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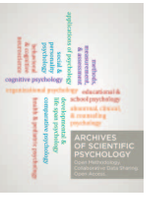

Development of a Large Outpatient Psychological Dataset of Marines and Navy Personnel

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A B S T R A C T

The recent wars have brought new challenges for military service members, particularly as it relates to posttraumatic stress disorder (PTSD) and blast injuries. Though research has been conducted on the psychological effects of these injuries, the 2 most common disorders have yet to be studied together with large sample sizes. This article describes the gathering and analysis of demographic, premorbid and subsequent neuropsychological and psychological data. The sample includes 893 active duty military personnel and has approximately 1 million data points. We believe that this is the largest dataset of its kind and will serve as a foundation for research by both the group involved in gathering and cleaning this dataset, as well as other researchers and clinicians that request access to the data.

S C I E N T I F I C A B S T R A C T

The use of improvised explosive devices, rocket-propelled grenades, and landmines in recent wars has raised awareness into the effects of mild traumatic brain injury (mTBI) and posttraumatic stress disorder (PTSD). In this study, 893 active duty military personnel were administered a comprehensive evaluation that included extensive premorbid functioning e.g., Armed Services Vocational Aptitude Battery (ASVAB), structured interview, as well as psychological and neuropsychological testing postdeployment. In this first publication on this dataset, we first present the approach taken to obtain, record, clean, and analyze the data. Over 1 million data points are presented in a descriptive fashion to provide an initial overview of the information obtained by grouping individuals into four groups: (a) blast only; (b) PTSD only; (c) comorbid blast and PTSD; and (d) neither blast nor PTSD. Findings using this dataset have the potential to meaningfully add to the understanding of deployment-related mTBI and PTSD. The robustness of a demographically and psychometrically extensive dataset is discussed, as well as the inclusion of blast and PTSD groups and the value of premorbid data.

Keywords: PTSD, blast injuries, TBI, military, large dataset
Data repository: https://osf.io/rv9cj/

Research conducted on previous military conflicts has suggested that exposure to combat results in an increased risk of mental health problems. The recent wars in Iraq (Operation Iraqi Freedom [OIF]) and Afghanistan (Operation Enduring Freedom [OEF]) are unique

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The authors have made available for use by others the data that underlie the analyses presented in this article (see Puente, 2020), thus allowing replication and potential extensions of this work by qualified researchers. Next users are obligated to involve the data originators in their publication plans, if the originators so desire.

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when compared with previous military conflicts for many reasons. First, with the advances in military technology and medical care, personnel are surviving combat injuries at higher rates than in previous wars (Marx, 2009). Thus, more soldiers are returning home from war with injuries. Second, personnel were deployed for multiple tours of duty that were longer in duration and provided shorter intervals between deployments (Marx, 2009). This significantly increases an individual's chance of sustaining traumatic brain injury (TBI) or being exposed to potentially traumatic experiences leading to posttraumatic stress disorder (PTSD) and/or other related mental health problems. According to the Mental Health Advisory Team (MHAT V, 2008), 12% of military personnel returning from their first deployment were positively screened for mental health problems. This percentage more than doubles to 27% among personnel returning from their third and fourth deployments. Additionally, 22% of those deployed for longer than six months screened positively for mental health problems, compared with just 15% of those deployed for less than 6 months (MHAT V, 2008). Third, new trademark weapons exist in the current wars. The use of improvised explosive devices (IEDs), rocket-propelled grenades, and landmines account for 78% of all combat-related injuries (Owens et al., 2008). Due to the novelty of recent combat weaponry, mild TBI (mTBI) as a result of blast trauma represents a relatively poorly understood type of military injury (Belanger, Kretzmer, Yoash-Gantz, Pickett, & Tupler, 2009). In such injuries, serious damage can occur due to the high-pressure waves associated with a blast rather than the mechanical injuries associated with a traditional mTBI (e.g., falls, motor vehicle accidents, sports-related head injuries). Due to the advancing medical technology, longer tours of duty, shorter intervals between deployments, and the use of new explosive mechanisms, PTSD and mTBI have been referred to as "signature injuries" in veterans returning from OEF and OIF.

TBI and PTSD are two of the leading causes of injury among U.S. military veterans who have served in Iraq and Afghanistan (Hoge et al., 2004). Estimates suggest that 12–22% of OEF/OIF veterans have sustained a TBI, with the majority (approximately 80%) of cases being mild in severity (Bahraini et al., 2014; Hoge et al., 2008; Tanielian & Jaycox, 2008; U.S. Department of Defense, 2018). However, this is likely an underestimate, as more than 50% of all TBI's sustained by U.S. troops deployed to Iraq or Afghanistan are likely undocumented (Chase & Nevin, 2015). The neuropsychological sequelae associated with sustaining blast-related mTBI vary, and may include deficits in attention, learning/memory processes, and executive function (see Dolan et al., 2012). This ambiguity in sequelae is

Table 1
Tests Used and Purpose of Assessment

Tests (alphabetical)	Purpose of instrument
Beck Anxiety Inventory (BAI)	Measures both physiological and cognitive symptoms of anxiety. It consists of 21 items, each with its own descriptive of a symptom of anxiety, and is rated on a scale of 0–3.[a]
California Verbal Learning Test (CVLT-II)	One of the most comprehensive and detailed assessments of verbal learning and memory. It consists of five learning trials of 16 words. It also provides an interference list, short-delay free and cued recall, long-delay free, recognition and forced choice recall.[b]
Controlled Oral Word Association Test (COWAT)	A verbal fluency test that measures spontaneous production of words beginning with the same letter or belonging to the same category within a certain time period.[c]
Grip Strength Test	Assesses motor function by measuring the strength or intensity of voluntary grip movements of each hand.[d]
Grooved Pegboard Test	A manipulative dexterity test assessing fine motor skills. Pegs must be rotated and inserted into 25 holes with randomly positioned slots.[e]
Trails A and B Test	A measure of processing speed and executive functions. Trails A consists of 25 circles each with a number from 1–25. The individual is to connect the circles as quickly as possible. Trails B consists of 25 circles numbered from 1–13 and lettered from A-L. The participant is to connect the circles in sequence, alternating between numbers and letters as quickly as possible.[d]
Hayling and Brixton tests	Consists of two tests of behavior regulation: Hayling to measure initiation speed as well as response suppression and Brixton to measure rule attainment. Contains two sets of 15 sentences each having the last word missing. In the first section the participant has to complete the sentence (response initiation speed), and in the second section the participant has to complete the sentence with a word that does not fit (response suppression ability). Additionally, a visuospatial sequencing task with rule changes is presented. The patient is to detect rules in these sequences.[f]
Minnesota Multiphasic Personality Inventory (MMPI-2)	A 567-item true/false questionnaire used to screen for personality and psychosocial disorders in adults.[g]
Stroop Neuropsychological Screening Test (Stroop NST)	Assessment of cognitive processing, providing information on brain dysfunction, cognition and psychopathology. Includes the color task (participant reads color names in which no name is presented in its matching color) and color-word task (participant names the ink color in which the color names are printed).[h]
Test of Memory Malingering (TOMM)	A visual recognition test designed to help distinguish between malingered and true memory impairments. It consists of two learning trials and one optional retention trial.[i]
Trauma Symptom Inventory (TSI)	A 100-item self-report test designed to assess ones functioning after experiencing a traumatic event. Participants are asked to rate certain behaviors, thoughts and feelings on a scale from 0–3.[j]
Wechsler Adult Intelligence Scale (WAIS-III/WAIS-IV)	Most widely used measure of cognitive ability. Includes the assessment of attention, concentration, verbal comprehension, abstraction, and visual spatial skills.[k]
Wechsler Memory Scale (WMS-III/WMS-IV)	Most widely used scale of adult memory. Includes the assessment of verbal and visual memory and learning.[l]
Wide Range Achievement Test (WRAT-4)	An achievement test that measures basic academic skills of reading, spelling and math.[m]
Zung Depression Scale (Zung)	Measures intensity of depression. It consists of 20 items, each with its own descriptive of a symptom of depression, and is rated on a 4-point Likert scale.[n]

[a] (Beck & Steer, 1993). [b] (Delis, Kramer, Kaplan, & Ober, 2000). [c] (Benton, Hamsher, Rey, & Sivan, 1994). [d] (Reitan & Wolfson, 1993). [e] (Trites, 2003). [f] (Strauss, Sherman, & Spreen, 2006). [g] (Hathaway & McKinley, 1989). [h] (Golden, 1978). [i] (Tombaugh, 1996). [j] (Briere, 1995). [k] (Wechsler, Coalson, & Railford, 2008). [l] (Wechsler, 2008). [m] (Wilkinson & Robertson, 2006). [n] (Zung, 1965).

Table 2
Demographic Characteristics of Participants

Demographic	*M*	Median	Mode	Range	*SD*
Age (years)	26.33	24.00	22.00	18–63	6.69
Education (years)	12.50	12.00	12.00	6–18	1.13
ASVAB					
AFQT	60.37	98.00	61.50	23–98	18.48
GT	109.20	139.00	110.00	13–139	11.95
MM	109.85	144.00	111.00	72–144	12.30
CL	98.12	144.00	106.00	0–144	31.29
EL	107.80	139.00	108.00	0–139	12.98

Note. *SD* = standard deviation; ASVAB = Armed Services Vocational Aptitude Battery; AFQT = Armed Forced Qualification Test; GT = general technical; MM = mechanical maintenance; CL = clerical; EL = electronics.

likely due to challenges related to mTBI diagnosis and the often-limited knowledge related to the severity and frequency of the blast event, as these injuries are often sustained during combat and in isolation from medical resources at the time of the injury (Nelson et al., 2011). Additionally, the characteristics related to classification of mTBI are often based on self-report, which is complicated by the long time period that typically exists between the time of injury and the time of assessment (Hoge, Goldberg, & Castro, 2009). This creates a challenge in conducting research because most cognitive effects following mTBI typically resolve within 30 to 90 days of injury (Belanger, Curtiss, Demery, Lebowitz, & Vanderploeg, 2005; Carroll et al., 2004; Dolan et al., 2012,). The effects of mTBI are generally found to have limited lasting neuropsychological consequences in contrast to PTSD, which has been associated with longer lasting cognitive impairment (Vasterling et al., 2012; Verfaellie, Lafleche, Spiro, & Bousquet, 2014).

Rates of PTSD in OEF/OIF veterans are similar to mTBI, with an estimated prevalence between 5% and 23%, depending on level of exposure (Fulton et al., 2015; Kok, Herrell, Thomas, & Hoge, 2012). In terms of neuropsychological concomitants of PTSD, impairment has been noted in intellectual ability, attention, executive functions, and memory. For example, intelligence has been associated with PTSD in both civilian and military samples, with a higher IQ serving as a protective factor for the development of PTSD (Brewin, Andrews, & Valentine, 2000; Hart et al., 2008; Vasterling et al., 2002). In addition, deficits in attention and executive functions serve as risk factors for the development of PTSD (Aupperle, Melrose, Stein, & Paulus, 2011; Brewin et al., 2000). Further, memory impairment is related to active symptom presentation in PTSD (Brewin, Kleiner, Vasterling, & Field, 2007). Additionally, other individual variables, such as age, ethnicity, life experiences, and perceived unit cohesion independently contribute to the development of PTSD (Brailey, Vasterling, Proctor, Constans, & Friedman, 2007).

