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Running Head: Reintegration in Post-9/11 veterans

Traumatic brain injury severity, comorbidity, social support, family functioning, and community reintegration among veterans of the Afghanistan and Iraq Wars

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Running Head: Reintegration in Post-9/11 veterans

Traumatic brain injury severity, comorbidity, social support, family functioning, and community reintegration among veterans of the Afghanistan and Iraq Wars

Abstract

Objective: Examine the association between traumatic brain injury (TBI) severity and social, family, community reintegration outcomes as well as return to work status among Post-9/11 veterans in Department of Veterans Affairs (VA) care.

Design: Retrospective observational cohort study.

Setting: Mail/online survey fielded to a national sample of veterans.

Participants: Among a sample of Post-9/11 veterans with at least 3 years of VA care stratified according to TBI severity and comorbidities, 2023 completed and returned surveys.

Interventions: Not applicable.

Main Outcome Measures: Deployment Risk and Resilience Inventory-2 family functioning and social support subscales; Military to Civilian Questionnaire; employment status.

Results: Bivariate analyses revealed that veterans with every classification of TBI severity reported significantly more difficulty on social, family, community reintegration outcomes than those with no TBI. In the fully adjusted model, veterans with unclassified and moderate/severe TBI reported significantly more difficulty with community reintegration and were less likely to be employed relative to those with no TBI; those with unclassified TBI also reported significantly more difficulty with family functioning.

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Veterans with mild TBI also reported significantly more difficulty with community reintegration.

Conclusions: This study provides insight into long-term outcomes associated with TBI in Post-9/11 veterans and suggests that exposure to TBI has a negative impact on social and family functioning, community reintegration, and return to work even after controlling for comorbidity, deployment experiences, and sociodemographic characteristics. Additional research is required to explicate what appear to be complex interactions among TBI severity, psychosocial well-being, combat exposures, and socioeconomic resources in this population.

Keywords: Brain Injury, Veterans, Mental Health, Stress Disorders, Post-Traumatic, Community Reintegration

List of Abbreviations:

AOC alteration of consciousness

CI Confidence Interval

CTBIE comprehensive traumatic brain injury evaluation

DRRI-2 Deployment Risk and Resilience Inventory-2

DoDTR Department of Defense Trauma Registry

FY fiscal year

GCS Glasgow Coma Scale

ICD-9-CM International Classification of Diseases, Ninth Revision, Clinical Modification

LOC loss of consciousness

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M2C-Q Military to Civilian Questionnaire

mTBI mild traumatic brain injury

OEF Operation Enduring Freedom

OIF Operation Iraqi Freedom

OND Operation New Dawn

OR Odds Ratio

PCT Polytrauma Clinical Triad

PTA post-traumatic amnesia

PTSD post-traumatic stress disorder

TBI traumatic brain injury

TBIMS Traumatic Brain Injury Model Systems

VA Department of Veterans Affairs

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After fifteen years of war in Iraq and Afghanistan, traumatic brain injury (TBI) remains one of the "signature injuries" among Post-9/11 veterans.[1] Previous research indicates that quality of life after TBI is significantly influenced by community integration, positive affect, and social support.[2] Research from the TBI Model Systems (TBIMS) has examined community reintegration in civilians with moderate and severe TBI, however, little is known about the impact of TBI on social/family functioning and returning to work among veterans. Moreover, perceptions of social, family, and community reintegration for veterans is complicated by common comorbidities like posttraumatic stress disorder (PTSD), depression, and chronic pain.[3–6]

More severe injury has generally been associated with poorer outcomes, with a substantial proportion of individuals who leave acute inpatient rehabilitation lacking independence in daily activities or are more likely to be unemployed relative to before injury.[7] However, evidence has revealed that the clinical manifestation of mild TBI (mTBI) may be complex. While symptoms usually resolve shortly after a single exposure, a small but meaningful contingent report prolonged post-concussive symptomology.[8] Belanger and colleagues noted that individuals with mTBI reported significantly more post-concussive complaints than those with moderate/severe TBI, even after controlling for age, mechanism of injury, and time since injury.[9] This difference disappeared, however, when controlling for PTSD symptom severity, indicating that emotional distress substantially contributed to post-concussive symptoms. The co-occurrence of post-concussive symptomology and mental health challenges may uniquely contribute to community reintegration and employment difficulties among Post-9/11 veterans.[10] In contrast, civilian studies have consistently

found that TBI itself, rather than mental health, was associated with less favorable community reintegration outcomes, including a dose-response relationship with higher unemployment among those with more severe TBI.[11–13] While a similar association was found for social relationships, functional status, and independent living, it was not possible to identify the TBI severity at which adverse outcomes became apparent.[11]

