brain injury (TBI), and quality of life, and neuropsychological tests measuring attention, learning and memory, working memory, inhibition, executive control, and visual motor coordination.

Results—Executive control, immediate and delayed verbal recall, and visual motor coordination were associated with quality of life. However, after controlling for the effects of combat exposure, PTSD, and probable TBI, no measure of neuropsychological functioning was directly associated

Correspondence concerning this article should be addressed to Sara L. Dolan, Ph.D., Department of Psychology and Neuroscience, Baylor University, One Bear Place #97334, Waco, TX 76798. sara_dolan@baylor.edu.
Sarah L. Martindale and Sara L. Dolan, Department of Psychology and Neuroscience, Baylor University; Sandra B. Morissette and Eric C. Meyer, VA VISN 17 Center of Excellence for Research on Returning War Veterans, Central Texas Veterans Health Care System, and Texas A&M Health Science Center, College of Medicine; Nathan A. Kimbrel, Durham Veterans Affairs Medical Center and VA Mid-Atlantic Mental Illness Research, Education, and Clinical Center; Marc I. Kruse, Austin Fire Department, Austin-Travis County Emergency Medical Services, and Texas A&M Health Science Center, College of Medicine; Suzy B. Gulliver, Warriors Research Institute, Baylor Scott and White Healthcare System.
Sarah L. Martindale is now at W.G. "Bill" Hefner Veterans Affairs Medical Center, and VA Mid-Atlantic Mental Illness Research, Education, and Clinical Center. Sandra B. Morissette is now at University of Texas at San Antonio.

with quality of life. Mediation analyses indicated that delayed verbal recall influenced quality of life through its effect on action-focused coping.

Conclusions—Although replication is needed, these findings indicate that delayed verbal recall may indirectly influence quality of life among Iraq/Afghanistan veterans through its association with action-focused coping strategies. Psychologists who are working with veterans that are experiencing memory difficulties and poor quality of life may consider focusing on improving coping skills prior to rehabilitation of memory deficits.

Keywords

military; veterans; coping; quality of life; neuropsychology; memory

Introduction/Background

Quality of life is generally conceptualized as the overall level of satisfaction individuals have with different aspects of their lives, including material and physical well-being, relationships with others, social and community activities, personal development and fulfillment, and recreation (Burckhardt & Anderson, 2003; Flanagan, 1978; Stock et al., 2014). Poor quality of life may be indicative of problems within these areas, and treatments often measure quality of life to determine broader effects beyond symptom remission (Reid-Amdt, Hsieh, & Perry, 2010). Unfortunately, returning Iraq and Afghanistan veterans experience a range of psychological problems that can have a profound impact on their quality of life, particularly posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI; Dolan et al., 2012; Hoge et al., 2004; Morissette et al., 2011). These and other types of psychological disorders are also associated with a number of neuropsychological difficulties, such as attention and memory deficits (Campbell et al., 2009; Dolan et al., 2012; Gilbertson, Gurvits, Lasko, Orr, & Pitman, 2001; Shandera-Ochsner et al., 2013), which may further worsen returning veterans' quality of life (Meneses, Pais-Ribeiro, da Silva, & Giovagnoli, 2009; Nys et al., 2006; Schnurr, Lunney, Bovin, & Marx, 2009; Wallin et al., 2009). Whereas it is clear that neuropsychological deficits have either direct or indirect effects on perceived quality of life (Halligan & Wade, 2005; Sohlberg & Mateer, 2001), there is a paucity of research available that directly examines the associations between specific neuropsychological functioning skills and indices of quality of life, particularly within a veteran sample.

Neuropsychological abilities, such as memory, can affect how someone learns, adopts, and ultimately utilizes different coping strategies (Krupan, Levine, Stuss, & Dawson, 2007). Coping strategies can be conceptually categorized into two types: action-focused (also referred to as active, problem-focused, and positive coping strategies), which includes active coping behaviors targeted at changing the source of a stressor; and emotion-focused (also sometimes referred to as avoidant coping or negative coping), that are used to regulate emotional responses to a stressor (Folkman & Lazarus, 1980). Although emotion-focused and avoidant coping are often used interchangeably, emotion-focused coping, defined as coping aimed at lessening emotional distress, has been adopted as a parent factor to avoidant coping, which is a type of emotion-focused coping expressed by actions that purposefully avoid confronting a stressor with the goal of indirectly reducing emotional distress (Billings

& Moos, 1981). Evidence supports a positive association between good neuropsychological functioning and action-focused coping skills as well as between poor neuropsychological functioning and emotion-focused coping skills. For example, higher IQ scores are related to better quality of coping strategies in TBI patients (Wolters, Stapert, Brands, & Van Heugten, 2011). Patients with PTSD more frequently use less efficacious coping mechanisms, such as suppression, which is a type of avoidance, and less frequently use positive coping skills, such as seeking alternate solutions (Amir et al., 1997). Evidence from TBI patients indicates that patients with better executive functioning use more active, problem solving coping skills and less avoidant coping skills regardless of injury severity and intelligence (Krpan et al., 2007).