The comorbidity of mTBI and other psychiatric disorders, including PTSD, in the military population is high and difficult to untangle due to the overlap in clinical presentation and underlying pathophysiology (Elder, Ehrlich, & Gandy, 2019; Hendrickson, Schindler, & Pagulayan, 2018; Morissette et al., 2011, Vasterling et al., 2012, 2018; Verfaellie et al., 2014). In one study Vasterling et al. (2012) reported that 18% of soldiers that had sustained a head injury with loss of

Table 3
Demographic Characteristics of Participants

Demographic	Frequency	Percentage
Ethnicity		
Caucasian	630	63.32
Unspecified	247	75.18
Hispanic	51	5.13
African American	50	5.02
Asian American	8	0.80
American Indian	3	0.30
Pacific Islander	5	0.50
Other	1	0.10
Gender		
Male	847	85.13
Unspecified	107	10.75
Female	41	4.12
Handedness		
Right	741	74.47
Unspecified	153	15.38
Left	85	8.54
Ambidextrous	16	1.61

Table 4
Service-Related Information

Demographic	*M*	Median	Mode	Range	*SD*
Number of deployments	1.94	2.00	2.00	0–10	1.31

Table 5
Service-Related Information

Demographic	Frequency	Percentage
Location of deployment		
Iraq	435	48.71
Afghanistan	149	16.69
Unspecified	141	15.79
Both	131	14.67
Home base	19	2.12
Other	18	2.02
Rank		
E1	1	0.11
E2	29	3.25
E3	208	23.29
E4	234	26.20
E5	173	19.37
E6	59	6.61
E7	27	3.02
E8	16	1.79
E9	10	1.12
O2	2	0.22
O3	5	0.56
O4	1	0.11
W2	4	0.45
W3	1	0.11
W4	3	0.34
Unspecified	120	13.44
Service branch		
USMC	635	71.11
Unspecified	219	24.52
USN	38	4.26
USMC and USN	1	0.11

Note. E1 = Private (Marine Corps) and Seaman Recruit (Navy); E2 = Private First Class (Marine Corps) and Seaman Apprentice (Navy); E3 = Lance Corporal (Marine Corps) and Seaman (Navy); E4 = Corporal/Petty Officer Third Class; E5 = Sergeant/ Petty Officer Second Class; E6 = Staff Sergeant/Petty Officer First Class; E7 = Gunnery Sergeant/Chief Petty Officer/Sergeant First Class; E8 = Master Sergeant/First Sergeant (Marine Corps) and Senior Chief Petty Officer (Navy); E9 = Master Gunnery Sergeant/ Sergeant Major (Marine Corps) and Master Chief Petty Officer (Navy); O2 = First Lieutenant (Marine Corps) and Lieutenant Junior Grade (Navy); O3 = Lieutenant/ Captain; O4 = Major (Marine Corps) and Lieutenant Commander (Navy); W2 = Chief Warrant Officer 2; W3 = Chief Warrant Officer 3; W4 = Chief Warrant Officer 4; USMC = United States Marine Corps; USN = United States Navy.

Table 6
Injury-Related Information

Demographic	*M*	Median	Mode	Range	*SD*
Time since injury (months)	25.95	14.00	13.00	1–156	27.58

consciousness screened positive for PTSD, and 31% screened positive for depression. The comorbidity of these psychiatric disorders and mTBI has been associated with small decrements in neuropsychological performance (Combs et al., 2015; Verfaellie et al., 2014). Storzbach et al. (2015) found that most of the differences in neurocognitive functioning between those with and without mTBI were eliminated once PTSD was accounted for. In a study assessing subjective cognitive change among servicemembers from Iraq and Afghanistan, PTSD symptom severity independently predicted perceived change in executive function, while objective neuropsychological performance did not (Karr et al., 2019). These studies suggest that traumatic stress mediates the cognitive effects of those with blast exposure, highlighting the importance of PTSD treatment.

Research related to the cognitive and emotional functioning of military personnel with PTSD and/or mTBI has numerous limitations. First, many of the studies published using military populations have relatively small sample sizes ($M = 64.40$; e.g., Armistead-Jehle, 2010; Bahraini et al., 2009; Belanger et al., 2009; Brenner, Terrio, et al., 2010; Cook et al., 2005; Gordon, Fitzpatrick, & Hilsabeck, 2011; Hart et al., 2008; Nelson et al., 2011; Nye, Qualls, & Katzman, 2006; Shandera-Ochsner et al., 2013; Storzbach et al., 2015; Troyanskaya et al., 2015; Vasterling et al., 2002; Verfaellie, Lafleche, Spiro, & Bousquet, 2014; Whitney, Shepard, Williams, Davis, & Adams, 2009). Although large scale studies exist (e.g., Baker et al., 2012; Brenner, Ivins, et al., 2010; Hoge et al., 2008; Vasterling et al., 2006), these are all inpatient samples that focus primarily on the understanding of PTSD. Another limitation in the literature associated with PTSD and mTBI is that effort testing is rarely incorporated into the assessment, as seen in Baker et al. (2012), Brailey et al. (2007), Hoge et al. (2008), McCarthy, Thompson, and Knox (2012), Morissette et al. (2011), and Owens et al. (2008). The literature suggests that, at times, veterans demonstrate insufficient effort during neuropsychological testing, with 17–28% of those with a history of mTBI performing poorly on at least two tests of effort (Jak et al., 2015; Whitney et al., 2009). Armistead-Jehle (2010) found that as many as 50% of veterans referred for mTBI testing performed poorly on at least one effort test. Poor performance on effort tests is associated with significantly lower scores on neuropsychological measures when compared with those that had valid scores (Jak et al., 2015). However, there may be different interpretations for less than optimal scores depending on the sample involved in the study. Another limitation relates to research including premorbid assessments of intellect and functioning. Only one study has been conducted to estimate the intellectual abilities of military servicemembers using Armed Services Vocational Aptitude Battery (ASVAB) scores, an important tool in the assessment of premorbid functioning (Kratz, Poppen, & Burroughs, 2007). No studies have been conducted using ASVAB scores in relation to extensive neuropsychological testing data.

Purpose of Dataset

The dataset described in the present article addresses several of the limitations mentioned above, including a large sample size with comprehensive psychological and neuropsychological testing, validity testing, and premorbid functioning data. Additionally, this dataset includes individuals with PTSD and/or exposure to blasts. The purpose of this article is to introduce the database with specific research questions being addressed subsequently. The dataset in the present study will be examined from a quantitative perspective and focus on both the cognitive and emotional functioning of servicemembers based on their test performance. It is anticipated that this is the first

Table 7
Injury-Related Information

Demographic	Frequency	Percentage
Blast frequencies		
Multiple blasts	446	49.94
Unspecified	280	31.35
One blast	109	12.21
No blasts	58	6.49
Headaches		
Yes	485	54.31
Unspecified	384	43.00
No	24	2.69
Loss of consciousness		
Yes	398	44.57
Unspecified	290	32.47
No	172	19.26
Unsure	33	3.70
Referral reason		
Blasts	594	66.52
Head injury	58	6.49
Fall	43	4.82
Closed head injury	35	3.92
Vehicle accident	33	3.70
Emotional changes	22	2.46
Memory problems	12	1.34
Unspecified	10	1.12
Physical assault	8	0.90
Heat stroke	6	0.67
Concussion	4	0.45
Cognitive changes	3	0.34
Hydrocephalus	3	0.34
Seizures	3	0.34
ADHD	2	0.22
Infection	2	0.22
Multiple sclerosis	1	0.11
Sleep problems		
Yes	511	57.22
Unspecified	345	38.63
No	37	4.14
Substance misuse		
Unspecified	481	53.86
Yes	219	24.52
No	193	21.61
Type of injury		
Unspecified	372	41.66
Multiple blast types	157	17.58
IED mounted	137	15.34
IED not specified	74	8.29
IED dismounted	72	8.06
Rocket propelled grenade	13	1.46
Fall	12	1.34
Vehicle	12	1.34
Concussion	10	1.12
Mortar	9	1.01
IED dismounted and mounted	7	0.78
Gunshot	5	0.56
Grenade	4	0.45
Motor vehicle accident	3	0.34
Motorcycle	3	0.34
Rocket	3	0.34

Note. ADHD = attention deficit hyperactivity disorder; IED = improvised explosive device.

Table 8
Preliminary Statistics on Effort Testing

Test	*M* (*SD*)	Median	Mode	Range
TOMM				
Trial 1[a]	44.28 (6.53)	47	50	13–50
Trial 2[a]	47.95 (5.19)	50	50	9–50
Retention trial[a]	47.71 (5.69)	50	50	12–50

Note. TOMM = Test of Memory Malingering.
[a] Total # correct.

article in a series of publications to follow that will analyze different aspects of the dataset across cognitive and emotional domains, and likewise that the dataset will be archived for use by other investigators and clinicians.

Method

A dataset of psychological testing results of 893 military personnel was compiled by the Roger W. Sperry Neuropsychology Laboratory at University of North Carolina Wilmington (UNCW) in collaboration with neuropsychologists in Carolina Psychological Health Services (CPHS), an independent practice serving servicemembers assigned to Military Base Camp Lejeune, Jacksonville, NC. Participants were referred to CPHS by military neurologists and other qualified medical officers from Naval Hospital Camp Lejeune for neuropsychological evaluation due to reported cognitive deficits as a result of military deployment (e.g., head injury due to blasts). Premorbid (e.g., ASVAB) and demographic variables (e.g., education) were gathered. Participants were interviewed and then administered a neuropsychological blast battery that was developed with input from neuropsychology colleagues at the Walter Reed National Medical Center. The battery provided a comprehensive assessment of the following neurocognitive domains: effort, emotional functioning, personality, executive functions, intelligence and achievement, learning and memory, and motor functioning (see Table 1 for the list of tests used to assess these cognitive domains). A total of 18 demographic variables were obtained and 17 tests were administered. Individual raw, cumulative, and standardized scores from the assessments were collected. For example, all 100 items from the Trauma Symptom Inventory (TSI) as well as raw and t-scores for each scale were obtained. In addition to this, 117 reassessments were conducted and entered into the dataset. Consequently, a total of 990 variables exist per individual file, providing a potential total of 999,900 data points. However, it must be noted that not all participants had all 990 variables recorded in their charts. When files had missing data point, no proration of the missing data was pursued.

Paper forms with testing data, demographic information, history, and symptoms were scanned and converted into searchable pdf's by personnel from the UNCW Roger W. Sperry Neuropsychology Laboratory, and files were stored on a Seagate Expansion Portable External Secure Hard Drive. The external hard drive was password protected. This data was transferred to laboratory computer hard drives where trained research assistants de-identified all of the data and entered all raw and standardized scores as well as coded demographic and TBI-related information into a secured Excel file. Data entry was double checked for accuracy and interrater reliability was calculated. This de-identified dataset was continuously backed up onto two passwords protected external WD My Passport Ultra 1TB Portable External USB hard drives throughout the coding process. Additionally, the dataset was backed up on a data server on UNCW's campus, which was only accessible to authorized users who had to be present in the lab to access. During this process, the data was protected and secured through passcodes. Only trained researchers had

Table 9
Preliminary Statistics on Emotional and Personality Testing

Test	*M* (*SD*)	Median	Mode	Range
BAI[a]	42.33 (14.36)	38	44	3–74
MMPI-2				
VRIN[b]	50.39 (11.30)	50	50	30–103
F[b]	74.34 (22.04)	50	70	36–120
Fb[b]	68.34 (23.30)	76	51	0–120
Fp[b]	60.02 (16.30)	63	56	41–120
L[b]	51.92 (9.77)	56	48	33–87
K[b]	40.98 (9.16)	52	30	30–77
S[b]	39.27 (9.18)	39	30	30–75
Hs (1)[b]	72.12 (16.06)	37	68	30–108
D (2)[b]	70.54 (16.75)	76	74	30–109
Hy (3)[b]	68.68 (16.96)	74	76	30–109
Pd (4)[b]	61.04 (14.96)	71	59	30–102
Mf (5)[b]	44.11 (9.59)	62	50	30–120
Pa (6)[b]	61.94 (18.10)	44	64	30–119
Pt (7)[b]	68.75 (18.03)	64	68	30–109
Sc (8)[b]	74.94 (20.60)	71	62	30–120
Ma (9)[b]	60.45 (14.62)	77	59	30–107
Si (0)[b]	59.09 (13.83)	62	70	30–88
PK[b]	74.06 (19.54)	78	92	37–113
MMPI-2-RF				
RCd[b]	63.69 (12.83)	64	62	37–86
RC1[b]	75.04 (13.03)	77	79	36–100
RC2[b]	65.72 (15.90)	65	65	34–99
RC3[b]	61.08 (11.45)	61	61	34–83
RC4[b]	59.96 (11.43)	59	65	34–93
RC6[b]	63.59 (15.48)	61	43	43–100
RC7[b]	60.50 (13.91)	60	62	34–94
RC8[b]	65.71 (14.14)	63	52	39–100
RC9[b]	58.46 (11.78)	58	56	28–91
VRIN-r[b]	53.47 (10.86)	53	48	34–97
TRIN-r[b]	66.09 (13.95)	65	57	50–120
F-r[b]	84.42 (23.17)	83	120	42–120
Fp-r[b]	69.18 (18.41)	68	68	42–120
Fs[b]	79.76 (21.03)	74	74	42–120
FBS-r[b]	70.15 (13.96)	70	73	32–108
RBS[b]	84.05 (18.94)	84	88	33–120
L-r[b]	54.87 (9.20)	52	52	37–91
K-r[b]	40.35 (9.58)	38	35	24–69
TSI				
Atypical response[b]	47.24 (10.05)	45	41	41–100
Response level[b]	50.91 (7.87)	49	45	37–95
Inconsistent response[b]	60.96 (15.85)	58	45	37–100
Anxious arousal[b]	63.56 (10.50)	66	66	38–82
Depression[b]	56.41 (11.26)	53	41	41–83
Anger/irritability[b]	65.72 (11.97)	69	79	37–82
Intrusive experiences[b]	67.70 (13.03)	69	77	42–89
Defensive avoidance[b]	61.27 (10.59)	62	67	41–85
Dissociation[b]	66.03 (13.00)	66	68	41–98
Sexual concerns[b]	53.73 (11.13)	51	42	41–94
Dysfunctional sexual behavior[b]	55.93 (13.28)	52	44	44–100
Impaired self-reference[b]	59.68 (11.39)	59	57	41–89
Tension reduction behavior[b]	60.34 (13.47)	58	43	43–100
Zung[a]	49.04 (10.49)	50	48	21–77