Evidence of psychiatric comorbidities and long-term outcomes in veterans with TBI suggests multiple factors may be at work.[14,15] An estimated 40% of Post-9/11 veterans using Department of Veterans Affairs (VA) medical services perceive difficulty in readjusting to civilian life, particularly among those with a diagnosis of PTSD.[16] The common comorbidity of TBI, PTSD, and depression suggests that studies of long-term TBI outcomes should control for mental health comorbidity and deployment exposures associated with trauma (e.g., fear of being killed).[3]

Studies exploring social, family, and community reintegration outcomes in Post-9/11 veterans have described the characteristics and challenges of the transition between military service and civilian life; however, longer-term social, family, and community reintegration outcomes have not been well examined. The purpose of this study was to examine the impact of TBI severity on measures of community reintegration, including social support, family functioning, military-to-civilian community reintegration, and return to work, controlling for comorbid conditions, deployment experiences, and sociodemographic characteristics. We hypothesized that veterans with less severe TBI would demonstrate more favorable outcomes than their more severely injured counterparts and that individuals with TBI of any severity would report less positive outcomes than individuals without TBI.

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Methods

Study Sample

After institutional review board approval, we identified a cohort of Post-9/11 veterans who received VA care between fiscal years (FY) 2007-2011 (October 1, 2006-September 30, 2011). Study data included the roster identifying veterans deployed in support of Operations Enduring Freedom, Iraqi Freedom, and New Dawn (OEF/OIF/OND), VA inpatient and outpatient data, Department of Defense Trauma Registry (DoDTR) data, VA TBI screening and CTBIE data, and survey data.

In a prior study we used VA diagnostic data to identify comorbidity groups among Post-9/11 veterans who entered VA care between FY2007-2009 and had three years of VA care before the end of FY2011 (N=164,933).[3] Findings revealed six major trajectories of comorbidity: Healthy, Minor Chronic (low probabilities of hypertension, obesity, diabetes), Chronic Disease, Mental Health, Pain, and Polytrauma Clinical Triad (PCT; TBI, PTSD, pain). Data describing how these trajectories were identified using latent class analysis have been reported elsewhere.[3] We controlled for comorbidity using these trajectory groups as physical and mental health comorbidities meaningfully influence outcomes.[17,18]

TBI Severity

In an effort to identify TBI in previously deployed veterans, the VA began screening veterans entering care in April 2007. Patients complete four questions regarding exposure to potential concussive events, symptomology immediately after exposure,

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trajectory of symptoms over time, and the presence of symptoms in the week prior to the interview. Veterans who endorse all four questions screen positive for TBI and are referred for the comprehensive TBI evaluation (CTBIE).[19] The CTBIE is a templated evaluation that identifies loss of consciousness, alteration of consciousness, and post-traumatic amnesia durations that can be used to identify TBI severity based on American Congress of Rehabilitation Medicine criteria.[20] Implementation of this screening and evaluation process has contributed to increased diagnosis of TBI in the Post-9/11 VA patient population, particularly mTBI.[21]

We estimated TBI severity using an algorithm with a hierarchy among data sources based on the availability of clinical data. Figure 1 shows the algorithm used to classify severity as mTBI, moderate/severe TBI, TBI for which severity could not be classified based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes[22] (Unclassified TBI), individuals who screen positive for TBI but had no other evidence of TBI (Screen Positive only), and those who had no evidence of TBI (no TBI). Briefly, the highest priority was given to data with more clinical information. The Glasgow Coma Scale is used by the American Congress of Rehabilitation Medicine to define TBI severity and thus was given highest priority. Next, self-reported duration of loss of consciousness, alteration of consciousness, and post-traumatic amnesia obtained in the CTBIE was prioritized.[20]. Third in priority was ICD-9-CM codes indicating TBI of different severities.[22] The final priority was self-reported experience of loss/alteration of consciousness (without information on duration) obtained using the four-item VA TBI screening instrument that inquires about exposure

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to potential concussive events, symptomology immediately after exposure, trajectory of symptoms over time, and the presence of symptoms in the week prior to the interview.[23]

Survey Administration

We mailed invitations to participate in the survey to approximately 9600 individuals randomly selected from each comorbidity group [approximately 800 from each trajectory stratified by gender]. This study used a modified Dillman survey method of paper and email based on participant preference.[24,25] Briefly, we sent an introduction letter, a paper survey, and a study information sheet that included a link to the online survey. Follow-up reminders to non-respondents were sent by mail 2, 4, and 6 weeks after the initial mailing; the final reminder included another copy of the paper survey. Participants indicated consent to participate using a check box on the returned survey. Invitations were fielded between September 2014 and February 2015 with a follow-up period of 6, 5, and 4 years for those who entered VA care in 2007, 2008, and 2009, respectively.