As with neuropsychological function, coping skills also impact quality of life. TBI patients who use action-focused coping strategies report better long-term quality of life than those who use emotion-focused coping strategies (Wolters, Stapert, Brands, & Van Heugten, 2010). It has been suggested that the adoption of emotion-focused coping strategies is positively associated with symptom development and severity of psychological distress, such as PTSD symptom severity, which then affects quality of life. One study found that patients with TBI who developed PTSD were more likely to have adopted an avoidant coping strategy, which positively influenced PTSD symptom severity (Bryant, Marosszeky, Crooks, Baguley, & Gurka, 2000). A similar pattern was also noted by Johnsen, Eid, Laberg, and Thayer (2002), which indicated that the adoption of emotion-focused coping did not improve symptom severity over time, when compared to other coping styles. In a similar vein, PTSD mediates the impact of coping skills on quality of life (Huijts, Kleijn, van Emmerik, Noordhof, & Smith, 2012). These studies suggest that it is important to study coping and quality of life in veterans who are at risk for PTSD, TBI, and other neuropsychological impairments that may negatively affect redeployment from the war zone. Veterans are a patient group that frequently present with symptoms of both PTSD and TBI, which are in turn associated with neuropsychological implications that can complicate treatment (Najavits, Highley, Dolan, & Fee, 2012; Vanderploeg, Curtiss, Luis, & Salazar, 2007). Although coping skills are already taught as part of evidence-based approaches to treatment for military personnel (Rosen, Chow, Finney, Greenbaum, Moos, Sheikh, & Yesavage, 2004), there is a paucity of literature that examines how different cognitive deficits, such as memory and attention, affect the ability of an individual to adopt and utilize these skills, and subsequently impact on quality of life. However, recent literature supports this relationship in patients with acquired brain injury (Wolters Gregório, Ponds, Smeets, Jonker, Pouwels, Verhey, & van Heugten, 2015), finding that executive functioning was related to greater use of passive coping, which was in turn related to lower quality of life. The current study investigated this relationship in veterans.

Taken together, these data suggest that not only may neuropsychological functioning and coping directly affect quality of life, but also that coping may act as an intervening mediator variable. That is, individuals with neuropsychological deficits may adopt less efficacious coping styles, leading to poor quality of life. Identifying modifiable mediators that explain the association between neuropsychological functioning and quality of life could have important implications for treatment intervention. It was hypothesized that attention, executive control, inhibition, immediate and delayed verbal recall, visual motor

coordination, and working memory would be positively related to quality of life. In addition, it was hypothesized that action-focused coping would positively predict quality of life and emotion-focused coping would negatively predict quality of life. Our final hypothesis posited that action-focused coping and emotion-focused coping would mediate the association between neuropsychological functioning and quality of life.

Methods

Participants

Participants included 130 eligible veterans who served in support of the wars in Iraq and Afghanistan ($M_{\text{age}} = 37.82$ years, $SD = 10.61$, range 22-66), who were enrolled in a local Veterans Health Care System. Representative of military demographics, women comprised 14.6% of the sample. The sample was well educated ($M_{\text{ed}} = 14.12$ years, $SD = 2.52$). Participants deployed an average of 2.22 times ($SD = 1.36$, range 1-7) in support of the wars in Iraq and Afghanistan, with the last deployment occurring on average 41.70 months ($SD = 25.40$, range = 0 - 97.63) prior to participation. Table 1 lists sample demographics and military characteristics.

This study reflects secondary analyses of a parent longitudinal study that was conducted to identify predictors of PTSD, depression, alcohol/substance use disorders and their comorbidity. Participants included male and female, English-speaking veterans who were 18 years of age or older. To be eligible, veterans were required to: (a) have served in support of the wars in Iraq and Afghanistan; (b) be enrolled in the local VA system; (c) be able to complete the informed consent process and assessments.

Participants were excluded if they: (a) had plans to relocate out of the local VA catchment area within four months of protocol initiation (due to parent longitudinal study); (b) recently started psychiatric medications or therapy to ensure symptoms were not related to recent treatment changes; (c) had diagnoses of a psychotic disorder or bipolar disorder; or (d) were actively suicidal or homicidal at the level of warranting crisis intervention. Regarding medication and therapy stabilization, participants were deemed stable on psychotropic medications per the following: 3 months on a selective serotonin reuptake inhibitor or monoamine oxidase inhibitor; 1 month on an anxiolytic or beta-blocker; or 1 month medication discontinuation. Participants were deemed stable if they were engaged in psychotherapy for >3 months or 1-month psychotherapy discontinuation.

Procedures

All procedures were reviewed and approved by the local Institutional Review Board. Participants were recruited using multiple strategies, including flyers posted in the local hospital, in-services to mental health and primary care staff, and mailings to veterans who served in support of the wars in Iraq and Afghanistan who were enrolled in the Central Texas Veterans Healthcare System. Participants were screened by telephone for inclusion/exclusion criteria after providing informed verbal consent. A total of 272 telephone screens were conducted, of which 224 were deemed eligible and scheduled for an initial assessment and 48 were deemed ineligible. Of those who were ineligible at the phone screen level, 19

were ruled out due to not being stabilized on psychiatric medications/psychotherapy, 10 were ruled out for bipolar disorder, seven who reported current hallucinations and delusions indicative of a psychotic disorder, four due to current suicidal/homicidal risk, two planning to relocate out of the area within 4 months, one who was not an OEF/OIF veteran, two who were not enrolled in the local VA system, and three other/unknown. Written consent was completed during an in-person assessment, after which final eligibility was determined using the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998; i.e., to exclude psychotic and bipolar disorders). A total of 145 veterans were enrolled to participate in a study evaluating post-deployment adjustment. Of those, 130 were deemed eligible to participate and completed the assessment battery. Of the 15 deemed ineligible after consent, eight were unable to complete the baseline assessment and seven had bipolar disorder.

Measures

Neuropsychological Assessment—Several neuropsychological measures were administered, including the Wide Range Achievement Test – Fourth Edition, word reading standard score (WRAT-4; Jastak & Jastak, 2006) as an estimate of pre-morbid intellectual functioning; California Verbal Learning Test, Second Edition (CVLT-II; Delis, Kramer, Kaplan, & Ober, 2000) for immediate verbal recall and delayed verbal recall raw scores for verbal learning and memory (CVLT-II raw scores were used in place of standardized z-scores to normalize the distribution); Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV; Wechsler, 2008), Digit Span Forward (DSF) scaled score to measure attention, Digit Span Backward (DSB) scaled score to measure working memory, and Coding scaled score to measure visual-motor coordination; Trail Making Test – A and B ratio score (TMT; Reitan, 1958) for executive control; and the Stroop Color and Word Test interference T-score (SCWT; Golden, 1978; Stroop, 1935) to measure inhibition.