Note. BAI = Beck Anxiety Inventory; MMPI = Minnesota Multiphasic Personality Inventory; TSI = Trauma Symptom Inventory; VRIN = variable response inconsistency; F = infrequency; Fb = back F; Fp = infrequency-psychopathology; L = lie; K = correction; S = superlative self-presentation; Hs = hypochondriasis; D = depression; Hy = hysteria; Pd = psychopathic deviate; Mf = masculinity/femininity; Pa = paranoia; Pt = psychasthenia; Sc = schizophrenia; Ma = hypomania; Si = social introversion; PK = PTSD; RCd = demoralization; RC1 = somatic complaints; RC2 = low positive emotions; RC3 = cynicism; RC4 = antisocial behavior; RC6 = ideas of persecution; RC7 = dysfunctional negative emotions; RC8 = aberrant experiences; RC9 = hypomanic activation; TRIN = true response inconsistency; Fs = infrequent somatic responses; FBS = symptom validity; RBS = Response Bias Scale; L-r = uncommon virtues; K-r = adjustment validity.
[a] Total score. [b] T score.

Table 10
Preliminary Statistics on Tests of Executive Functioning

Test	*M* (*SD*)	Median	Mode	Range
COWAT				
Letter fluency[a]	30.70 (9.80)	30	24	8–75
Semantic fluency[b]	19.27 (5.38)	19	17	5–38
Trail making test				
Trail making test A[c]	34.22 (17.58)	30	27	11–239
Trail making test B[c]	77.25 (36.08)	70	63	18–301
Hayling and Brixton test				
Sensible sentence completion[d]	15.66 (4.43)	8	3	5–24
Unconnected completion: Speed[c]	25.72 (5.36)	31	4	7–44
Unconnected completion: Inhibition[d]	13.06 (4.87)	4	0	5–101
Spatial anticipation task[d]	27.98 (8.65)	13	12	2–52
Stroop NST				
Color[e]	110.20 (18.80)	112	112	25–305
Color word[e]	89.74 (22.36)	95	112	12–140

Note. COWAT = Controlled Oral Word Association Test; Stroop NST = Stroop Neuropsychological Screening Test.
[a] Total number of words for three trials. [b] Total number of words for one trial. [c] Seconds. [d] Total correct. [e] Total number of words.

access to the data. Both SPSS and R statistical programs were used for data analysis.

The UNCW Institutional Review Board (IRB) approved this research (protocol number H1213-145; approval date 12.08.2015). Laboratory personnel associated with this project received IRB training and oversight from each other and supervisory personnel.

Participants

Of the 1,010 assessments completed, 893 were distinct individuals. The remaining assessments were a result of repeated testing, with some individuals being tested two or three times due to a request from the medical board. Participant information was calculated using distinct individuals; all repeated testing profiles were excluded. In addition, the following demographic information has been calculated using only those for whom the data was available. To review the number of individuals who did not specify for each variable, please see Tables 3, 5, and 7.

Table 11
Preliminary Statistics on Intelligence and Achievement Testing

Test	*M* (*SD*)	Median	Mode	Range
WAIS-III				
Verbal comprehension	101.54 (10.10)	101	103	76–134
Perceptual organization	102.04 (12.81)	101	109	70–142
Working memory	99.00 (13.45)	97	99	61–148
Processing speed	93.75 (12.84)	93	86	60–141
Full scale	97.50 (12.02)	97	99	60–137
WAIS-IV				
Verbal comprehension	95.96 (11.13)	96	93	66–130
Perceptual reasoning	100.01 (13.00)	100	100	55–133
Working memory	93.46 (12.68)	95	97	37–133
Processing speed	88.51 (13.67)	89	92	50–137
Full scale	94.08 (11.43)	94	89	55–128
General ability	97.25 (12.23)	99	101	42–133
WRAT-4				
Word reading[a]	58.82 (6.32)	59	60	31–106
Math[a]	42.79 (10.30)	41	40	27–115

Note. WAIS-III/WAIS-IV = Wechsler Adult Intelligence Scale; WRAT-4 = Wide Range Achievement Test.
[a] Raw Score.

Table 12
Preliminary Statistics on Memory Tests

Test	*M* (*SD*)	Median	Mode	Range
CVLT-II				
Trial 1[a]	5.71 (1.53)	6	5	1–11
Trial 2[a]	8.50 (2.07)	8	8	3–16
Trial 3[a]	10.22 (2.46)	10	10	1–22
Trial 4[a]	11.25 (2.49)	11	12	3–16
Trial 5[a]	11.92 (2.45)	12	13	2–18
Trials 1–5[a]	47.61 (9.38)	48	50	13–72
Trial B[a]	5.15 (1.52)	5	5	1–11
Short delay free recall[a]	9.89 (3.23)	10	10	0–16
Short delay cued recall[a]	10.96 (3.06)	11	10	0–40
Long delay free recall[a]	9.91 (3.55)	10	11	0–16
Long delay cued recall[a]	10.69 (3.25)	11	12	0–16
WMS-III				
Auditory immediate	85.09 (27.57)	94	97	30–142
Visual immediate	94.37 (15.69)	94	97	45–138
Immediate memory	94.10 (15.75)	95	84	45–134
Auditory delayed	96.61 (14.83)	98	102	46–136
Visual delayed	94.03 (15.73)	94	97	45–132
Auditory recognition delayed	96.06 (15.60)	95	110	53–130
General memory	95.89 (15.85)	96	110	45–132
Working memory	97.14 (14.12)	99	96	45–146
WMS-IV				
Auditory memory	92.93 (13.94)	94	102	47–126
Visual memory	96.90 (14.56)	96	95	48–139
Visual working memory	93.73 (13.12)	94	94	60–130
Immediate memory	94.68 (13.61)	96	96	54–129
Delayed memory	93.88 (15.90)	94	102	40–130

Note. CVLT-II = California Verbal Learning Test; WMS-III/WMS-IV = Wechsler Memory Scale.
[a] Total number of words.

The participants were on average 26.33 (*SD* = 6.69) years of age, majority were male (*N* = 847 males), and Caucasian (*N* = 630). For detailed demographic information, see Tables 2 and 3. Individuals had a mean educational attainment of 12.50 (*SD* = 1.13) years. Number of deployments ranged between 0 and 10 with an average of 1.94 (*SD* = 1.31) and most deployments being to Iraq. Blast frequencies consisted of 58 individuals with no blasts, 109 individuals with one blast, and 446 individuals with more than one blast. For additional service-related information, please see Tables 4 and 5. Majority of the participants (*N* = 635) were in the Marine Corps. According to The Marine Corps Demographics Update (2015), our sample is representative of the Marine Corps population, which has the following demographics: 64% are age 25 or younger, 92.3% are male, 65.9% are Caucasian, and 94% of the enlisted servicemen have an education of 12 years. Although this sample is representative of the Marine Corps population, it must be noted that this is not a standard sample, as participants were referred with cognitive difficulties.

Of the 893 distinct participants, 398 self-reported loss of consciousness, 172 self-reported no loss of consciousness, and 33 indicated

Table 13
Preliminary Statistics on Motor Tests

Test	*M* (*SD*)	Median	Mode	Range
Grip strength test				
Right hand[a]	44.87 (10.08)	48	47.5	12–68
Left hand[a]	42.95 (9.36)	44	46	10–59.5
Grooved pegboard test				
Dominant hand[b]	75.04 (15.37)	72	70	48–160
Nondominant hand[b]	79.68 (18.90)	76	70	49–300

[a] Kilograms. [b] Seconds.

Table 14
Demographics of Blasts/PTSD Groups

Demographic	*M* (*SD*)			
	Blasts	PTSD	Both	None
Age[a]	25.97 (5.86)	27.31 (7.30)	25.94 (5.48)	26.90 (8.28)
Education[a]	12.48 (1.15)	12.41 (1.22)	12.47 (0.96)	12.61 (1.22)
Number of deployments	2.05 (1.24)	1.82 (1.47)	2.14 (1.25)	1.37 (1.22)
Time since injury[b]	26.28 (28.25)	25.20 (30.09)	29.24 (27.18)	21.20 (24.24)
ASVAB				
AFQT	64.13 (18.44)	58.15 (18.52)	58.05 (18.41)	62.45 (16.35)
GT	109.93 (14.05)	109.18 (10.70)	109.05 (11.38)	111.09 (9.32)
MM	111.89 (13.28)	109.87 (11.54)	109.15 (13.11)	110.66 (11.11)
CL	101.85 (27.74)	97.64 (28.73)	96.34 (32.98)	105.15 (19.50)
EL	109.40 (11.12)	108.45 (10.24)	106.88 (14.39)	108.11 (13.44)
Total *N*	230	126	402	252

Note. ASVAB = Armed Services Vocational Aptitude Battery; AFQT = Armed Forced Qualification Test; GT = general technical; MM = mechanical maintenance; CL = clerical; EL = electronics.
[a] Years. [b] Months.

uncertainty of loss of consciousness. Finally, the clinical interview allowed the following information to be obtained: 485 reported headaches and 24 reported no headaches; 511 reported sleep problems and 37 reported no sleep problems; and 219 reported substance abuse problems and 193 reported no substance abuse problems. For additional injury-related information, please see Tables 6 and 7.

Procedure

Participants were referred for a neuropsychological evaluation to assess current cognitive functioning due to a report of cognitive or emotional symptoms or complaints. Upon arrival, participants were informed of the purpose of the evaluation, the characteristics of the examination, and the limits to confidentiality. Informed-consent forms were then explained and signed by participants. The evaluation took approximately 3 days, with the clinical interview taking 1 day, and neuropsychological testing taking 2 days. This is consistent with Sweet, Benson, Nelson, and Moberg (2015), suggesting that outpatient evaluations are much longer than inpatient evaluations for the determination of diagnosis and treatment planning. Two primary evaluators, trained specifically in neuropsychological testing, administered the neuropsychological tests. Each assessment was carried out in the following four stages: patient history, clinical interview, neuropsychological test battery, and follow-up session.

1. Patient history: The patient's medical record, documentation, and ASVAB scores were reviewed. Other records included educational history, reports from supervisors, and occupational history.

Table 15
Effort Testing Data of Blasts/PTSD Groups

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
TOMM				
Trial 1[a]	44.64 (6.38)	44.11 (7.10)	43.84 (6.44)	44.87 (6.52)
Trial 2[a]	47.89 (5.36)	47.72 (6.02)	48.10 (4.54)	47.90 (4.54)
Retention trial[a]	47.48 (6.32)	47.58 (6.02)	47.74 (5.26)	48.01 (5.26)
Total *N*	230	126	402	252

Note. TOMM = Test of Memory Malingering.
[a] Total number correct.

2. Clinical interview: Each patient was interviewed with the purpose of gathering relevant information and clinical impressions. The interview consisted of gathering the information such as general presentation, mood and affect, orientation to place and time, suicidal or homicidal ideation/intent, sleep disturbance, and any additional observations reported by the interviewer. Clinical interview information was used to determine whether administration of neuropsychological test was necessary and if one could not participate due to exclusion criteria (e.g., color blindness).