Outcome Measures

Deployment Risk and Resilience Inventory-2 (DRRI-2). The DRRI-2 post-deployment social support and family functioning subscales were included in the survey.[26] Responses were presented in a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Scores were then summed among each of the two subscales. The social support subscale has 10 items (range 10 to 50) and the family functioning subscale has 12 items (range 12 to 60), wherein higher scores indicated better

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functioning after deployment. Cronbach's alpha in this sample was 0.89 and 0.96 for the social support and family functioning subscales, respectively.

Military to Civilian Questionnaire (M2C-Q). A general assessment of community reintegration is the M2C-Q, a 16-item scale developed for Post-9/11 veterans.[27] Responses ranged from 0 (no difficulty) to 4 (extreme difficulty), with a 'does not apply' option for four items that may not be relevant to all respondents (e.g., getting along with children). The M2C-Q is scored by summing item responses and dividing by the number of items completed (excluding "does not apply" items) Scores on the M2C-Q range from 0 to 4 with higher scores indicating more difficulty with reintegration. Cronbach's alpha in this sample was 0.92.

Employment. Employment was assessed by asking whether individuals were currently employed with the options of employed and looking for another job, employed and not looking for another job, unemployed and looking for a job, and unemployed and not looking for another job. The two employed categories were categorized as "yes," and the unemployed categories were categorized as "no".

Covariates

Sociodemographic characteristics. Characteristics were derived from VA data (inpatient, outpatient, OEF/OIF/OND roster file) and included age, sex, race/ethnicity, marital status, co-pay status (indicator of low income based on the means test), rank at military discharge (enlisted and other), branch of service, and component of service (active duty and other).

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Deployment Experiences. Combat-related exposure in this sample was assessed using dichotomous (yes/no) responses that mirrored the items in the post-deployment health assessment used by the Department of Defense including: (1) were you engaged in direct combat where you discharged your weapon (Engaged Weapon); (2) did you ever feel that you were in great danger of being killed (Feared Being Killed); (3) did you ever see anyone wounded, killed, or dead (Saw Wounded or Dead); and (4) were you wounded or injured by hostile actions (Wounded in Combat).[28]

Analysis

We first generated descriptive statistics of the sample for sociodemographic, deployment experiences, and comorbidity groups by TBI severity. TBI severity was operationalized using dummy coded variables with the no TBI group as the comparator. We then used generalized linear model regression and logistic regression analyses to examine the association of TBI severity with reintegration outcomes, using the no TBI group as the comparator. Finally, we developed multivariable models to determine if there were statistical differences on scale scores (general linear model) or employment (logistic) by TBI severity, controlling for comorbidity groups, sociodemographic characteristics, and deployment experiences. Analyses were conducted with SAS 9.3 ® (Carey, NC) with statistical significance set at $p<0.05$.

Results

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For this study, 9358 surveys were mailed (5483 to men; 3875 to women); of those, 474 were returned as “non-deliverable”. Overall, 2046 individuals returned surveys; 2023 (1059 men, 913 women) completed at least half (23% response rate). Table 1 describes comorbidity groups, sociodemographic characteristics, and deployment experiences by TBI severity. Respondents were more likely to be Caucasian, Officers at the time of military discharge, female, married, older than 61, or have some post-college education than non-respondents.

DRRI-2 social support

Table 2 shows mean scores for the DRRI-2 social support subscale. Regression with only TBI severity found that compared to those with no TBI, all other TBI groups had significantly lower social support scores [$F(4, 2003)=14.68$, $p<0.001$; $R^2=0.03$]. Multivariable regression (Table 3) found that comorbidity group, deployment experiences, and sociodemographic characteristics were significant predictors of social support scores, but TBI severity was no longer significant [$F(28,1934)=10.60$, $p<0.001$; $R^2=0.13$].

DRRI-2 family functioning

Mean scores on the DRRI-2 family functioning scale are shown in Table 2. Regression with TBI severity found that compared to those with no TBI, those with Screen Positive, or had mTBI, moderate/severe TBI, and unclassified TBI scored significantly lower [$F(4, 2003)=14.87$, $p<0.001$; $R^2=0.03$]. Full model multivariable regression (Table 3) found that TBI severity (unclassified TBI), comorbidity group,

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sociodemographic characteristics, and deployment experiences were significantly associated with family functioning scores [$F(28, 1934)=10.66$, $p<0.001$; $R^2=0.13$].

Military to Civilian Questionnaire (M2C-Q)

Mean M2C-Q scale scores from bivariate analyses are shown in Table 2. Regression with TBI severity only found that those with mTBI, moderate/severe TBI, and unclassified TBI had significantly higher scores than those with no TBI [$F(4,2002)=49.45$, $p<0.001$; $R^2=0.09$]. Multivariable regression (Table 3) found that TBI severity (mTBI, moderate/severe TBI, and unclassified TBI), comorbidity group, deployment experiences, and sociodemographic characteristics were significant predictors of community reintegration scores [$F(28, 1933)=24.89$, $p<0.001$; $R^2=0.27$].