Coping Assessment—Coping was measured using the Brief COPE (B-COPE; Carver, 1997), a self-report inventory of 14 action-focused and emotion-focused 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. Higher scores indicate greater frequency of use. Cronbach's alpha in the current study was .73.

Quality of Life Assessment—The Quality of Life Scale (QOLS; Burckhardt & Anderson, 2003) is a 16 item self-report inventory that assesses how satisfied people are in regards to 5 areas distinct from health status based on the domains of quality of life described by Flanagan (1978, 1982). Scores on the QOLS can range from 16-112, with higher scores indicative of better satisfaction with quality of life ($M = 73.94$, $SD = 19.09$). Cronbach's alpha in the current study was .94.

Covariates—Combat exposure, diagnosis of PTSD, and diagnosis of TBI were included as covariates in mediation analyses. Combat exposure was measured using the total score of the combat exposure scale of the Deployment Risk and Resilience Inventory (DRRI; King, King, & Vogt, 2003). Cronbach's alpha in the current study was .88. PTSD diagnosis was assessed by trained assessors who were supervised by licensed clinical psychologists using

the Clinician Administered PTSD Scale (CAPS; Blake et al., 1995). The CAPS was administered based on the worst event identified during their service in Iraq/Afghanistan, or if no DSM-IV criterion A event, in response to general deployment stress. This allowed for a continuous PTSD severity score to be derived for all participants. Exposure to a probable TBI was determined using the Brief Traumatic Brain Injury Screen (BTBIS; Schwab et al., 2006). The BTBIS has been used successfully in military populations as an early intervention and screening tool (Drake, Meyer, Cessante, Cheung, Cullen, McDonald, & Holland, 2010) and has shown to have good reporting consistency between other TBI questionnaires and interviews (Schwab et al., 2007). A positive TBI screen was based on report of a head injury during deployment (e.g., from a blast, vehicular accident, fall, bullet, fragment) that resulted in an alteration of consciousness (e.g., being disoriented, “dazed,” or confused, seeing “stars”), loss of consciousness, or posttraumatic amnesia.

Data Analysis

To determine the second-order factor structure of the B-COPE, principal component analysis (PCA) with Promax rotation was used. Variables were created, based on the second-order factor structure, using unit weighting (Carver, Scheier, & Weintraub, 1989). The associations between neuropsychological functioning and quality of life as well as coping and quality of life were evaluated using linear regression. To determine whether action- and emotion-focused coping acted as mediators in the association between neuropsychological functioning, outcomes were assessed using a statistical mediation analysis, as described by Preacher and Hayes (2004). Indirect effects were tested using a nonparametric bootstrapping procedure, which has been developed into a macro for use in SPSS (Preacher & Hayes, 2008). Because the derived action- and emotion-focused coping variables were unrelated, mediation was used.

Covariates for linear regressions and mediation analysis included intensity of combat exposure, and PTSD diagnosis, and probable TBI. These covariates were chosen because of their high prevalence in veteran samples and because of their previously established effects on neuropsychological functioning (Vasterling et al., 2006) and quality of life (Anderson et al., 2011; Vasterling & Brailey, 2005). Age was not related to any neuropsychological function, coping style, or quality of life outcome, and therefore was not used as a covariate. Additionally, word reading (WRAT-4) was normally distributed ($M = 99.24$, $SD = 12.59$) and not significantly related to any measure of neuropsychological function, coping style, or quality of life outcome, and therefore not included as a covariate.

Results

Cognitively, this sample was not significantly impaired, with the highest impairment rates ranging between 15.9-19.8% on verbal memory, and ranging between 0-7.8% on all other neuropsychological measures. Table 2 depicts means, standard deviations and impairment percentages (defined as greater than or equal to 1.5 *SDs* below the standardized mean) by neuropsychological measure.

Higher-Order Factor Analysis of the Brief COPE

Parallel analysis (O'Connor, 2000) indicated that two factors should be extracted from the PCA for the Brief COPE, which corresponded to theoretically derived action- (eigenvalue of 4.38) and emotion-focused (eigenvalue of 2.19) coping skills. The first component, which represented action-focused coping, included the positive reframing (.82), active coping (.76), planning (.75), emotional support (.68), instrumental support (.68), acceptance (.60), religion (.50), humor (.35), and self-distraction (.34) subscales of the B-COPE. The second component represented emotion-focused coping and included the behavioral disengagement (.67), self-blame (.62), venting (.59), denial (.53), and substance use (.31) subscales of the B-COPE. Unit weighting was used to create factor scores based on the factor score coefficients that were at least 33% as large as the largest factor score for each respective factor. Positive reframing, active coping, planning, emotional support, instrumental support, acceptance, religion, humor, and self-distraction were summed to create the action-focused coping factor. Behavioral disengagement, self-blame, venting, denial, and substance use were summed to create the emotion-focused coping factor. The unit-weighted action-focused coping and emotion-focused coping factors were not significantly related to one another, $r = -.09$, $p = .30$.

Neuropsychological Functioning and Quality of Life

Attention, inhibition, and working memory were not significantly associated with QoL. Executive control, immediate and delayed verbal recall and visual motor coordination were associated with quality of life, but were no longer significant after controlling for combat exposure, PTSD diagnosis, and probable TBI status. Table 3 depicts the predictive associations between neuropsychological function and quality of life before and after accounting for combat exposure, PTSD diagnosis, and probable TBI status. In support of the second hypothesis, action-focused coping was positively associated with quality of life, $\beta = .27$, $p < .001$, $f^2 = .10$, and emotion-focused coping was negatively associated with quality of life, $\beta = -.44$, $p < .001$, $f^2 = .27$, after controlling for combat exposure, PTSD diagnosis, and probable TBI.