3. Neuropsychological blast battery: A total of 15 tests were administered as part of this blast battery. Table 1 displays the tests administered, along with a brief description of the purpose of each test. Testing was scheduled on a different day than the clinical interview. Technicians, with graduate training in psychology and specific training in neuropsychological assessment, were responsible for the administration of the blast battery. The clinical neuropsychologists associated with CPHS supervised the technicians following the Medicare guidelines (www.psychologycoding.com). The technicians and neuropsychologist seen by the patient were held constant.

4. Follow-up session: Test results and interpretations, along with any applicable diagnoses, were discussed with the patient by the attending neuropsychologist. A neuropsychological evaluation summary form (see form at http://militarytbi.org/tbi-dataset/) was completed in order to assess the patients overall functioning and to make an accurate diagnosis. The *Diagnostic Statistical Manual of Mental Disorders IV* (*DSM–IV*) was used to make diagnoses.

Data Collection

Assessments at CPHS began in November 2007; however, the Neuropsychological Blast Battery was not developed and utilized until February 2008. The variables were chosen by a group of four neuropsychologists, two from CPHS and two from the Roger W. Sperry Neuropsychology Laboratory at UNCW. The variables chosen to be part of the dataset were those that could provide information about a patient's history, deployment, the nature of their injury, and their psychological and neuropsychological wellbeing.

Table 16
Emotional and Personality Testing Data of Blasts/PTSD Groups

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
BAI[a]	39.50 (11.91)	47.08 (13.78)	41.91 (11.15)	37.44 (12.57)
MMPI-2				
VRIN[b]	51.48 (11.58)	52.29 (9.06)	51.99 (9.63)	53.34 (11.85)
F[b]	68.42 (21.26)	87.26 (18.24)	80.12 (18.36)	72.81 (21.72)
Fb[b]	62.03 (21.47)	80.49 (23.68)	73.97 (22.34)	66.76 (22.34)
Fp[b]	57.52 (15.05)	63.52 (15.21)	62.49 (15.91)	61.44 (18.00)
L[b]	54.51 (9.33)	52.03 (8.79)	51.55 (8.27)	54.08 (10.23)
K[b]	45.90 (9.79)	37.95 (6.56)	39.41 (7.60)	43.84 (9.74)
S[b]	44.22 (10.11)	35.95 (6.49)	37.58 (7.28)	41.83 (10.03)
Hs (1)[b]	69.85 (13.14)	80.65 (13.26)	77.51 (10.64)	71.00 (13.62)
D (2)[b]	66.89 (14.84)	80.48 (11.92)	76.03 (12.60)	69.36 (14.36)
Hy (3)[b]	66.20 (16.58)	77.66 (14.55)	73.19 (19.14)	67.37 (18.64)
Pd (4)[b]	58.74 (12.83)	69.16 (13.26)	64.21 (12.04)	61.86 (13.44)
Mf (5)[b]	42.19 (8.78)	46.99 (8.21)	45.59 (8.47)	44.95 (9.60)
Pa (6)[b]	57.32 (16.49)	71.22 (17.49)	66.30 (15.30)	61.21 (17.38)
Pt (7)[b]	64.38 (16.58)	79.74 (13.57)	74.66 (13.79)	67.21 (16.20)
Sc (8)[b]	69.80 (19.43)	87.84 (15.41)	81.55 (15.59)	73.94 (18.01)
Ma (9)[b]	59.45 (13.19)	64.71 (12.23)	63.25 (12.70)	62.21 (13.89)
Si (0)[b]	56.36 (12.30)	65.57 (10.82)	63.61 (11.30)	58.49 (12.70)
PK[b]	66.50 (18.41)	87.49 (12.93)	81.70 (14.80)	70.45 (17.80)
MMPI-2-RF				
RCd[b]	58.00 (12.88)	69.27 (10.98)	66.77 (11.31)	61.36 (13.50)
RC1[b]	69.75 (13.12)	80.66 (12.76)	78.50 (10.66)	71.38 (13.92)
RC2[b]	60.74 (16.20)	72.50 (13.69)	68.03 (14.68)	62.93 (16.47)
RC3[b]	57.05 (10.96)	62.60 (11.00)	63.85 (11.04)	59.84 (11.29)
RC4[b]	56.77 (10.85)	62.47 (11.59)	61.51 (11.47)	59.23 (11.22)
RC6[b]	57.80 (15.57)	68.12 (15.81)	65.37 (13.83)	64.12 (16.61)
RC7[b]	54.86 (13.43)	64.91 (12.71)	64.25 (12.23)	57.48 (14.95)
RC8[b]	60.45 (14.03)	71.96 (13.62)	68.61 (13.05)	62.87 (13.94)
RC9[b]	55.46 (11.33)	60.52 (11.65)	60.41 (11.51)	57.31 (11.71)
VRIN-r[b]	52.94 (11.19)	53.79 (10.24)	53.46 (9.91)	54.04 (12.22)
TRIN-r[b]	64.21 (12.59)	67.56 (14.31)	65.79 (12.96)	67.35 (15.75)
F-r[b]	74.83 (22.81)	95.25 (20.81)	89.75 (21.01)	79.42 (23.62)
Fp-r[b]	64.35 (18.82)	73.39 (17.48)	71.90 (17.28)	67.13 (19.46)
Fs[b]	71.51 (20.86)	89.55 (19.55)	84.13 (19.17)	75.40 (21.21)
FBS-r[b]	64.82 (14.06)	77.61 (12.69)	73.32 (11.74)	66.18 (14.93)
RBS[b]	78.31 (19.30)	92.42 (16.56)	88.16 (17.12)	78.69 (19.51)
L-r[b]	56.46 (9.08)	54.58 (9.07)	53.70 (8.45)	55.06 (9.81)
K-r[b]	44.47 (10.52)	36.19 (7.56)	38.05 (7.98)	42.10 (9.88)
TSI				
Atypical response[b]	49.05 (10.13)	48.49 (12.44)	46.02 (9.85)	46.90 (8.05)
Response level[b]	49.81 (7.62)	51.69 (9.16)	51.18 (7.49)	51.22 (7.97)
Inconsistent response[b]	54.22 (13.25)	65.98 (18.00)	63.33 (14.56)	60.72 (17.24)
Anxious arousal[b]	58.46 (11.36)	66.76 (8.52)	67.02 (8.09)	60.14 (11.63)
Depression[b]	50.80 (10.14)	61.28 (10.05)	58.36 (10.56)	55.50 (11.86)
Anger/irritability[b]	59.57 (13.26)	69.37 (9.71)	69.30 (9.52)	63.12 (12.74)
Intrusive experiences[b]	60.56 (13.97)	72.39 (11.49)	71.96 (10.88)	63.90 (13.65)
Defensive avoidance[b]	55.07 (11.11)	65.89 (8.41)	64.74 (8.91)	58.22 (10.06)
Dissociation[b]	59.31 (13.30)	71.22 (11.75)	69.12 (11.42)	64.00 (12.90)
Sexual concerns[b]	50.15 (9.90)	56.87 (11.72)	55.30 (11.67)	53.09 (11.34)
Dysfunctional sexual[b]	52.40 (11.49)	58.72 (14.50)	56.73 (13.08)	56.52 (13.97)
Impaired self-reference[b]	53.93 (11.33)	64.61 (10.14)	61.86 (9.89)	58.57 (12.23)
Tension reduction[b]	54.77 (11.89)	64.87 (13.45)	62.99 (12.71)	58.28 (14.34)
Zung[a]	48.83 (10.88)	41.74 (5.09)	51.49 (8.80)	57.46 (8.08)
Total *N*	230	126	402	252

Note. BAI = Beck Anxiety Inventory; MMPI = Minnesota Multiphasic Personality Inventory; TSI = Trauma Symptom Inventory; TRIN = true response inconsistency; FBS = symptom validity; RBS = Response Bias Scale; VRIN = variable response inconsistency; F = infrequency; Fb = back F; Fp = infrequency-psychopathology; L = lie; K = correction; S = superlative self-presentation; Hs = hypochondriasis; D = depression; Hy = hysteria; Pd = psychopathic deviate; Mf = masculinity/femininity; Pa = paranoia; Pt = psychasthenia; Sc = schizophrenia; Ma = hypomania; Si = social introversion; PK = PTSD.
[a] Total score. [b] T score.

Table 17
Executive Functioning Testing Data of Blasts/PTSD Groups

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
COWAT				
Letter fluency[a]	31.30 (10.57)	29.59 (9.33)	30.31 (9.58)	31.52 (9.56)
Semantic fluency[b]	20.06 (5.58)	18.16 (5.35)	18.84 (5.04)	19.83 (5.63)
Trail making test				
Trail making A[c]	33.26 (16.00)	35.05 (20.00)	34.37 (16.08)	34.37 (20.02)
Trail making B[c]	73.19 (32.73)	83.73 (39.75)	78.69 (35.19)	74.94 (36.64)
Hayling and Brixton tests				
Sensible sentence[d]	15.81 (4.52)	15.81 (4.70)	15.54 (4.55)	15.55 (4.05)
Unconnected: Speed[c]	26.68 (5.40)	24.71 (5.73)	25.38 (5.36)	25.71 (4.99)
Unconnected: Inhibition[d]	13.35 (3.06)	12.19 (3.27)	13.17 (6.87)	12.99 (2.91)
Spatial anticipation task[d]	29.31 (8.57)	27.10 (9.60)	26.97 (8.38)	28.55 (8.48)
Stroop NST				
Color[e]	110.50 (18.42)	109.50 (27.91)	110.40 (16.80)	110.30 (16.42)
Color word[e]	91.34 (21.62)	84.33 (24.81)	89.42 (21.92)	91.62 (22.01)
Total *N*	230	126	402	252

Note. COWAT = Controlled Oral Word Association Test; Stroop NST = Stroop Neuropsychological Screening Test.
[a] Total number of words for three trials. [b] Total number of words for one trial. [c] Seconds. [d] Total correct. [e] Total number of words.

Data collection and entry were subdivided into the following groups:

In August, 2014, individuals from the Roger W. Sperry Neuropsychology Laboratory and Interdisciplinary Data Excellency and Analytics Laboratory (IDEAL) from UNCW were trained on how to accurately code the data. From August 2014 to September 2015, trained individuals from both labs coded the data into a new excel spreadsheet resulting in a dataset of 1,010 active duty servicemembers serving at Marine Corps Base Camp Lejeune, NC. Due to the volume of information that was searched, along with the time needed to complete the manual data extraction, data from the TSI's 100 response items and the Minnesota Multiphasic Personality Inventory (MMPI)-2's 567 response items were both automatically and manually entered. For the TSI, a neural network written in the C# programming language was used to identify which individuals completed this test. Each image was encoded into a matrix in which each element represented pixel values. A back-propagation-training algorithm was used to perform classification on whether the input image contained the data being analyzed. Each element was then placed into a folder for manual transcription. However, for the MMPI-2, python packages and scripts were written in order to search each individual's chart and locate the MMPI-2 response sheet. After this, the coders went back through each file to ensure that these scripts identified the automatically coded files and that the information was also coded correctly. If they were not, the items were manually entered. MMPI-2 items were then converted to *T* scores. Following the entry of MMPI-2 items, the items were converted to MMPI-2-RF, and restructured clinical and validity scales were calculated.