Employment

Table 2 shows the percent employed by TBI severity group. After controlling for comorbidity groups, deployment experiences, and sociodemographic characteristics, the odds of employment among those with moderate/severe and Unclassified TBI were significantly lower relative to those with no TBI (Table 3). Comorbidity group, deployment experiences, and sociodemographic characteristics were also significant predictors of employment.

Discussion

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Our study examined long-term social, family, and community reintegration outcomes associated with TBI severity in Post-9/11 veterans. We found that there were significant differences in bivariate analyses on all included measures of reintegration by TBI severity. However, after controlling for sociodemographics, deployment experiences, and comorbidity groups, TBI severity was no longer a significant predictor of reported social support (DRRI-2). However, those with moderate/severe and unclassified TBI had more difficulty with community reintegration (M2C-Q) and were significantly less likely to be employed than those with no TBI. Those with mTBI had significantly more difficulty with community reintegration and those with unclassified TBI had significantly lower scores on family functioning (DRRI-2) relative to those with no TBI.

After controlling for sociodemographic characteristics, comorbidity groups, and deployment experiences, few differences on outcome measures remained significant with regard to TBI severity. Multivariable regression indicated that TBI severity accounted for little variance (~3%) on measures of social support and family functioning with slightly more variance accounted for on the community reintegration measure (~9%). Addition of comorbidity groups, sociodemographic characteristics, and deployment experiences added significant explanatory value to the model. Mental Health and PCT comorbidity groups consistently fared more poorly on all outcome measures, suggesting mental health conditions play an important role in community reintegration distinct from that of TBI, consistent with findings in prior studies.[9,29] Moreover, the diminished influence of TBI severity following the inclusion of mental

health comorbidities in our analyses supports emotional distress as an explanatory factor in poorer outcomes, consistent with prior work by Belanger and colleagues.[9]

Sociodemographic characteristics may also account for bivariate TBI severity findings becoming non-significant. Consistent with Sander and colleagues, we found that income was associated with all social, family, and community reintegration outcomes examined in this study.[30] Individuals with indicators of lower income (eligible for no copay; prior enlisted veterans) consistently reported lower levels of social support and family functioning, more difficulty with community reintegration, were less likely to be employed, and more likely to have had a TBI (Table 1).

Moreover, we found that women reported significantly more difficulty with community reintegration and were significantly less likely to be employed in the fully adjusted analyses. Consistent with this finding, previous work has found that women veterans more frequently report being unemployed or looking for work than their male counterparts.[31] While there were also significant associations with sex and race/ethnicity on outcomes, groups with the least favorable outcomes (e.g., women, African-Americans) were significantly less likely to have had a TBI (Table 1). This pattern suggests that factors other than TBI, such as discrimination and gender bias, may contribute to poorer community reintegration outcomes. Further research specific to outcomes among female and racial/ethnic minority Veterans is warranted.

Deployment experiences may also account for many bivariate TBI severity findings becoming non-significant. Individuals who reported combat-related exposures were more likely to have had a TBI (especially mTBI). Those who reported a fear of being killed or having seen wounded or dead people had significantly less social

support and more difficulty with community reintegration. These findings align with existing research that indicates that the psychological ramifications of these experiences may have the propensity to influence long-term outcomes, including social, family, and community reintegration, particularly among veterans.[10,14,15]

The most consistent finding related to TBI severity concerned unclassified TBI. These individuals reported significantly lower family functioning, greater difficulty with community reintegration, and were significantly less likely to be employed relative to individuals with no TBI. This is consistent with previous work that individuals with unclassified TBI had a similar likelihood of having epilepsy as individuals with moderate/severe TBI.[32] Based on our TBI severity hierarchy (Figure 1), these individuals did not have data in the DoDTR; and while they may have screened positive for TBI, they did not also complete the CTBIE, which would have provided more information with which to classify severity. Thus, they may be less likely to engage fully in VA care and represent a group at risk for adverse outcomes. While additional research is needed to better understand outcomes in these individuals, this study suggests that it is important to include them in analyses in studies using diagnostic data to classify TBI severity.

Study Limitations

Our study has several limitations. TBI severity was based on administrative data and therefore does not include an exhaustive history of TBI exposure, including non-deployment TBI, although it is likely to capture more severe injuries requiring medical evacuation from theater. There may have been inaccuracies with coding of injury

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severity, although our TBI classification hierarchy used a wider variety of data sources than prior studies in order to mitigate this potential problem.[32] Finally, the response rate to the survey was relatively low (25%). Data from this selective sample of Post-9/11 VA users may not be representative of all users with the specified TBI severity levels or comorbidities. However, a particular strength of this study is that it compared social and community reintegration outcomes among TBI groups with greater granularity than most other studies of Post-9/11 veterans to date. Although results may not be generalizable to a broader population, our findings suggest associations between TBI severity, mental health comorbidities, deployment experiences, sociodemographics, with social and community reintegration outcomes highlight areas in critical need of further investigation in more representative, population-based samples.