Coping as a Modifiable Mediator

Finally, the hypothesis that action- and emotion-focused coping would mediate the association between neuropsychological functioning and quality of life was tested. Attention, executive control, inhibition, immediate verbal recall, visual motor coordination, and working memory were not significantly related to action- or emotion-focused coping, and therefore were not examined in the mediation analyses. Of note, delayed verbal recall was associated with action-focused coping, and PTSD diagnosis was positively associated with emotion-focused coping. The associations between neuropsychological functioning and action- and emotion-focused coping skills can be seen in Table 4. Mediation analysis indicated that delayed verbal recall influenced quality of life through its effects on action-focused coping, after accounting for the effects of combat exposure, $\beta = -.06$, $p = .55$, PTSD, $\beta = -.42$, $p < .001$, and probable TBI status, $\beta = .02$, $p = .84$. As can be seen in Figure 1, delayed verbal recall was positively associated with action-focused coping skills, a ; $\beta = .19$, $p = .04$, which was, in turn, positively associated with quality of life, b ; $\beta = .27$, p

< .01. A 95% bias-corrected bootstrap confidence interval for the indirect effect, ab ; $\beta = .05$, based on 10,000 bootstrap samples was above zero (.04 to .66).

Discussion

Contrary to our first hypothesis and the existing literature, neuropsychological functioning did not directly affect quality of life after controlling for degree of combat exposure, PTSD diagnosis, and probable TBI. Many veterans who experience psychological problems also experience neuropsychological difficulties including attention and memory deficits (Dolan et al., 2012). In turn, these difficulties have the potential to impair quality of life. For example, if a veteran has difficulty remembering to complete a task his/her spouse has asked him/her to do, this could cause difficulties within their relationship. These findings may be due to the majority of neuropsychological tests in this sample indicating a less than 8% impairment rate, which suggests minimal overall impairment despite high rates of PTSD diagnosis and self-reported, TBI exposure.

PTSD diagnosis was the only variable positively associated with emotion-focused coping. This is congruent with previous studies that have indicated PTSD as a differential mediator for the relationship between avoidant coping and family functioning (Creech, Benzer, Liebsack, Proctor, & Taft, 2013). PTSD is associated with many neuropsychological deficits, including attention, learning, and memory, which may account for the increased use in emotion-focused coping style (Vasterling, Brailey, Constans, Borges, & Sutker, 1997; Vasterling, Duke, Brailey, Constans, Allain, & Sutker, 2002). For example, a veteran with memory deficits may not be able to readily recall or access action-focused coping alternatives and will instead rely on more habitual emotion-focused coping skills.

Consistent with previous literature, both action- and emotion-focused coping directly predicted quality of life in veterans. Action-focused coping skills were positively predictive of a higher quality of life score, whereas emotion-focused coping was negatively predictive of a low quality of life score. In practice, this suggests treatment strategies that emphasize healthy action-focused coping and curb emotion-focused coping styles could be beneficial to veterans' quality of life.

Finally, action-focused coping mediated the association between delayed verbal recall and quality of life even after controlling for combat exposure, PTSD, and probable TBI. Interestingly, this indirect finding was specific to delayed verbal recall and not other neuropsychological deficits. It is possible that veterans who have difficulty with delayed recall also have difficulties accessing or remembering to use action-focused coping skills. These results were similar to a recent study by Wolters Gregório et al. (2015), which found TBI patients with self-reported executive functioning difficulties tended to use more passive coping strategies and ultimately reported lower quality of life. Of note, although significant, the magnitude of the relationship between delayed verbal recall and action-focused coping was small. This might be due to the generally low impairment rates in this sample, compared to other studies that have similarly reported that neuropsychological functioning affects coping skills (Krupan et al., 2007).

Teaching coping skills is already a focus of some evidence-based approaches to treatment for military personnel (Rosen et al., 2004). Coping skills training has been found to be effective in reducing anxiety and depression in active-duty members who deploy (Jones, Perkins, Cook, & Ong, 2008). However, no known study has investigated how neuropsychological deficits impact these coping skills, and in turn, a veteran's quality of life. Although this effect was small in magnitude, these findings are clinically relevant and have a variety of implications for treatment, care, and rehabilitation in a veteran population. Notably, neuropsychological rehabilitation requires specialized training and experience. However, teaching coping skills does not require as much training and experience and, therefore, could be more easily disseminated in treatment. This study suggests that concentrating on action-focused coping skills can be a point of intervention that can improve outcomes – particularly in veterans who are also experiencing difficulties with delayed verbal recall. Focusing on teaching veterans with memory difficulties to use more effective action-focused coping skills may not only help them to improve general coping with life stressors, but could also help to improve overall quality of life. Specifically, difficulties in delayed verbal recall may make it difficult for veterans to acquire new coping skills taught in treatment. It may benefit these veterans to present new action-focused coping skills in treatment multi-modally (e.g., in traditional auditory and additional visual formats) and to rehearse new coping skills in treatment so they may be encoded and stored more deeply, thus more able to be accessed and utilized outside of treatment.

Limitations

A number of limitations should be considered when interpreting cross-sectional data from the current study. First, consistent with military demographics for the current war theatres, the sample was largely male, which limits generalizability. Second, participants were not asked if they had undergone previous neuropsychological testing, which could have introduced bias via practice effects. Third, after meeting initial treatment stabilization requirements, participants were allowed to take psychiatric medications or engage in psychotherapy, the latter of which could have included components of coping skills training. Fourth, it is possible that participants may have had co-morbid neurological conditions that were not assessed or ruled out. Finally, PTSD and probable TBI were used as covariates in regressions of neuropsychological functioning predicting quality of life. Because severity of current symptoms of both PTSD and probable TBI and time since head injury were not assessed, this could have confounded the overall interpretation of the effects of neuropsychological functioning on quality of life.