Individuals in the Sperry Neuropsychology Laboratory and IDEAL analyzed the dataset to ensure that coding was accurate (i.e., typos that

Table 18
Intelligence and Achievement Testing Data of Blasts/PTSD Groups

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
WAIS-III (index)				
Verbal comprehension	102.07 (9.69)	97.34 (7.63)	101.68 (10.70)	103.57 (10.26)
Perceptual organization	105.33 (13.45)	97.13 (10.97)	101.11 (12.16)	103.92 (13.57)
Working memory	98.45 (14.39)	95.37 (14.54)	99.14 (11.90)	101.46 (14.48)
Processing speed	94.10 (12.77)	91.28 (13.42)	94.25 (12.73)	94.14 (12.57)
Full scale	101.47 (13.29)	91.94 (11.19)	97.46 (10.64)	97.27 (12.78)
WAIS-IV (index)				
Verbal comprehension	96.95 (11.52)	94.40 (10.29)	95.17 (11.33)	96.76 (11.80)
Perceptual reasoning	100.49 (12.61)	101.14 (12.86)	99.84 (13.12)	98.73 (14.31)
Working memory	95.61 (13.69)	91.19 (12.84)	92.60 (12.61)	93.66 (11.34)
Processing speed	90.36 (10.99)	86.82 (14.26)	86.95 (13.32)	89.98 (13.97)
Full scale	95.64 (10.99)	92.51 (11.55)	92.97 (11.87)	94.98 (10.91)
General ability	97.93 (11.80)	97.94 (9.81)	98.06 (11.28)	97.59 (10.47)
WRAT-4 (standard score)				
Word reading	58.94 (5.35)	58.83 (8.63)	58.55 (6.10)	59.28 (6.28)
Math	42.62 (8.55)	44.43 (15.96)	41.53 (7.79)	44.39 (12.08)
Total *N*	230	126	402	252

Note. WAIS-III/WAIS-IV = Wechsler Adult Intelligence Scale; WRAT-4 = Wide Range Achievement Test.

Table 19
Memory Testing Data of Blasts/PTSD Groups

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
CVLT-II				
Trial 1[a]	5.59 (1.39)	5.86 (1.66)	5.72 (1.51)	5.72 (1.62)
Trial 2[a]	8.40 (2.01)	8.75 (2.20)	8.55 (1.98)	8.42 (2.21)
Trial 3[a]	10.31 (2.39)	10.03 (2.38)	10.35 (2.46)	10.08 (2.57)
Trial 4[a]	11.31 (2.50)	11.11 (2.52)	11.39 (2.36)	11.10 (2.66)
Trial 5[a]	11.94 (2.55)	11.83 (2.42)	12.04 (2.36)	11.78 (2.49)
Trial 1–5[a]	47.67 (9.30)	47.43 (9.60)	48.07 (8.89)	47.02 (10.08)
Trial B[a]	5.04 (1.47)	5.28 (1.65)	5.16 (1.50)	5.15 (1.56)
Short delay free recall[a]	10.02 (3.34)	9.52 (3.04)	9.94 (3.12)	9.90 (3.40)
Short delay cued recall[a]	11.20 (2.94)	10.75 (2.71)	11.02 (2.76)	10.78 (3.76)
Long delay free recall[a]	10.13 (3.59)	9.63 (3.44)	9.95 (3.38)	9.83 (3.85)
Long delay cued recall[a]	11.06 (3.29)	10.40 (3.02)	10.79 (3.07)	10.39 (3.57)
WMS-III (index)				
Auditory immediate	85.64 (26.76)	80.98 (25.00)	84.81 (27.83)	81.00 (32.94)
Visual immediate	94.02 (15.26)	92.88 (16.80)	94.95 (14.78)	94.64 (17.02)
Immediate memory	94.31 (15.65)	90.86 (15.91)	94.34 (14.94)	95.18 (17.05)
Auditory delayed	97.13 (14.83)	94.65 (13.06)	96.37 (14.05)	97.66 (16.98)
Visual delayed	93.80 (16.09)	93.73 (15.69)	93.93 (14.35)	94.70 (17.55)
Auditory recog. delayed	94.94 (16.36)	95.37 (15.36)	96.58 (14.77)	96.54 (16.44)
General memory	95.52 (16.30)	95.35 (15.87)	96.53 (14.74)	95.58 (17.31)
Working memory	97.26 (16.07)	95.76 (11.43)	97.53 (12.66)	97.16 (16.05)
WMS-IV (index)				
Auditory memory	94.38 (13.92)	89.53 (12.50)	93.28 (14.14)	91.94 (14.79)
Visual memory	98.08 (15.05)	95.92 (15.74)	96.29 (13.97)	96.60 (15.37)
Visual working memory	95.41 (12.48)	93.58 (13.45)	92.98 (13.68)	93.18 (12.55)
Immediate memory	96.28 (13.51)	91.61 (12.72)	94.72 (13.64)	93.84 (14.88)
Delayed memory	95.53 (16.14)	91.19 (15.68)	93.60 (16.11)	93.32 (15.98)
Total *N*	230	126	402	252

Note. CVLT-II = California Verbal Learning Test; WMS-III/WMS-IV = Wechsler Memory Scale.
[a] Total number of words.

indicated extreme values were cautiously examined) and the style between coders was consistent (e.g., all "time since last injury" were coded in months). Outliers in the dataset were carefully analyzed and five individuals were deleted because of age (e.g., one individual was 14 and one individual was 76) and lack of information as to whether they were in service (i.e., no information on service branch, rank, deployments, etc.). Once the coding process was complete, clean and concise coding legends were made in order to have a transparent dataset that all researchers could clearly understand. Systematic sampling of the coding ensured that there was consistency between coders. During the coding process, one in every 25 files was recoded. The entry of variables by each coder was blocked, ensuring that each coder had one out of 25 files double coded. All of the variables were recoded, and the percentage of the difference in coding was calculated. These strict guidelines resulted in an interrater reliability error of 0.6%.

A total of 25 individuals (six licensed psychologists, one postdoctoral fellow, nine graduate students, and nine undergraduate students) worked on this dataset (see full list at http://militarytbi.org/tbi-dataset/). In order to maintain the integrity of research, significant emphasis was placed on the accuracy of coding among all individuals involved with the creation of the dataset to ensure reliable data. A total of 1,173 hr were put into gathering and cleaning of this dataset.

Results

Considering the extent of the data involved in this dataset, the results were conducted in three phases: Phase 1 displays descriptive statistics on all data; Phase 2 displays descriptive data between PTSD, mTBI, both PTSD and mTBI, and neither groups; and Phase 3 displays descriptive statistics of valid testing data for overall data and between-groups comparisons.

Table 20
Motor Testing Data of Blasts/PTSD Groups

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
Grip strength (kg)				
Right hand[a]	45.74 (9.39)	44.49 (9.11)	46.05 (9.10)	43.27 (11.68)
Left hand[a]	45.19 (7.50)	43.01 (11.17)	42.93 (8.22)	41.22 (10.80)
Grooved pegboard test (second)				
Dominant hand[b]	73.38 (14.89)	77.75 (17.85)	75.39 (15.62)	74.44 (13.48)
Nondominant hand[b]	78.31 (17.06)	82.81 (28.10)	79.68 (17.78)	79.11 (15.48)
Total *N*	230	126	402	252

[a] Kilograms. [b] Seconds.

Table 21
Number of Profiles Eliminated by Group

Group	Total profiles	Total valid profiles	Total invalid profiles
Blasts only	230	201	29
PTSD only	126	110	16
Both	402	349	53
Neither	252	225	27
Total	1,010	885	125

Phase 1: Descriptive Data Report

Descriptive statistics on each of the clinical measures and neuropsychological assessments were completed. These can be found in Tables 2 and 8–13, which are divided by cognitive domain. Descriptive statistics for ASVAB scores are reported in Table 2: Armed Forced Qualification Test (M = 60.37), general technical (M = 109.20), mechanical maintenance (M = 109.85), Clerical (M = 98.12), and electronics (M = 107.80). It can be seen that the results from the Test of Memory Malingering (TOMM) vary greatly (see Table 8), as the mode is 50, but the range is substantial (Trial 1 = 13–50; Trial 2 = 9–50; Retention = 12–50).

Elevated scores on measures of emotional status can be seen in Table 9, compared with neuropsychological assessments. Mean BAI score is 42.33, indicating severe anxiety. Additionally, the following scales from the MMPI-2 appear to be high (>65): hypochondriasis (M = 72.12), depression (M = 70.54), hysteria (M = 68.68), psychasthenia (M = 61.94), schizophrenia (M = 74.94), and PTSD (M = 74.06). Furthermore, the following scales from the TSI appear to be elevated (>65): anger/irritability (M = 65.72), intrusive experiences (M = 67.70), and dissociation (M = 66.03). The mean score for the Zung (M = 49.04) appears to be within normal limits.

Executive functioning results can be seen in Table 10. COWAT Letter Fluency, Trail Making A, and Trail Making B tests have means of 30.7, 34.22, and 77.25, respectively. Intelligence and achievement tests are within normal limits, as seen in Table 11. The only scale greater than one standard deviation below the average score was the processing speed on the WAIS-IV (M = 88.51). Memory testing is marginally below average, with WMS-III and WMS-IV scores being slightly below average, as seen in Table 12. The only scale greater than one standard deviation below the average score was the Auditory Immediate Index on the WMS-III (M = 85.09). It can be seen in Table 13 that the motor tasks appear to be within normal limits, with right and left hand grip strength tests having means of 44.87 and 42.95, respectively, and dominant and nondominant hand grooved pegboard tests having means of 75.04 and 79.68, respectively.

In summary, the results from Phase 1 show a large amount of variation in effort testing, as well as elevated scores on emotional status and impairment in memory testing. Additionally, there appears to be minor impairment in executive functioning, while motor, intelligence and achievement tests appear to be within normal limits.

Table 22
Demographics of Valid Profiles

Demographic	M	Median	Mode	Range	SD
Age[a]	26.29	24.00	22.00	18–63	6.46
Education[a]	12.48	12.00	12.00	6–18	1.09
Number of deployments	1.96	2.00	2.00	0–10	1.30
Time since injury[b]	26.58	14.00	12.00	1–156	28.04
ASVAB					
AFQT	61.03	63.00	68.00	23–98	18.15
GT	109.72	111.00	105.00	13–139	11.74
MM	110.32	111.00	111.00	72–166	12.68
CL	99.92	107.00	0.00	0–134	28.78
EL	108.28	109.00	101.00	0–139	12.21

Note. ASVAB = Armed Services Vocational Aptitude Battery; AFQT = Armed Forced Qualification Test; GT = general technical; MM = mechanical maintenance; CL = clerical; EL = electronics.
[a] Years. [b] Months.

Table 23
Preliminary Statistics on Valid Effort Testing Profiles

Test	M (SD)	Median	Mode	Range
TOMM				
Trial 1[a]	46.20 (4.23)	48	50	29–50
Trial 2[a]	49.64 (1.00)	50	50	45–50
Retention trial[a]	49.63 (1.01)	50	50	45–50

Note. TOMM = Test of Memory Malingering.
[a] Total # correct.

Phase 2: Between-Groups Comparisons

The second part of data analysis sought to compare the neuropsychological test results for those with only mTBI or PTSD, as well as those with both diagnoses and neither. Participants were categorized into four groups: those with a history of blast exposures (i.e., Blasts), those with PTSD (i.e., PTSD), those with both blast exposures and PTSD (i.e., Both), and those with neither blast exposures nor PTSD (i.e.. None). Blast exposures were categorized based on self-report of individuals (i.e., they reported that they had experienced blast injuries in the past). PTSD was categorized by a clinical neuropsychologist according to *Diagnostic and Statistical Manual* definition of PTSD (American Psychiatric Association, 2013) based on clinical interview and psychological testing. Sorting participants into these four groups resulted in the following: 230 individuals were blasted, 126 individuals were diagnosed with PTSD, 402 individuals were both blasted and diagnosed with PTSD, and 252 individuals were neither blasted nor had PTSD.

The age, education, number of deployments, and time since injury is similar between these four groups, as seen in Table 14. Mean ASVAB scores are also reported in Table 14. Additionally, Tables 15–20 contain the clinical and neuropsychological testing data of each group, split into cognitive domains. Additional statistical information (such as mode and range) can be found at http://militarytbi.org/tbi-dataset/. According to the TOMM, effort testing was consistent across the four groups, with Trial 1 means ranging from 43.84–44.87, Trial 2 means ranging from 47.72–48.10, and Retention Trial means ranging from 47.48–48.01 (see Table 15).