Conclusions

This study provides insight into long-term outcomes associated with TBI in Post-9/11 veterans and suggests that TBI continues to have a negative impact on social community reintegration after the transition from military to civilian life, even after controlling for comorbidity, deployment experiences, and sociodemographic characteristics. Additional research is required to fully explicate the complex interactions among TBI severity, psychosocial well-being, combat exposures, and socioeconomic resources in this population.

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Figure Legends

Figure 1. Schematic representation of the algorithm used to categorize traumatic brain injury (TBI) severity. With this algorithm, data from the DoDTR was first considered. The DoDTR contains Glasgow Coma Scale scores, which range between 3 and 15; an individual with a score of 12 or less would be considered to have a moderate/severe TBI, whereas an individual with a score of 13 to 15 would be considered to have mTBI. Then, if the previously mentioned data source was not available for an individual, self-reported duration of loss of consciousness, alteration of consciousness, and post-traumatic amnesia from the comprehensive TBI evaluation (CTBIE) was used to classify TBI severity based on Department of Defense criteria.[20] Then, if the aforementioned data sources were not available for an individual, International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes from VA care were used to classify TBI severity based on coding guidance from the Department of Defense.[22] Lastly, if data were not available from all of the above listed sources, responses from the the VA TBI screening measure was examined to help identify those that had indicated a history of TBI and recent symptomology (Screened Positive). If a veteran did not have any evidence among these data sources of exposure to TBI, they were categorized as No TBI.

* For each individual in the Department of Defense Trauma Registry (DoDTR) with a Glasgow Coma Scale (GCS) score of 3, the algorithm instead prioritizes the most severe TBI from among the ICD-9-CM diagnosis codes from the DoDTR and responding on the CTBIE at the United States Department of Veterans Affairs (VA).

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Table 1. Sociodemographics, comorbidity groups, and deployment experiences group by traumatic brain injury (TBI) severity in the surveyed sample.

N (%)	**No TBI** N=1455 (67.08%)	**Screen Positive only** N=143 (6.59%)	**mTBI** N=324 (16.83%)	**Moderate/ Severe TBI** N=60 (3.50%)	**Unclassified TBI** N=41 (1.89%)	**Total** N=2023 (100%)
Age [Mean,(SD)]	41.59 (10.48)	39.50 (9.60)	37.72 (9.17)	40.37 (9.45)	35.51 (7.94)	40.66 (10.27)
30 and Under	15.26%	18.88%	27.47%	13.33%	34.15%	17.80%
31-45	46.94%	51.75%	50.31%	56.67%	43.90%	48.05%
46 and Over	37.80%	29.37%	22.22%	30.00%	21.95%	34.16%
Sex (Male)*	47.97%	65.73%	71.91%	71.67%	60.98%	1093 (54.03)
Marital status (Married)*	47.08%	55.24%	49.07%	50.00%	48.78%	973 (48.10)
Race/Ethnicity*						
White	65.91%	68.53%	73.46%	68.33%	56.10%	1359 (67.18)
African-American	21.03%	15.38%	12.35%	8.33%	21.95%	382 (18.88)
Hispanic	8.66%	9.79%	10.19%	21.67%	7.32%	189 (9.34)
Asian	2.13%	2.10%	2.47%	0%	9.76%	46 (2.27)
Native American/ Pacific Islander	1.03%	2.10%	1.23%	1.67%	2.44%	24 (1.19)
Unknown	1.24%	2.10%	0.31%	0%	2.44%	23 (1.14)
Copay Status (Exempt)*	83.23%	94.41%	96.30%	98.33%	95.12%	1756 (86.80)
Rank (Enlisted)*	86.74%	93.71%	93.83%	91.67%	97.56%	1795 (88.73)
Component (Active Duty)*	58.01%	57.34%	58.02%	53.33%	75.61%	1177 (58.18)
Branch*						
Army	57.66%	71.33%	75.62%	66.67%	65.85%	1253 (61.94)
Air Force	17.11%	10.49%	3.40%	6.67%	14.63%	285 (14.09)
Marines	7.56%	11.89%	13.27%	16.67%	12.20%	185 (9.14)
Navy/Coast Guard	17.66%	6.29%	7.72%	10.00%	7.32%	300 (14.83)
Comorbidity Group*						
Healthy	20.21%	9.79%	4.32%	5.00%	4.88%	327 (16.16)
Minor Chronic	7.15%	11.19%	6.79%	11.67%	9.76%	153 (7.56)
Chronic	26.39%	8.39%	6.79%	5.00%	7.32%	424 (20.96)
Mental Health	14.71%	23.08%	12.96%	10.00%	7.32%	298 (14.73)