Future Directions

Future research is needed to examine the prospective influence of the proposed mediation model. A prospective study would account for the temporal nature of causality that a mediation model assumes. Also, certain types of action- (e.g., planning, acceptance) or emotion-focused coping (e.g., venting) skills may be more strongly related to quality of life. In addition to focusing on individual skills, larger studies are needed that explore the level, frequency, and efficacy of specific coping skills. Previous studies have also found coping skills to be more sensitive to self-reported executive functioning deficits (Wolters Gregório et al., 2015). Future research is needed to evaluate the impact of executive functioning

measures in addition to intellectual and memory measures. Additionally, rates of substance use in military personnel are higher than in the general population, and the presence of co-occurring substance use disorders can complicate both treatment and quality of life. Including substance use as a covariate in future analyses exploring these hypotheses would help evaluate an additional spectrum of difficulties that can impact neuropsychological functioning, coping skills, and quality of life in veterans. Effect sizes were small, which indicates other factors impact quality of life. Future studies are needed to identify such other constructs, including, for example, distress tolerance, attributional bias, or social support. In addition, studies are needed that examine a wider array of neuropsychological functions (e.g., executive functioning and visual memory) and take into account other complicating problems that veterans experience, such as pain and co-occurring medical conditions. Finally, future studies are needed to determine whether findings are generalizable to other war theatres and within samples of women veterans and those in different age cohorts.

Conclusions

The current study provides evidence that action-focused coping mediates the association between long-term memory functioning and quality of life in returning veterans. Neuropsychological functioning impacts quality of life through coping skills. This suggests that focusing on action-focused coping skills could be valuable in improving quality of life for veterans with memory impairment. Additional research is clearly needed to determine whether teaching action-focused coping skills could serve as an intermediary solution to improving quality of life in veterans with delayed verbal recall deficits. However, because the magnitude of the indirect relationship established between delayed verbal recall and quality of life was small, it is likely that other components affect this association. Understanding the complex bidirectional relationships between neuropsychological functioning and quality of life is a critical step in developing empirically-informed recovery programs.

Acknowledgments

This research was supported by a Merit Award (I01RX000304) to Dr. Morissette from the Rehabilitation Research and Development Service of the Department of Veterans Affairs (VA) Office of Research and Development (ORD); a VISN 17 New Investigator Award to Dr. Meyer; a Career Development Award (IK2 CX000525) to Dr. Kimbrel from the Clinical Science Research and Development Service of VA ORD; the VA VISN 17 Center of Excellence for Research on Returning War Veterans; Central Texas Veterans Health Care System; and Baylor University Graduate School. We appreciate the contributions of veterans who participated in this study as well as numerous study staff who helped conduct the study. A complete list of publications from the project is available upon request from Dr. Morissette at Sandra.Morissette@utsa.edu. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.

References

- Amir M, Kaplan Z, Efroni R, Levine Y, Benjamin J, Kotler M. Coping styles in post-traumatic stress disorder (PTSD) patients. *Personality and Individual Differences*. 1997; 23(3):399–405.
- Blake DD, Weathers FW, Nagy LM, Kaloupek DG, Gusman FD, Charney DS, Keane TM. Development of a clinician-administered PTSD scale. *Journal Of Traumatic Stress*. 1995; 8:75–90. [PubMed: 7712061]
- Billings AG, Moos Rudolf, H. The role of coping responses and social resources in attenuating the stress of life events. *Journal of Behavioral Medicine*. 1981; 4:139–157. [PubMed: 7321033]