Differences can be seen between-groups in Table 16. The BAI appears to have differences, ranging from 37.44 to 47.08. Scales on the MMPI-2 also seem to vary, with the F scale ranging from 68.42 to 87.26, Fb scale ranging from 62.03 to 80.49, hypochondriasis scale ranging from 69.85 to 80.65, depression scale ranging from 66.89 to 80.49, hysteria scale ranging from 66.20 to 77.66, psychopathic deviate scale ranging from 58.74 to 69.16, paranoia scale ranging from 57.32 to 71.22, psychasthenia scale ranging from 64.38 to 79.74, schizophrenia scale ranging from 69.80 to 87.84, social introversion scale ranging from 56.36 to 65.57, and PTSD scale ranging from 66.50 to 87.49. Furthermore, scales on the TSI show differences between groups, with inconsistent response ranging from 54.22 to 65.98, anxious arousal ranging from 58.46 to 67.02, depression ranging from 50.80 to 61.28, anger/irritability ranging from 59.57 to

Table 24
Preliminary Statistics on Valid Emotional and Personality Testing Profiles

Test	*M* (*SD*)	Median	Mode	Range
BAI[a]	39.25 (12.60)	37	25	21–71
MMPI-2				
VRIN[b]	52.30 (10.74)	50	50	31–103
F[b]	75.78 (20.35)	73	70	36–120
Fb[b]	69.60 (22.93)	63	51	42–120
Fp[b]	60.94 (16.42)	56	48	41–120
L[b]	52.92 (9.18)	52	48	35–87
K[b]	41.92 (9.02)	41	30	30–77
S[b]	39.91 (9.18)	37	30	30–74
Hs (1)[b]	74.11 (12.85)	75	81	39–103
D (2)[b]	72.39 (13.93)	74	74	34–109
Hy (3)[b]	70.21 (14.60)	71	76	35–109
Pd (4)[b]	62.94 (12.99)	62	59	34–97
Mf (5)[b]	44.85 (8.95)	44	50	30–79
Pa (6)[b]	63.23 (16.43)	61	64	32–119
Pt (7)[b]	70.73 (15.75)	70	68	30–109
Sc (8)[b]	77.35 (17.92)	77	77	34–120
Ma (9)[b]	62.40 (13.25)	59	59	36–107
Si (0)[b]	60.51 (12.12)	62	70	31–88
PK[b]	75.83 (17.67)	77	80	37–112
MMPI-2-RF				
RCd[b]	63.21 (12.71)	63	62	37–86
RC1[b]	74.17 (12.95)	74	72	36–100
RC2[b]	64.77 (15.61)	65	65	34–99
RC3[b]	60.82 (11.37)	61	61	34–83
RC4[b]	60.17 (11.35)	59	65	34–93
RC6[b]	63.07 (15.16)	61	43	43–100
RC7[b]	59.94 (13.82)	60	62	34–94
RC8[b]	65.26 (13.95)	63	52	39–100
RC9[b]	58.39 (11.66)	58	51	28–91
VRIN-r[b]	53.63 (10.85)	53	48	34–97
TRIN-r[b]	66.10 (13.98)	65	57	50–120
F-r[b]	83.20 (23.02)	83	120	42–120
Fp-r[b]	68.48 (18.39)	68	59	42–120
Fs[b]	78.94 (20.98)	74	74	42–120
FBS-r[b]	69.15 (13.80)	70	70	32–108
RBS[b]	82.62 (18.75)	84	88	33–120
L-r[b]	54.80 (9.10)	52	52	37–91
K-r[b]	40.60 (9.55)	38	35	24–69
TSI				
Atypical response[b]	47.15 (9.75)	45	41	41–95
Response level[b]	50.99 (7.93)	49	45	37–95
Inconsistent response[b]	60.14 (15.29)	58	45	37–100
Anxious arousal[b]	62.98 (10.65)	64	66	38–82
Depression[b]	55.75 (11.10)	53	41	41–83
Anger/irritability[b]	65.04 (12.09)	67	79	37–82
Intrusive experiences[b]	66.70 (13.26)	67	61	42–89
Defensive avoidance[b]	60.55 (10.59)	62	68	41–85
Dissociation[b]	65.21 (12.82)	64	60	41–98
Sexual concerns[b]	53.34 (10.82)	51	42	42–94
Dysfunctional sexual behavior[b]	55.60 (13.08)	52	44	44–100
Impaired self-reference[b]	59.12 (11.29)	59	62	41–89
Tension reduction behavior[b]	59.74 (13.34)	58	43	43–100
Zung[a]	47.08 (10.03)	47	43	21–71

Note. BAI = Beck Anxiety Inventory; MMPI = Minnesota Multiphasic Personality Inventory; TSI = Trauma Symptom Inventory; TRIN = true response inconsistency; FBS = symptom validity; RBS = Response Bias Scale; VRIN = variable response inconsistency; F = infrequency; Fb = back F; Fp = infrequency-psychopathology; L = lie; K = correction; S = superlative self-presentation; Hs = hypochondriasis; D = depression; Hy = hysteria; Pd = psychopathic deviate; Mf = masculinity/femininity; Pa = paranoia; Pt = psychasthenia; Sc = schizophrenia; Ma = hypomania; Si = social introversion; PK = PTSD.
[a] Total score. [b] T score.

Table 25
Preliminary Statistics on Valid Tests of Executive Functioning

Test	*M* (*SD*)	Median	Mode	Range
COWAT				
Letter fluency[a]	31.33 (9.69)	31	24	8–75
Semantic fluency[b]	19.72 (5.34)	19	17	6–38
Trail making test				
Trail making test A[c]	32.12 (13.72)	29	27	11–180
Trail making test B[c]	73.50 (30.26)	67	63	19–301
Hayling and Brixton test				
Sensible sentence completion[d]	12.48 (15.44)	7	5	0–163
Unconnected completion: Speed[c]	38.07 (35.37)	29	4	0–264
Unconnected completion: Inhibition[d]	7.59 (10.62)	3	0	0–67
Spatial anticipation task[d]	13.75 (6.82)	13	12	0–99
Stroop NST				
Color[e]	111.74 (17.85)	112	112	25–305
Color word[e]	92.40 (20.33)	97	112	23–140

Note. COWAT = Controlled Oral Word Association Test; Stroop NST = Stroop Neuropsychological Screening Test.
[a] Total number of words for three trials. [b] Total number of words for one trial. [c] Seconds. [d] Total correct. [e] Total number of words.

69.37, intrusive experiences ranging from 60.56 to 72.39, defensive avoidance ranging from 55.07 to 65.89, dissociation ranging from 59.31 to 71.22, impaired self reference ranging from 53.93 to 64.61, and tension reduction ranging from 54.77 to 64.87. The Zung also has some variability between groups, ranging from 41.74 to 57.46.

The intelligence and achievement domain can be seen in Table 18. Additionally, the memory domain can be seen in Table 19. Finally, the motor domain, with disparities in both the dominant and nondominant hand, ranging from 73.38 to 77.75, and 78.31 to 82.81, respectively, can be found in Table 20.

Phase 3: Valid Profiles

With the literature revealing portions of the military population receiving low scores on effort tests, the third phase of data analysis eliminated those receiving poor scores on the TOMM. The purpose of the TOMM is to help determine if the performance on tests of neurocognitive functioning accurately reflects an individual's abilities (Tombaugh, 1996).

Table 26
Preliminary Statistics on Valid Intelligence and Achievement Testing Profiles

Test	*M* (*SD*)	Median	Mode	Range
WAIS-III				
Verbal comprehension	102.28 (9.73)	101	101	80–134
Perceptual organization	102.61 (14.18)	103	109	20–142
Working memory	99.35 (14.64)	99	95	29–148
Processing speed	93.91 (14.02)	93	86	25–141
Full scale	97.51 (13.97)	98	99	20–137
WAIS-IV				
Verbal comprehension	95.64 (13.60)	96	93	24–130
Perceptual reasoning	99.66 (15.64)	101	107	11–133
Working memory	93.76 (14.97)	95	97	18–133
Processing speed	88.74 (15.70)	89	92	10–137
Full scale	95.34 (10.63)	95	100	71–128
General ability	98.48 (10.83)	99	101	61–128
WRAT-4				
Word reading[a]	59.09 (6.28)	59	60	38–106
Math[a]	43.16 (10.73)	42	41	27–115

Note. WAIS-III/WAIS-IV = Wechsler Adult Intelligence Scale; WRAT-4 = Wide Range Achievement Test.
[a] Raw score.

Table 27
Preliminary Statistics on Valid Memory Test Profiles

Test	*M* (*SD*)	Median	Mode	Range
CVLT-II				
Trial 1[a]	5.80 (1.53)	6	5	1–11
Trial 2[a]	8.71 (2.02)	9	8	3–16
Trial 3[a]	10.51 (2.35)	10	10	1–22
Trial 4[a]	11.55 (2.34)	12	12	3–16
Trial 5[a]	12.23 (2.24)	12	13	4–18
Trials 1–5[a]	48.79 (8.74)	49	50	13–72
Trial B[a]	5.23 (1.52)	5	5	1–11
Short delay free recall[a]	10.32 (3.03)	10	10	0–16
Short delay cued recall[a]	11.36 (2.87)	12	12	0–40
Long delay free recall[a]	10.42 (3.30)	11	11	0–16
Long delay cued recall[a]	11.16 (2.97)	11	12	0–16
WMS-III				
Auditory immediate	82.78 (30.49)	94	97	13–142
Visual immediate	95.67 (15.61)	97	97	15–138
Immediate memory	95.61 (15.61)	96	84	33–134
Auditory delayed	97.59 (16.19)	99	102	11–136
Visual delayed	95.25 (15.83)	97	94	14–132
Auditory recognition delayed	97.18 (16.15)	97	110	8–130
General memory	97.29 (15.23)	98	110	38–132
Working memory	98.10 (14.47)	99	96	18–146
WMS-IV				
Auditory memory	94.29 (14.16)	95	102	10–126
Visual memory	98.05 (15.42)	98	104	8–139
Visual working memory	94.74 (14.42)	94	106	14–130
Immediate memory	95.85 (14.27)	96	108	11–129
Delayed memory	95.73 (15.85)	96	102	10–130

Note. CVLT-II = California Verbal Learning Test; WMS-III/WMS-IV = Wechsler Memory Scale.
[a] Total number of words.

The TOMM is popular because of its high diagnostic accuracy levels, low cost, easy administration, and also because it is largely unaffected by variation in age, gender, education, or ethnic groups. Detailed examinations show that nonmalingerers (even those with substantial neurological impairments) score well on the TOMM, whereas malingerers score very low, suggesting that the TOMM has high diagnostic validity (Rees, Tombaugh, Gansler, & Moczynski, 1998; Tombaugh, 1996; Wisdom, Brown, Chen, & Collins, 2012). Therefore, for phase three, individuals that received scores below 45 on either of the trials were eliminated (see Tombaugh, 1996), and descriptive statistics for the psychological and neuropsychological tests were recalculated. The number of profiles that were eliminated from each of the four groups presented in Phase 2 can be seen in Table 21. In this table, it can be seen that 125 profiles were deleted due to low scores on the TOMM, leaving 885 valid profiles.

The age, education, number of deployments, and time since injury can be seen in Table 22. Mean ASVAB scores are also reported in Table 22: AFQT ($M = 61.03$), GT ($M = 109.72$), MM ($M = 110.32$), CL ($M = 99.92$), and EL ($M = 108.28$). Additionally, Tables 23–34

Table 28
Preliminary Statistics on Valid Motor Test Profiles

Test	*M* (*SD*)	Median	Mode	Range
Grip strength test				
Right hand[a]	45.30 (9.87)	47.5	47.5	12–68
Left hand[a]	43.14 (9.36)	44.25	46	10–59.5
Grooved pegboard test				
Dominant hand[b]	73.23 (13.10)	71	70	48–154
Nondominant hand[b]	77.83 (17.70)	75	68	49–300

[a] Kilograms. [b] Seconds.

Table 29
Effort Testing Data of Valid Profiles by Group

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
TOMM				
Trial 1[a]	46.62 (3.75)	46.06 (4.34)	45.64 (4.63)	46.81 (3.79)
Trial 2[a]	49.73 (0.77)	49.50 (1.14)	49.60 (1.06)	49.68 (1.01)
Retention trial[a]	49.67 (0.97)	49.56 (1.51)	49.58 (1.07)	49.74 (0.81)
Total *N*	201	110	349	225

Note. TOMM = Test of Memory Malingering.
[a] Total number correct.

contain the clinical and neuropsychological testing data of each group, split into cognitive domains.