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Pain	17.80%	14.69%	10.80%	13.33%	19.51%	331 (16.36)
PCT	13.75%	32.87%	58.33%	55.00%	51.22%	490 (24.22)
Deployment Experiences*						
Wounded in combat (Yes)	10.59%	31.16%	56.07%	52.54%	37.50%	419 (21.22)
Fear being killed (Yes)	71.95%	91.37%	93.15%	87.93%	85.00%	1532 (77.49)
Saw wounded or dead people (Yes)	65.64%	90.21%	91.36%	88.33%	85.37%	1468 (72.57)
Engaged weapon (Yes)	24.40%	51.75%	67.90%	61.67%	56.10%	709 (35.05)

Abbreviations: TBI, traumatic brain injury; mTBI, mild TBI; pTBI, penetrating TBI; PCT, Polytrauma Clinical Triad

Percent is presented in order to adhere to data security guidelines set forth by the Department of Veterans Affairs (VA).

*significant at the $p<0.05$ level

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Table 2. Scores on each of the survey measures by traumatic brain injury (TBI) severity, sociodemographic characteristics, comorbidity groups, and deployment experiences in this sample.

Mean (SD)	DRRI-2 Social Support N=2008	DRRI-2 Family Function N=2008	M2C-Q N=2007	Percent Employed N=1982 (%)
TBI Severity				
No TBI	37.16 (9.24)	44.02 (12.73)	1.39 (1.00)	988 (69.19)
Screen Positive only	34.63 (8.37)	39.96 (12.57)	1.91 (0.94)	81 (59.12)
mTBI	33.71 (9.47)	39.35 (12.96)	2.07 (0.94)	173 (54.40)
Moderate/Severe TBI	32.56 (8.79)	38.14 (12.04)	2.28 (0.94)	15 (25.42)
Unclassified TBI	32.63 (9.27)	37.22 (12.10)	2.22 (0.95)	18 (45.00)
Age				
30 and Under	35.72 (9.37)	42.21 (13.18)	1.66 (1.01)	243 (68.26)
31-45	36.01 (9.22)	41.94 (12.82)	1.67 (1.02)	619 (65.02)
46 and Over	36.71 (9.44)	43.96 (12.79)	1.42 (1.04)	413 (61.28)
Sex				
Male	35.86 (9.17)	42.56 (12.80)	1.62 (1.02)	713 (66.95)
Female	36.59 (9.50)	42.84 (13.02)	1.53 (1.04)	562 (61.29)
Marital status				
Married	36.72 (9.02)	44.02 (12.41)	1.54 (1.04)	607 (63.56)
Not Married	35.71 (9.58)	41.44 (13.22)	1.61 (1.03)	668 (65.04)
Race/Ethnicity				
White	36.67 (9.07)	43.17 (12.75)	1.56 (1.01)	874 (65.57)
African-American	34.74 (9.94)	41.25 (12.94)	1.61 (1.08)	224 (60.22)
Hispanic	34.97 (9.77)	41.37 (13.45)	1.67 (1.07)	115 (61.83)
Asian	36.78 (8.49)	42.24 (13.76)	1.80 (1.21)	27 (60.00)
Native American/Pacific Islander	36.33 (8.48)	44.33 (11.39)	1.63 (1.00)	15 (62.50)
Unknown	40.91 (9.12)	47.22 (14.20)	1.19 (0.99)	20 (90.91)
Copay Status				