- Bryant RA, Marosszeky JE, Crooks J, Baguley IJ, Gurka J. Coping style and post-traumatic stress disorder following severe traumatic brain injury. *Brain Injury*. 2000; 14(2):175–180. [PubMed: 10695572]
- Burckhardt CS, Anderson KL. The Quality of Life Scale (QOLS): Reliability, validity, and utilization. *Health and Quality of Life Outcomes*. 2003; 1(60):1–7. [PubMed: 12605709]
- Campbell TA, Nelson LA, Lumpkin R, Yoash-Gantz RE, Pickett TC, McCormick CL. Neuropsychological measures of processing speed and executive functioning in combat veterans with PTSD, TBI, and comorbid TBI/PTSD. *Psychiatric Annals*. 2009; 39(8):796–803. doi: 10.3928/00485713-20090728-01.
- Carver CS. You want to Measure Coping But Your Protocol's Too Long: Consider the Brief COPE. *International Journal of Behavioral Medicine*. 1997; 4(1):92. [PubMed: 16250744]
- Carver CS, Scheier MF, Weintraub JK. Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*. 1989; 56(2):267–283. [PubMed: 2926629]
- Creech SK, Benzer JK, Liebsack BK, Proctor S, Taft CT. Impact of coping style and PTSD on family functioning after deployment in Operation Desert Shield/Storm returnees. *Journal Of Traumatic Stress*. 2013; 26(4):507–511. doi: 10.1002/jts.21823. [PubMed: 23893396]
- Delis, DC.; Kramer, JH.; Kaplan, E.; Ober, BA. The California Verbal Learning Test: Second Edition CVLT-II. The Psychological Corporation; San Antonio, TX: 2000.
- Dolan SL, Martindale SL, Robinson J, Kimbrel N, Meyer E, Kruse M, Gulliver SB. Neuropsychological sequelae of PTSD and TBI following war deployment among OEF/OIF Veterans. *Neuropsychology Review*. 2012; 22(1):21–34. [PubMed: 22350690]
- Drake AI, Meyer KS, Cessante LM, Cheung CR, Cullen MA, McDonald EC, Holland MC. Routine TBI screening following combat deployments. *NeuroRehabilitation*. 2010; 26(3):183–189. [PubMed: 20448308]
- Flanagan JC. A research approach to improving our quality of life. *American Psychologist*. 1978; 33:138–147.
- Flanagan JC. Measurement of the quality of life: Current state of the art. *Archives of Physical Medicine & Rehabilitation*. 1982; 63:56–59. [PubMed: 6460487]
- Folkman S, Lazarus RS. An analysis of coping in a middle-aged community sample. *Journal of Health & Social Behavior*. 1980; 21:219–239. [PubMed: 7410799]
- Gilbertson MW, Gurvits TV, Lasko NB, Orr SP, Pitman RK. Multivariate assessment of explicit memory function in combat veterans with posttraumatic stress disorder. *Journal Of Traumatic Stress*. 2001; 14(2):413. [PubMed: 11469166]
- Golden, CJ. Stroop Color and Word Test SCWT. Stoelting; Chicago, IL: 1978.
- Halligan, PW.; Wade, DT. The effectiveness of rehabilitation for cognitive deficits. Oxford University Press; New York, NY: 2005.
- Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine*. 2004; 351(1):13–22. doi: 10.1056/NEJMoa040603. [PubMed: 15229303]
- Huijts I, Kleijn WC, van Emmerik AAP, Noordhof A, Smith AJM. Dealing with man-made trauma: The relationship between coping style, posttraumatic stress, and quality of life in resettled, traumatized refugees in the Netherlands. *Journal Of Traumatic Stress*. 2012; 25:71–78. [PubMed: 22354510]
- Jastak, JF.; Jastak, S. Wide Range Achievement Test. PAR Psychological Assessment Resources, Inc.; Lutz, FL: 2006.
- Johnsen BH, Eid J, Laberg JC, Thayer JF. The effect of sensitization and coping style on post-traumatic stress symptoms and quality of life: Two longitudinal studies. *Scandinavian Journal of Psychology*. 2002; 43:181–188. [PubMed: 12004957]
- Jones DE, Perkins K, Cook JH, Ong AL. Intensive coping skills training to reduce anxiety and depression for forward-deployed troops. *Military Medicine*. 2008; 173(3):241–246. [PubMed: 18419025]
- King, DW.; King, LA.; Vogt, DS. Manual for the Deployment Risk and Resilience Inventory (DRRI): A Collection of Scales for Studying Deployment-Related Experiences in Military Veterans. National Center for PTSD; Boston, MA: 2003.

- Krpan KM, Levine B, Stuss DT, Dawson DR. Executive function and coping at one-year post traumatic brain injury. *Journal of Clinical & Experimental Neuropsychology*. 2007; 29(1):36–46. [PubMed: 17162720]
- Morissette SB, Woodward M, Kimbrel NA, Meyer EC, Kruse MI, Dolan S, Gulliver SB. Deployment-related TBI, persistent postconcussive symptoms, PTSD, and depression in OEF/OIF veterans. *Rehabilitation Psychology*. 2011; 56(4):340–350. doi: 10.1037/a0025462. [PubMed: 22121940]
- Najavits, LM.; Highley, J.; Dolan, SL.; Fee, FA. Substance use disorder.. In: Vasterling, JJ.; Bryant, RA.; Keane, TM., editors. PTSD and mild traumatic brain injury. Guilford Press; New York, NY US: 2012. p. 124-145.
- Nys GMS, van Zandvoort MJE, van der Worp HB, de Haan EHF, de Kort PLM, Jansen BPW, Kappelle LJ. Early cognitive impairment predicts long-term depressive symptoms and quality of life after stroke. *Journal of the Neurological Sciences*. 2006; 247(2):149–156. doi: <http://dx.doi.org/10.1016/j.jns.2006.04.005>. [PubMed: 16716359]
- O'Connor BP. SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instruments & Computers*. 2000; 32(3):396–402.
- Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments & Computers*. 2004; 36(4):717–731. doi: 10.3758/bf03206553.
- Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*. 2008; 40(3):879–891. [PubMed: 18697684]
- Reid-Amdt SA, Hsieh C, Perry MC. Neuropsychological functioning and quality of life during the first year after completing chemotherapy for breast cancer. *Psycho-Oncology*. 2010; 19(5):535–544. doi: 10.1002/pon.1581. [PubMed: 19472296]
- Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Perceptual & Motor Skills*. 1958; 8:271–276.
- Rosen CS, Chow HC, Finney JF, Greenbaum MA, Moos RH, Sheikh JI, Yesavage JA. VA practice patterns and practice guidelines for treating posttraumatic stress disorder. *Journal Of Traumatic Stress*. 2004; 17(3):213–222. doi: 10.1023/B:JOTS.0000029264.23878.53. [PubMed: 15253093]
- Schnurr PP, Lunney CA, Bovin MJ, Marx BP. Posttraumatic stress disorder and quality of life: Extension of findings to veterans of the wars in Iraq and Afghanistan. *Clinical Psychology Review*. 2009; 29:727–735. [PubMed: 19744758]
- Schwab KA, Baker G, Ivins B, Sluss-Tiller M, Lux W, Warden D. The Brief Traumatic Brain Injury Screen (BTBIS): Investigating the validity of a self-report instrument for detecting traumatic brain injury (TBI) in troops returning from deployment in Afghanistan and Iraq. *Neurology*. 2006; 66(5):A235.
- Schwab KA, Ivins B, Cramer G, Johnson W, Sluss-Tiller M, Kiley K, Warden D. Screening for traumatic brain injury in troops returning from deployment in Afghanistan and Iraq: initial investigation of the usefulness of a short screening tool for traumatic brain injury. *Journal of Head Trauma Rehabilitation*. 2007; 22(6):377–389. doi: 10.1097/01.htr.0000300233.98242.87. [PubMed: 18025970]
- Shandera-Ochsner AL, Berry DTR, Harp JP, Edmundson M, Graue LO, Roach A, High WM Jr. Neuropsychological effects of self-reported deployment-related mild TBI and current PTSD in OIF/OEF veterans. *The Clinical Neuropsychologist*. 2013; 27(6):881–907. doi: 10.1080/13854046.2013.802017. [PubMed: 23755991]
- Sheehan DV, Lecrubier Y, Sheehan KH, Amorim P, Janavs J, Weiller E, Dunbar GC. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *The Journal Of Clinical Psychiatry*. 1998; 59(Suppl 20):22–33. [PubMed: 9881538]
- Sohlberg, MM.; Mateer, CA. Cognitive Rehabilitation: An integrative neuropsychological approach. Guilford Press; New York, NY: 2001.