In this phase, results from valid testing data are presented, and are comparable with the overall testing data presented in Phase 1 (see Tables 23–34). To give one example from each cognitive domain, the BAI overall data has a mean of 42.33 compared with the valid data, which has a mean of 39.25; the COWAT letter fluency overall data has a mean of 30.70 compared with the valid data, which has a mean of 31.33; the WAIS-III Verbal Comprehension has a mean of 101.54 compared with the valid data, which has a mean of 102.28; the CVLT-II Trial 1 has a mean of 5.71 compared with the valid data, which has a mean of 5.80; and the right hand grip strength test has a mean of 44.87 compared with the valid data, which has a mean of 45.30.

Discussion

This study presents the method for gathering, cleaning, and storing as well as the descriptive statistics of a large-scale, outpatient-based dataset, assessing the cognitive and emotional functioning of military servicemembers. In Phase 1 of this study, both sample size and amount of neuropsychological assessments (i.e., we have validity testing, neuropsychological assessments, and emotional data in the same place) are explained. Additionally, a significant amount of descriptive information (e.g., ASVAB scores, rank, number of deployments, etc.) was included in this dataset, which makes it unique compared with previous studies (e.g., Bahraini et al., 2009; Brenner, Ivins, et al., 2010; Hoge et al., 2008; Troyanskaya et al., 2015).

Both PTSD and mTBI have a high prevalence among servicemembers returning from OEF and OIF. It has been estimated that of more than 2 million veterans involved in OEF and OIF, 12% of those returning from Afghanistan and 18% of those returning from Iraq, have reported PTSD symptoms, and 20% (or over 200,000) of them have filed a disability claim of PTSD (Litz & Schlenger, 2009). Similarly, according to the U.S. Department of Defense (2018) 315,897 service members have been diagnosed with mTBI between 2000 and 2018, with the majority sustained while on active duty. It has also been suggested that TBI is a risk factor for the development of neurodegenerative diseases, such as Alzheimer's disease and chronic traumatic encephalopathy (see Elder, Ehrlich, & Gandy, 2019). Due to the high prevalence and potential long-term consequences, it is vital to have research on the effects of these disorders in this population.

In Phase 1, the results of traditional psychological tests that focus on emotional variables, and neuropsychological data that focus on neurocognitive functioning are presented. The purpose of Phase 2 was to assess the differences between those with PTSD and mTBI. According to Hoge et al. (2008), little is known about the epidemiology of combat-related mTBI, with the majority of the literature conducted

Table 30
Emotional and Personality Valid Testing Data by Group

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
BAI[a]	34.26 (11.70)	46.15 (13.17)	41.58 (11.19)	36.93 (12.97)
MMPI-2				
VRIN[b]	51.48 (11.53)	52.48 (9.25)	51.90 (9.99)	52.58 (12.12)
F[b]	66.95 (20.38)	86.01 (17.92)	79.43 (18.14)	71.35 (21.31)
Fb[b]	60.84 (19.85)	78.79 (23.49)	73.38 (22.55)	65.46 (22.59)
Fp[b]	56.66 (14.69)	63.26 (15.74)	62.08 (16.08)	61.31 (18.18)
L[b]	54.54 (9.01)	52.21 (9.03)	51.75 (8.29)	54.00 (10.54)
K[b]	46.33 (9.59)	38.20 (6.69)	39.56 (7.55)	44.34 (9.83)
S[b]	44.38 (9.98)	36.20 (6.76)	37.53 (7.33)	42.31 (10.33)
Hs (1)[b]	68.73 (12.93)	79.96 (13.56)	77.36 (10.66)	69.85 (12.90)
D (2)[b]	65.98 (13.62)	79.73 (12.33)	75.63 (12.55)	68.20 (13.87)
Hy (3)[b]	64.94 (13.69)	76.91 (14.59)	73.12 (13.23)	65.99 (15.01)
Pd (4)[b]	58.45 (12.65)	68.26 (13.35)	64.22 (12.02)	61.62 (13.43)
Mf (5)[b]	42.04 (8.76)	47.14 (8.01)	45.58 (8.44)	44.68 (9.91)
Pa (6)[b]	56.30 (15.36)	70.42 (17.56)	65.94 (15.01)	60.49 (16.51)
Pt (7)[b]	63.82 (16.46)	78.96 (13.57)	74.29 (13.95)	65.94 (15.47)
Sc (8)[b]	68.82 (19.00)	86.52 (15.28)	81.14 (15.79)	72.99 (17.75)
Ma (9)[b]	59.46 (13.20)	64.04 (12.27)	63.41 (13.02)	62.21 (13.91)
Si (0)[b]	55.79 (11.93)	64.90 (10.87)	63.12 (11.28)	57.58 (12.37)
PK[b]	65.50 (17.86)	86.46 (13.00)	81.37 (14.78)	69.16 (17.40)
MMPI-2-RF				
RCd[b]	57.21 (12.65)	68.70 (10.98)	66.57 (11.33)	60.68 (13.73)
RC1[b]	68.43 (12.57)	79.77 (12.91)	78.23 (10.56)	69.95 (13.55)
RC2[b]	59.34 (15.58)	71.80 (13.60)	67.58 (14.59)	61.65 (15.89)
RC3[b]	57.01 (11.21)	62.05 (10.81)	63.37 (10.98)	59.53 (11.41)
RC4[b]	56.74 (10.83)	62.10 (11.77)	61.79 (11.36)	59.65 (11.12)
RC6[b]	57.51 (15.22)	68.14 (15.66)	64.85 (13.24)	63.11 (16.24)
RC7[b]	54.03 (13.45)	64.82 (13.07)	63.95 (12.17)	56.77 (14.53)
RC8[b]	59.76 (13.45)	71.34 (13.67)	68.58 (12.54)	62.05 (13.78)
RC9[b]	55.48 (11.32)	60.25 (13.67)	60.26 (11.35)	57.37 (11.98)
VRIN-r[b]	53.03 (10.99)	54.00 (10.58)	53.64 (9.71)	53.88 (12.51)
TRIN-r[b]	64.28 (12.97)	67.74 (14.83)	65.71 (13.07)	67.73 (16.16)
F-r[b]	73.54 (22.36)	93.58 (20.99)	89.28 (20.99)	77.40 (23.04)
Fp-r[b]	63.22 (18.29)	72.85 (17.81)	71.69 (17.22)	66.12 (19.32)
Fs[b]	70.15 (19.83)	88.30 (19.77)	83.97 (19.26)	74.04 (20.88)
FBS-r[b]	63.36 (13.48)	76.62 (13.01)	73.24 (11.60)	64.35 (14.11)
RBS[b]	76.36 (18.81)	91.22 (13.01)	87.29 (17.00)	76.46 (18.71)
L-r[b]	56.50 (8.91)	54.63 (9.17)	53.73 (8.42)	54.96 (10.12)
K-r[b]	44.95 (10.54)	36.53 (7.68)	38.13 (7.80)	42.58 (9.97)
TSI				
Atypical response[b]	48.97 (10.20)	47.53 (10.79)	46.22 (9.99)	46.59 (7.53)
Response level[b]	50.10 (7.65)	51.54 (9.21)	51.17 (7.68)	50.93 (9.19)
Inconsistent response[b]	53.23 (12.37)	65.93 (17.96)	62.57 (14.04)	59.85 (16.29)
Anxious arousal[b]	57.70 (11.17)	66.41 (8.37)	66.80 (8.35)	59.30 (11.61)
Depression[b]	50.35 (10.11)	60.16 (9.74)	58.07 (10.62)	54.69 (11.46)
Anger/irritability[b]	58.63 (13.10)	68.87 (9.81)	69.09 (9.58)	62.03 (12.67)
Intrusive experiences[b]	59.32 (13.05)	72.05 (11.44)	71.39 (11.09)	62.54 (13.30)
Defensive avoidance[b]	54.19 (10.63)	65.46 (8.33)	64.26 (9.13)	57.45 (9.86)
Dissociation[b]	58.41 (12.81)	70.45 (11.80)	68.74 (11.37)	62.85 (12.29)
Sexual concerns[b]	50.08 (8.74)	55.95 (10.87)	54.96 (11.42)	52.26 (10.82)
Dysfunctional sexual[b]	52.30 (11.26)	58.36 (14.41)	56.61 (13.25)	55.75 (13.27)
Impaired self-reference[b]	53.28 (10.94)	64.08 (10.05)	61.66 (9.96)	57.81 (11.98)
Tension reduction[b]	54.15 (11.52)	64.51 (13.38)	62.74 (12.98)	57.30 (13.37)
Zung[a]	43.38 (10.53)	41.57 (5.16)	51.35 (8.83)	46.50 (10.30)
Total *N*	201	110	349	225

Note. BAI = Beck Anxiety Inventory; MMPI = Minnesota Multiphasic Personality Inventory; TSI = Trauma Symptom Inventory; TRIN = true response inconsistency; FBS = symptom validity; RBS = Response Bias Scale; VRIN = variable response inconsistency; F = infrequency; Fb = back F; Fp = infrequency-psychopathology; L = lie; K = correction; S = superlative self-presentation; Hs = hypochondriasis; D = depression; Hy = hysteria; Pd = psychopathic deviate; Mf = masculinity/femininity; Pa = paranoia; Pt = psychasthenia; Sc = schizophrenia; Ma = hypomania; Si = social introversion; PK = PTSD.
[a] Total score. [b] T score.

with civilian samples. In Phase 3, only those that exerted optimal levels of effort, according to scores on the TOMM, were examined and descriptive statistics for each test and each group were calculated. The first approach to the data suggests that there is large variability in effort testing, depicted by the wide range in the TOMM. This is consistent with the past literature, suggesting that 50% of veterans referred for mTBI testing performed poorly on at least one effort test (Armistead-Jehle, 2010), and 17–28% of those with a history of mTBI

Table 31
Executive Functioning Valid Testing Data by Group

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
COWAT				
Letter fluency[a]	32.10 (10.44)	29.84 (9.04)	30.87 (9.52)	32.13 (9.48)
Semantic fluency[b]	10.50 (5.58)	18.52 (5.24)	19.25 (5.07)	20.35 (5.45)
Trail making test				
Trail making A[c]	30.89 (13.04)	33.25 (18.31)	32.60 (13.35)	31.91 (12.14)
Trail making B[c]	69.62 (28.42)	78.94 (30.36)	75.20 (29.06)	71.81 (33.35)
Hayling and Brixton tests				
Sensible sentence[d]	10.66 (14.22)	16.66 (23.89)	12.96 (14.13)	11.31 (12.38)
Unconnected: Speed[c]	35.01 (30.24)	43.83 (41.36)	41.37 (37.23)	32.53 (32.71)
Unconnected: Inhibition[d]	7.52 (10.42)	7.35 (9.18)	7.89 (10.94)	7.31 (11.12)
Spatial anticipation task[d]	13.37 (8.52)	14.40 (6.04)	13.58 (6.01)	14.06 (6.54)
Stroop NST				
Color[e]	112.57 (16.95)	111.03 (27.31)	111.77 (15.56)	111.25 (15.97)
Color word[e]	93.86 (19.52)	85.90 (22.92)	92.05 (20.10)	94.93 (19.45)
Total *N*	201	110	349	225

Note. COWAT = Controlled Oral Word Association Test; Stroop NST = Stroop Neuropsychological Screening Test.
[a] Total number of words for three trials. [b] Total number of words for one trial. [c] Seconds. [d] Total correct. [e] Total number of words.

performed poorly on at least two tests of effort (Jak et al., 2015; Whitney et al., 2009). In addition, these results suggest that the data in Phase 1 (i.e., all profiles) were comparable with the data in phase three (i.e., valid profiles only). This is particularly surprising as suboptimal levels of effort are predictive of decrements in neuropsychological testing (Jak et al., 2015). Though future studies must be conducted to address this disparity, it could be that individuals are malingering or overreporting in one specific domain that was not identified in this preliminary analysis. Sweet (1999) explains that clinicians and researchers tend to view malingering as a dichotomous diagnostic conclusion, whereas feigning or overreporting in one domain does not imply feigning or overreporting overall. This concept of selective presentation has been supported in the literature (e.g., Ruocco et al., 2008; Willer, Johnson, Rempel, & Linn, 1993). In addition, future studies using this dataset can explore this result further by assessing suboptimal effort using a multimethod assessment approach (i.e., TOMM, MMPI-2-RF validity scales, TSI validity scales). The literature suggests that multiple assessments are needed to accurately assess effort (Heilbronner et al., 2009), as the use of one effort measure alone has poor predictive validity (Zakzanis, Gammada, & Jeffay, 2012). A multimethod approach to assessment will determine which specific area is being feigned or exaggerated with greater predictive accuracy, thus explaining the results in Phase 3. Addressing these results is of importance as effort may be creating a source of variance in the literature, causing disparities in research conclusions. For example, levels of attention seem to be impaired in some studies of PTSD, but these results have not been easily replicated (Dolan et al., 2012).