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Exempt	35.66 (9.35)	42.01 (12.91)	1.67 (1.03)	1054 (61.35)
Not Exempt	39.72 (8.38)	47.11 (11.93)	1.01 (0.85)	221 (83.71)
Rank				
Officer/Warrant Officer	38.74 (9.02)	46.43 (12.69)	1.20 (1.02)	164 (72.89)
Enlisted	35.87 (9.32)	42.20 (12.85)	1.63 (1.02)	1111 (62.23)
Component				
Guard/Reserve	36.12 (9.39)	42.75 (12.92)	1.53 (1.04)	530 (64.01)
Active Duty	36.25 (9.29)	42.63 (12.90)	1.61 (1.03)	745 (64.56)
Branch				
Army	35.78 (9.36)	42.12 (12.85)	1.65 (1.03)	765 (62.45)
Air Force	37.31 (9.32)	44.47 (12.60)	1.29 (1.00)	192 (68.33)
Marines	35.42 (9.14)	41.77 (12.85)	1.72 (0.98)	122 (66.67)
Navy/Coast Guard	37.37 (9.17)	43.86 (12.82)	1.46 (1.04)	196 (66.89)
Comorbidity Group				
Healthy	39.19 (8.91)	46.08 (12.78)	1.14 (0.96)	254 (78.64)
Minor Chronic	38.38 (7.79)	45.64 (11.61)	1.31 (1.00)	113 (75.33)
Chronic	37.59 (9.29)	45.40 (12.14)	1.30 (0.96)	272 (64.76)
Mental Health	33.79 (9.59)	39.32 (12.95)	1.84 (0.93)	181 (61.99)
Pain	37.74 (9.01)	45.60 (11.70)	1.36 (0.99)	239 (74.69)
PCT	32.73 (8.75)	37.18 (12.48)	2.18 (0.91)	216 (45.28)
Deployment Experiences				
Wounded in combat				
Yes	33.53 (8.98)	39.45 (12.41)	2.07 (0.99)	213 (51.57)
No	36.96 (9.29)	43.57 (12.85)	1.44 (1.00)	106 (67.76)
Had fear of being killed				
Yes	35.23 (9.22)	41.39 (12.81)	1.74 (1.02)	935 (62.17)
No	39.64 (8.91)	47.06 (12.21)	1.00 (0.85)	313 (71.14)
Saw wounded or dead people				
Yes	35.15 (9.15)	41.41 (12.81)	1.75 (1.02)	894 (62.26)

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No	38.95 (9.24)	46.02 (12.54)	1.12 (0.93)	381 (69.78)
Engaged weapon				
Yes	34.02 (9.15)	40.21 (12.86)	1.94 (0.99)	416 (60.29)
No	37.36 (9.22)	44.00 (12.73)	1.38 (1.00)	859 (66.49)

Abbreviations: TBI, traumatic brain injury; DRRI-2, Deployment Risk and Resilience Inventory-2; M2C-Q, Military to Civilian Questionnaire; mTBI, mild TBI; PCT, Polytrauma Clinical Triad

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Table 3. Results of the multivariable regression analyses on each of the survey measures by traumatic brain injury (TBI) severity, sociodemographic characteristics, comorbidity groups, and deployment experiences in this sample.

	DRRI-2 Social Support **B (SE)** N=1963	**DRRI-2 Family Function** **B (SE)** N=1963	**M2C-Q** **B (SE)** N=1962	**Percent Employed** **AOR (95% CI)** N=1939
TBI Severity				
No TBI	Ref	Ref	Ref	Ref
Screen Positive only	-0.232 (0.82)	-1.007 (1.13)	0.156 (0.08)	0.79 (0.53-1.17)
mTBI	-0.158 (0.65)	-0.360 (0.90)	0.160 (0.06)*	0.81 (0.59-1.11)
Moderate/Severe TBI	-1.465 (1.22)	-1.580 (1.69)	0.423 (0.12)*	0.19 (0.10-0.37)*
Unclassified TBI	-2.405 (1.44)	-3.923 (1.98)*	0.427 (0.15)*	0.42 (0.21-0.84)*
Age				
30 and Under	Ref	Ref	Ref	Ref
31-45	-0.483 (0.58)	-1.605 (0.79)*	0.097 (0.06)	0.79 (0.57-1.03)
46 and Over	-0.534 (0.70)	-1.034 (0.96)	-0.033 (0.07)	0.54 (0.38-0.77)*
Sex				
Male	Ref	Ref	Ref	Ref
Female	0.045 (0.48)	-0.194 (0.66)	0.111 (0.05)*	0.59 (0.46-0.75)*
Marital status				
Married	Ref	Ref	Ref	Ref
Not Married	-1.144 (0.45)*	-2.590 (0.62)*	-0.011 (0.05)	0.98 (0.79-1.23)
Race/Ethnicity				
White	Ref	Ref	Ref	Ref
African-American	-1.945 (0.54)*	-1.793 (0.75)*	0.054 (0.06)	0.92 (0.70-1.20)
Hispanic	-1.216 (0.70)	-0.982 (0.97)	0.032 (0.07)	1.11 (0.78-1.58)
Asian	0.524 (1.33)	-0.133 (1.84)	0.214 (0.14)	0.82 (0.42-1.58)