- Stock EM, Kimbrel NA, Meyer EC, Copeland LA, Monte R, Zeber JE, Morissette SB. A bayesian model averaging approach to examining changes in quality of life among returning Iraq and Afghanistan veterans. *International Journal of Methods in Psychiatric Research*. 2014
- Stroop JR. Studies of interference in serial verbal reaction. *Journal of Experimental Psychology: General*. 1935; 18:643–662.
- Vanderploeg RD, Curtiss G, Luis CA, Salazar AM. Long-term morbidities following self-reported mild traumatic brain injury. *Journal of Clinical Experimental Neuropsychology*. 2007; 29:585–598. [PubMed: 17691031]
- Vasterling, JJ.; Brailey, K. Neuropsychological Findings in Adults with PTSD.. In: Vasterling, JJ.; Brewin, CR., editors. *Neuropsychology of PTSD: Biological, cognitive, and clinical perspectives*. Guilford Press; New York, NY US: 2005. p. 178-207.
- Vasterling JJ, Brailey K, Constans JI, Borges A, Sutker PB. Assessment of intellectual resources in Gulf War Veterans: Relationship to PTSD. *Assessment*. 1997; 4:51–59.
- Vasterling JJ, Duke LM, Brailey K, Constans JI, Allain AN, Sutker PB. Attention, learning, and memory performances and intellectual resources in Vietnam veterans: PTSD and no disorder comparisons. *Neuropsychology*. 2002; 16(1):5–14. doi: 10.1037/0894-4105.16.1.5. [PubMed: 11853357]
- Vasterling JJ, Proctor SP, Amoroso P, Kane R, Heeren T, White RF. Neuropsychological outcomes of Army personnel following deployment to the Iraq war. *JAMA: Journal of the American Medical Association*. 2006; 296(5):519–529. doi: 10.1001/jama.296.5.519. [PubMed: 16882958]
- Wallin MT, Wilken J, Alfaro MH, Rogers C, Mahan C, Chapman JC, Kane R. Neuropsychologic assessment of a population-based sample of Gulf War veterans. *Cognitive and Behavioral Neurology*. 2009; 22(3):155–166. [PubMed: 19741325]
- Wechsler, D. *Wechsler Adult Intelligence Scale—Fourth Edition (WAIS–IV)*. Pearson Education, Inc.; San Antonio, TX: 2008.
- Wolters Gregório G, Ponds RWHM, Smeets SMJ, Jonker F, Pouwels CGJG, Verhey FR, van Heugten CM. Associations between executive functioning, coping, and psychosocial functioning after acquired brain injury. *British Journal of Clinical Psychology*. 2015 doi: 10.1111/bjc.12074.
- Wolters G, Stapert S, Brands I, Van Heugten C. Coping styles in relation to cognitive rehabilitation and quality of life after brain injury. *Neuropsychological Rehabilitation*. 2010; 20(4):587–600. doi: 10.1080/09602011003683836. [PubMed: 20446171]
- Wolters G, Stapert S, Brands I, Van Heugten C. Coping following acquired brain injury: Predictors and correlates. *Journal of Head Trauma Rehabilitation*. 2011; 26(2):150–157. [PubMed: 20535030]

Impact and Implications

- Identification of malleable treatment factors is imperative to improve quality of life among veterans who have high rates of traumatic brain injury, psychological disorders and neuropsychological difficulties.
- Veterans with delayed verbal recall problems may benefit from focusing on learning coping skills to improve quality of life.

Figure 1.

Mediation model. This figure illustrates the mediation model with unit-weighted action-focused coping as mediator after accounting for the effects of combat exposure, $\beta = -.06$, $p = .55$, PTSD, $\beta = -.42$, $p < .001$, and TBI status, $\beta = .02$, $p = .84$. β = standardized beta coefficient, *ns* = not significant, * $p < .05$, ** $p < .01$.

Table 1

Demographics and Military Characteristics

Demographic	N	% of Participants
Gender		
Female	19	14.6
Male	111	85.4
Ethnicity		
Hispanic	36	28.0
Race		
American Indian/Alaska Native	3	2.3
Asian/Asian American	5	3.8
Black/African American	24	18.9
Hawaiian/Pacific Islander	1	.8
White/Caucasian	82	64.6
Other	12	9.4
Education		
High School Diploma/GED	20	15.4
Some College, No Degree	55	42.3
Associates Degree	14	10.8
Technical School Certification	2	1.5
Bachelor's Degree	19	14.6
Some Graduate School	3	2.3
Graduate Degree	16	12.3
Branch of Service		
Air Force	6	4.7
Army	105	82.0
Marine Corps	11	8.6
National Guard	21	16.4
Navy	8	6.3
War Zone Deployments [*]		
Iraq	122	94.6
Afghanistan	23	17.8
Combat Experience		
Yes	122	93.9
No	6	4.6
Unknown	2	1.5
Diagnostics and Treatment [*]		
PTSD	55	42.3
Probable TBI	59	45.4
PTSD and Probable TBI	36	27.5
Current Psychiatric Care	58	45.0
Psychiatric Medications	47	36.2

Demographic	<i>N</i>	% of Participants
Current Individual Psychotherapy	44	34.4
Current Group Psychotherapy	27	21.1
Current Self-Help Group	10	7.8
Current Spiritual Counseling	21	16.5

Note. *N* = 130.