Several limitations to this dataset should be addressed. Individuals were grouped based on their self-report and clinical diagnosis to explore possible implications for determining their cognitive outcomes. The psychological and neuropsychological tests used in this

Table 32
Intelligence and Achievement Valid Testing Data by Group

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
WAIS-III (index)				
Verbal comprehension	102.83 (9.20)	99.04 (6.62)	101.95 (10.32)	104.38 (10.18)
Perceptual organization	106.09 (13.56)	98.24 (10.35)	102.17 (11.61)	102.38 (19.45)
Working memory	99.66 (14.27)	96.02 (14.02)	99.80 (11.78)	99.99 (19.57)
Processing speed	94.94 (12.68)	90.33 (11.98)	95.26 (12.61)	92.13 (18.05)
Full scale	102.91 (12.50)	92.13 (11.23)	97.78 (10.58)	94.70 (19.96)
WAIS-IV (index)				
Verbal comprehension	97.82 (11.59)	94.60 (9.98)	95.74 (11.09)	93.88 (19.16)
Perceptual reasoning	101.42 (12.44)	102.02 (11.49)	100.69 (12.07)	95.33 (22.65)
Working memory	96.75 (13.29)	92.86 (11.30)	94.26 (12.02)	90.60 (20.55)
Processing speed	91.65 (12.77)	88.00 (13.72)	88.21 (12.44)	87.16 (21.96)
Full scale	96.85 (10.42)	93.66 (9.92)	94.18 (10.82)	96.45 (10.67)
General ability	98.53 (12.17)	98.44 (9.54)	98.69 (10.41)	98.11 (10.79)
WRAT-4 (standard score)				
Word reading[a]	59.35 (5.20)	58.83 (8.91)	58.62 (5.96)	59.66 (6.25)
Math[a]	42.93 (8.92)	44.70 (16.97)	41.84 (8.06)	44.87 (12.52)
Total *N*	201	110	349	225

Note. WAIS-III/WAIS-IV = Wechsler Adult Intelligence Scale; WRAT-4 = Wide Range Achievement Test.
[a] Standard score.

Table 33
Memory Valid Testing Data by Group

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
CVLT-II				
Trial 1[a]	5.67 (1.38)	5.92 (1.64)	5.81 (1.51)	5.84 (1.63)
Trial 2[a]	8.58 (1.93)	8.89 (2.18)	8.74 (1.95)	8.68 (2.13)
Trial 3[a]	10.60 (2.23)	10.19 (2.35)	10.63 (2.38)	10.41 (2.39)
Trial 4[a]	11.61 (2.28)	11.39 (2.43)	11.68 (2.23)	11.39 (2.52)
Trial 5[a]	12.30 (2.27)	12.16 (2.32)	12.30 (2.25)	12.09 (2.19)
Trial 1–5[a]	48.92 (8.38)	48.38 (9.32)	49.13 (8.43)	48.34 (9.28)
Trial B[a]	5.12 (1.44)	5.35 (1.67)	5.25 (1.50)	5.24 (1.54)
Short delay free recall[a]	10.48 (3.12)	10.08 (2.74)	10.28 (3.01)	10.33 (3.13)
Short delay cued recall[a]	11.63 (2.63)	11.22 (2.42)	11.33 (2.59)	11.20 (3.62)
Long delay free recall[a]	10.71 (3.22)	10.20 (3.08)	10.37 (3.19)	10.31 (3.62)
Long delay cued recall[a]	11.58 (2.93)	10.91 (2.72)	11.18 (2.85)	10.88 (3.28)
WMS-III (index)				
Auditory immediate	87.05 (26.46)	82.26 (25.34)	86.27 (27.84)	73.81 (37.59)
Visual immediate	95.74 (14.61)	94.40 (15.76)	96.28 (14.18)	95.27 (19.62)
Immediate memory	96.05 (14.80)	92.52 (14.79)	95.86 (14.49)	96.34 (18.31)
Auditory delayed	99.05 (13.57)	96.54 (10.93)	97.98 (13.07)	96.23 (23.48)
Visual delayed	95.94 (14.75)	95.70 (14.14)	95.01 (13.60)	94.84 (20.45)
Auditory recog. delayed	97.04 (14.87)	97.11 (13.98)	98.07 (14.31)	96.10 (20.62)
General memory	97.40 (15.15)	96.54 (10.77)	97.64 (13.89)	96.72 (17.98)
Working memory	99.78 (13.35)	93.06 (21.23)	98.22 (12.25)	97.20 (19.60)
WMS-IV (index)				
Auditory memory	96.50 (12.22)	91.44 (11.34)	95.68 (12.50)	90.93 (18.78)
Visual memory	100.24 (13.80)	97.96 (14.72)	97.95 (13.57)	95.80 (19.80)
Visual working memory	96.78 (11.72)	95.47 (12.69)	94.94 (12.61)	91.68 (19.77)
Immediate memory	98.15 (12.20)	93.46 (11.41)	96.80 (12.68)	92.92 (19.08)
Delayed memory	98.42 (14.12)	93.48 (14.20)	96.14 (13.82)	93.15 (19.54)
Total *N*	201	110	349	225

Note. CVLT-II = California Verbal Learning Test; WMS-III/WMS-IV = Wechsler Memory Scale.
[a] Total number of words.

dataset were not of the type that by themselves warranted diagnosis (e.g., the Trauma Symptom Inventory can be used as a tool to assess symptom severity, but it cannot be used in isolation to diagnose PTSD); therefore PTSD diagnosis could not be based solely on the testing data. Also, blast injuries were self-reported. The current assessment of mTBI and PTSD in the military population relies heavily on behavioral observations and patient recall (Hoge et al., 2009). However, historically, self-report has not been the most reliable method of research. Further, much of the demographic information was self-reported. For example, it is unknown exactly how many times the individuals were blasted. Although more objective assessments are currently being researched, such as the use of advanced brain imaging (e.g., fMRI), this assessment method was not available for this study. Further, the fourth group that was characterized as neither PTSD or mTBI is limited. It is unknown whether these individuals would be warranted such diagnoses because all that is known is that the records show no diagnoses were made for PTSD or mTBI, as is typically the case in these types of clinical referrals.

Another limitation to this dataset is that it is restricted to the information collected in this neuropsychological evaluation. It is a limited sample, as individuals that were not suspected of cognitive impairment were not referred for neuropsychological assessment. Therefore, this sample only contains those who were referred for an assessment due to a reported, rather than a documented, cognitive impairment. It is not known if this information generalizes to all servicemembers involved in deployment. Moreover, it would be valuable to have information obtained on the site of injury such as the number of firefights exposed to, or whether the blast injury was primary, secondary, tertiary, and so forth. However, it must be underscored that even with these limitations, the broad neuropsychological battery and the accuracy with which the data were collected raises confidence despite these concerns.

Table 34
Motor Valid Testing Data by Group

Test	*M* (*SD*)			
	Blasts	PTSD	Both	None
Grip strength (kg)				
Right hand[a]	46.51 (8.32)	44.49 (9.11)	46.30 (9.23)	43.72 (11.73)
Left hand[a]	45.04 (8.32)	43.01 (11.17)	43.26 (8.27)	41.57 (10.84)
Grooved pegboard test (seconds)				
Dominant hand[b]	72.40 (13.28)	75.06 (14.20)	73.36 (13.14)	72.80 (12.14)
Nondominant hand[b]	77.41 (14.62)	80.99 (28.81)	77.48 (916.12)	77.02 (14.41)
Total *N*	201	110	349	225

[a] Kilograms. [b] Seconds.

The literature is often complicated due to the variable and lengthy duration between the time of injury and formal neuropsychological assessments (Hoge et al., 2008; Vasterling et al., 2006). Furthermore, according to Dolan et al. (2012), the standardized neuropsychological tests currently being used may not be sufficiently sensitive to detect the subtle decrements in cognitive abilities following mTBI, that while mild, may have a significant impact on an individual's level of distress and/or ability to function. Whereas this dataset is unusual in that is has ASVAB scores, research with this test is limited, and there is a paucity of information on the relationship between the ASVAB and the measures used in this study.

Several methods have been put into place in order to screen individuals for mental health problems. For example, the Military Acute Concussion Evaluation (MACE) is a screening tool currently being used in the acute injury period following a suspected concussion in military members (French, McCrea, & Baggett, 2008). The Department of Defense has also required all military servicemen to complete the Post-Deployment Health Assessment (PDHA) in order to screen deployment-related physical and mental health concerns. Similarly, the Post-Deployment Health Reassessment (PDHRA) is administered 90–180 days after deployment in order to track aforementioned issues (McCarthy et al., 2012). The Department of Defense Instruction also mandates a 24-hr rest period for the first concussion and a 7-day rest period if there are two concussions within 12 months. Furthermore, if there are more than three concussions in 12 months, the individual must undergo a comprehensive neurological/neurocognitive examination before they return to duty (Helmick et al., 2015). Efforts are being made to get predeployment assessments to serve as a baseline for postdeployment evaluations. For this reason, the Automated Neuropsychological Assessment Metric (ANAM) is being used to help gather predeployment baseline functioning in order to help identify postconcussive cognitive deficits (Helmick et al., 2015).

Despite these recent advances, challenges continue to exist with respect to improvements in the mental health care of service members. Hoge and Castro (2014) suggest that the structure of care is specialty driven, leading to poorly coordinated care. A close collaboration between health care professionals should be available and is critical to the progression of health care for these individuals. A broader approach and focus on the multiple overlapping health needs of individuals returning from deployment is imperative. The strong associations between mTBI and PTSD in the military population emphasizes the need for a multidisciplinary approach centered in primary care (Hoge et al., 2008; Morissette et al., 2011) as well as a focus on comorbidities. The overlapping symptoms associated with mTBI and PTSD are significant military health issues. Due to their comorbidity, diagnosis and treatment is a challenge. Having a de-identified database available for the purpose of research would be extremely useful.

The main goal of this study is was to create a large dataset, describe its process and the dataset and to describe the relationship between combat-related mTBI and PTSD. Future analysis of this dataset will determine the sensitivity and specificity of the tests involved, and will illustrate their use in the military setting in order to create a standardized assessment for the military population. Efforts will be made in order to shorten psychological and neuropsychological tests, in the attempt to create a shortened battery for neuropsychological evaluation after deployment. The repeated testing in this dataset will also be analyzed in order to see the relationship of time since injury and cognitive changes. Risk and resilience factors of PTSD and blast-related injuries will be analyzed. Structure equation modeling will be conducted in order to statistically analyze the latent traits underlying the data and better understand the variables that are most prominent to the development of combat-related PTSD and mTBI. The influence of PTSD on the cognitive effects of blast-related injury will be explored using Bayesian analysis as well. Thus, the utility of this dataset must be underscored. To summarize, this dataset has the potential to elucidate the relationship between various psychological and neuropsychological factors in order to better understand PTSD and blast-related trauma in the military population.

The results from this study illustrate importance in several aspects of the PTSD and blast injury literature. They include the following: (a) large datasets provide a wider perspective; (b) effort testing adds a required perspective in these research studies; (c) extensive demographic information along with premorbid data is highly useful; (d) having individuals with PTSD and/or blasts injuries allows for important comparison; and (e) the combination of cognitive and emotional instruments helps clarify the distinctions and overlap of these often comorbid disorders.

In conclusion, this ongoing study contains many advantages that will enhance the understanding of postdeployment related disorders, addressing both emotional and cognitive impairment. No inferential statistical analyses were conducted in this article, as its purpose was to describe the dataset and the methods used to gather and clean it. With the surge of military personnel returned from OEF and OIF and the lingering effects of both PTSD and blast injuries, there is a critical and timely need to understand the emotional and neuropsychological effects of these injuries. Future research using this dataset will build on the current understanding of the emotional and neurocognitive changes presented with combat-related PTSD and/or mTBI. Ultimately, this research will inform servicemembers, policymakers, and clinicians about the possible emotional and neuropsychological effects of the current wars, leading to improved care.

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