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Native American/Pacific Islander	-0.032 (1.85)	2.610 (2.55)	-0.066 (0.19)	1.11 (0.44-2.79)
Unknown	2.282 (1.90)	1.176 (2.63)	-0.050 (0.19)	3.94 (0.89-17.48)*
Copay Status				
Exempt	Ref	Ref	Ref	Ref
Not Exempt	6.168 (0.63)*	2.327 (0.87)*	-0.327 (0.06)*	2.18 (1.51-3.15)*
Rank				
Officer/Warrant Officer	Ref	Ref	Ref	Ref
Enlisted	-1.444 (0.67)*	-2.129 (0.92)*	0.189 (0.07)*	0.65 (0.46-0.92)*
Component				
Guard/Reserve	Ref	Ref	Ref	Ref
Active Duty	0.844 (0.46)	0.989 (0.63)	-0.022 (0.05)	1.05 (0.84-1.32)
Branch				
Army	Ref	Ref	Ref	Ref
Air Force	-0.925 (0.62)	-0.848 (0.86)	0.011 (0.06)	1.02 (0.74-1.40)
Marines	-0.557 (0.74)	-0.566 (1.02)	0.051 (0.08)	0.99 (0.68-1.43)
Navy/Coast Guard	0.084 (0.63)	-0.326 (0.86)	0.112 (0.06)	1.14 (0.83-1.56)
Comorbidity Group				
Healthy	Ref	Ref	Ref	Ref
Minor Chronic	-0.047 (0.91)	0.311 (1.25)	0.074 (0.09)	0.72 (0.44-1.18)
Chronic	-1.504(0.68)*	-0.903 (0.94)	0.155 (0.07)*	0.58 (0.40-0.82)*
Mental Health	-4.581 (0.72)*	-5.673 (1.00)*	0.515 (0.07)*	0.52 (0.36-0.76)*
Pain	-980 (0.70)	0.000 (0.97)	0.113 (0.07)	0.97 (0.66-1.42)
PCT	-4.415 (0.71)*	-6.626 (0.97)*	0.627 (0.07)*	0.33 (0.23-0.48)*
Deployment Experiences				
Wounded in combat				
Yes	Ref	Ref	Ref	Ref
No	0.611 (0.57)	0.386 (0.79)	-0.123 (0.06)*	1.37 (1.04-1.81)*
Had fear of being killed				

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Yes	Ref	Ref	Ref	Ref
No	2.055 (0.55)*	2.780 (0.76)*	-0.383 (0.06)*	1.11 (0.83-1.47)
Saw wounded or dead people				
Yes	Ref	Ref	Ref	Ref
No	1.798 (0.53)*	2.093 (0.72)*	-0.276 (0.05)*	1.10 (0.85-1.44)
Engaged weapon				
Yes	Ref	Ref	Ref	Ref
No	0.982 (0.53)	0.699 (0.73)	-0.150 (0.05)*	0.93 (0.72-1.22)

Abbreviations: TBI, traumatic brain injury; DRRI-2, Deployment Risk and Resilience Inventory-2; M2C-Q, Military to Civilian Questionnaire; AOR, adjusted odds ratio; CI, confidence interval; Ref, Reference group; mTBI, mild TBI; PCT, Polytrauma Clinical Triad

* significant at the $p<0.05$ level

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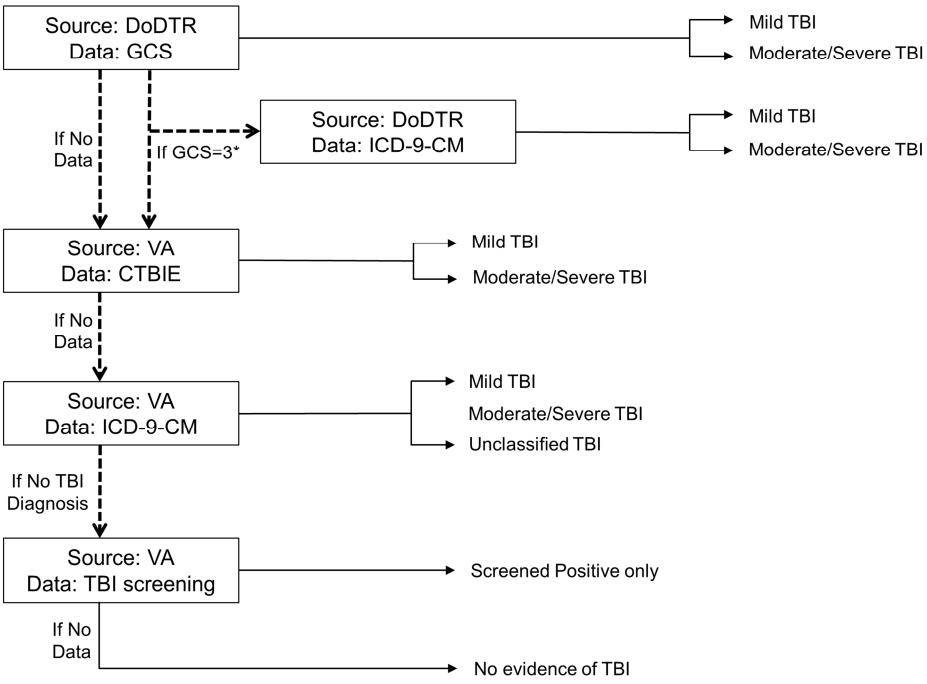

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