* Categories are not mutually exclusive.

Table 2

Neuropsychological Measure Means, Standard Deviations, and Impairment Percentages

Neuropsychological Measure	<i>M</i>	<i>SD</i>	Min.	Max.	% Impaired
Word Reading (N = 105)					
Standard Score	99.24	12.59	66	134	1.0
CVLT-II (N = 126)					
Short Delay Free Recall Raw Score	9.58	3.29	2	16	15.9
Long Delay Free Recall Raw Score	10.01	3.44	2	16	19.8
Digit Span Forward (N = 128)					
Scaled Score	9.20	2.71	3	17	7.8
Digit Span Backward (N = 128)					
Scaled Score	9.23	2.42	4	18	3.9
Digit Symbol Coding (N = 127)					
Scaled Score	9.23	2.44	2	15	5.5
SCWT (N = 125)					
Interference T-Score	51.18	8.02	29	78	8.0
Trail Making Test (TMT) A & B (N = 126)					
A Time (seconds)	28.53	10.30	12.44	74.47	0
B Time (seconds)	70.20	9.89	28.40	211	0

Note. Standard Scores have a *M* of 100 and a *SD* of 15, Scaled Scores have a *M* of 10 with a *SD* of 3, and T-Scores have a *M* of 50 with a *SD* of 10. Impairment was defined as 1.5 *SD* below the manual-normed standardized *M*. A time >78s on TMT A is considered impaired, whereas a time of >278s on TMT B is considered impaired.

Table 3

Associations between Neuropsychological Functioning and Quality of Life Accounting for the Effects of Combat Exposure, PTSD, and TBI

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	<i>R</i> ²	<i>f</i> ²
Neuropsychological Variables							
Attention	1.01	.67	.14	1.52	.13	.02	–
Executive Control	–4.64	1.83	–.23	–2.53	.01	.05	–
Inhibition	.06	.11	.05	.51	.61	.00	–
Immediate Verbal Recall	1.36	.52	.24	2.60	.01	.06	–
Delayed Verbal Recall	1.26	.50	.24	2.57	.01	.06	–
Visual Motor Coordination	1.56	.71	.20	2.20	.03	.04	–
Working Memory	.55	.74	.07	.74	.46	.01	–
Combat Exposure	–.99	.40	–.22	–2.47	.02	.05	–
PTSD Diagnosis	–14.73	2.43	–.48	–5.93	< .001	.23	–
Probable TBI	–4.73	3.4	–.13	–1.39	.17	.02	–
Accounting for Covariates							
Attention	.86	.60	.12	1.43	.16	–	.02
Executive Control	–3.16	1.68	–.16	–1.89	.06	–	.03
Inhibition	.10	.10	.09	1.04	.30	–	.01
Immediate Verbal Recall	.85	.50	.15	1.70	.09	–	.03
Delayed Verbal Recall	.68	.48	.13	1.43	.16	–	.02
Visual Motor Coordination	1.21	.65	.16	1.85	.07	–	.03
Working Memory	.33	.66	.04	.51	.62	–	.00

Note. Covariates include combat exposure (DRRI; King et al., 2006) diagnosis of PTSD (CAPS; Blake et al., 1995), and probable TBI (BTBIS; Schwab et al., 2006). *B* = unstandardized beta coefficient, *SE B* = standard error of beta, β = standardized beta coefficient, f^2 = Cohen's f^2 , effect size attributable to the neuropsychological predictors, when controlling for covariates.

Table 4
Association Between Neuropsychological Functioning and Action- and Emotion-Focused Coping Skills Accounting for the Effects of Combat Exposure, PTSD, and TBI

Neuropsychological Domain	Action-Focused Coping						Emotion-Focused Coping					
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	<i>f</i> ²	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	<i>f</i> ²
Attention	-.05	.12	-.03	-.37	.71	.00	-.06	.05	-.11	-1.28	.20	.01
Executive Control	.40	.33	.12	1.22	.23	.01	.21	.14	.14	1.55	.12	.02
Inhibition	.00	.02	.02	.16	.87	.00	-.01	.01	-.09	-1.04	.30	.01
Immediate Verbal Recall	.15	.10	.15	1.55	.12	.02	-.02	.04	-.05	-.52	.61	.00
Delayed Verbal Recall	.18	.09	.19	2.01	<.05	.04	.02	.04	.05	.53	.60	.00
Visual Motor Coordination	.07	.13	.05	.55	.58	.00	-.05	.05	-.08	-.91	.36	.01
Working Memory	-.16	.13	-.12	-1.30	.20	.02	.03	.05	.06	.66	.51	.00
Combat Exposure	.03	.07	.04	.42	.68	-.001	.06	.03	.19	2.13	.04	.04
PTSD Diagnosis	-.94	.49	-.17	-1.91	.06	-.03	.89	.20	.38	4.54	<.001	.15
TBI Status	-.06	.60	-.01	-.09	.93	-.00	.32	.25	.11	1.25	.21	.01

Note. Covariates include combat exposure (DRRI; King et al., 2006), diagnosis of PTSD (CAPS; Blake et al., 1995), and probable TBI (BTBIS; Schwab et al., 2006). *B* = unstandardized beta coefficient, *SE B* = standard error of beta, β = standardized beta coefficient, *t* = Cohen's *d*.