

Risk-Taking Behaviors and Impulsivity Among Veterans With and Without PTSD and Mild TBI

Lisa M. James, PhD*†; Thad Q. Strom, PhD*†; Jennie Leskela, PhD*†

ABSTRACT Military personnel commonly experience post-traumatic stress disorder (PTSD) and mild traumatic brain injury (mTBI), both of which are associated with premature mortality. The present study examined two factors that may play a role in premature mortality—impulsivity and risk-taking behaviors—in a sample of 234 veterans screening positive for PTSD, mTBI, PTSD + mTBI, and controls. Analyses of variance demonstrated that veterans with PTSD, regardless of mTBI status, reported engaging in more frequent risky behaviors and reported a greater tendency to engage in impulsive behaviors when in a negative affective state. They also reported more premilitary delinquent behaviors and more suicide-related behaviors than controls. The present study highlights associations between impulsivity, risk-taking behaviors, and PTSD, and suggests continuity across the lifespan in terms of a predisposition to engage in impulsive and/or risky behaviors. Thorough evaluation of impulsivity and potentially risky behaviors is important in clinical settings to guide interventions and reduce the mortality and public health impact of high-risk behaviors in veterans.

INTRODUCTION

Post-traumatic stress disorder (PTSD) and mild traumatic brain injury (mTBI) are two of the most common consequences of warzone deployment.¹ Estimates suggest that across service eras, approximately 12 to 20% of military personnel meet criteria for PTSD,^{2–6} translating into a significant and costly public health concern.⁷ Regarding mTBI, up to 30% of recent returnees from the conflicts in Iraq and Afghanistan have suffered some form of TBI,^{8,9} with mTBI accounting for nearly half of all TBI cases.^{1,8–10} In addition, these disorders often co-occur with 44% of individuals with a history of mTBI also meeting criteria for PTSD.⁸ Both disorders are associated with high rates of psychiatric comorbidities,^{11,12} functional impairment,^{13,14} and increased risk for premature mortality.^{15–17} In the case of PTSD, prior research has demonstrated that premature mortality is largely attributable to external causes such as motor vehicle accidents, suicides, and other accidental injuries.^{15,17} To our knowledge, the long-term cause of mortality in individuals who have sustained an mTBI is unknown but likely parallels findings in individuals with PTSD and the general population, which demonstrate that accidents (e.g., motor vehicle, accidental discharge of firearms) and suicide are among the leading causes of death.¹⁸

Two factors that may contribute to increased risk for premature mortality due to external causes of death in veterans with PTSD or mTBI are impulsivity and proclivity to engage in risk-taking behaviors. Several studies have demonstrated increased impulsivity among individuals with PTSD^{19–20} and mTBI^{21–23} relative to nonaffected comparison groups. Recent

conceptualizations that characterize impulsivity as a multi-dimensional construct define at least two dimensions that are particularly germane to the study of PTSD and mTBI. First, Negative Urgency reflects the tendency to engage in impulsive behaviors when experiencing negative affect.²⁴ Both PTSD^{25,26} and mTBI^{27,28} are associated with negative affective states and impulsive or risky behaviors may provide a means to modulate negative affect. Second, Sensation Seeking reflects the tendency to enjoy and pursue activities that are new and exciting and has been linked to engagement in risk-taking behaviors.²⁹ Recent reports about veterans have emerged documenting that the severity and intensity of combat is associated with increased engagement in risky behaviors, in part due to a sense of invincibility and boredom proneness.³⁰ This finding is particularly robust in veterans with PTSD, regardless of mTBI status,³¹ paralleling previous findings in the literature. Specifically, prior research has demonstrated that PTSD is associated with a range of impulsive and risky behaviors including problematic substance use,^{31–34} interpersonal violence,^{35,36} weapon-related aggressive behavior,³⁷ and self-injurious or suicide-related behavior,^{20,38} in addition to elevated rates of risky sexual behavior, aggressive driving behavior, and thrill seeking in veterans.³⁴ Similar problematic impulsive and risky behaviors have been associated with mTBI, including higher levels of Sensation Seeking³⁹ and increased substance misuse,⁴⁰ suicide-related behavior,^{41,42} and aggression.⁴³

Thus, PTSD and mTBI have independently been linked to impulsivity and risk-taking behaviors. Here, we sought to evaluate the unique and combined associations of PTSD and mTBI to impulsivity and a wide range of risk-taking behaviors. We hypothesized that the impact of co-occurring PTSD and mTBI would result in the highest impulsivity scores and risk-taking behaviors, followed by either condition alone, with the nonaffected individuals reporting the lowest impulsivity

*Minneapolis Veterans Affairs Health Care System, One Veterans Drive, Minneapolis, MN 55417.

†Department of Psychiatry and Center for Cognitive Sciences, University of Minnesota, Minneapolis, MN 55455.

doi: 10.7205/MILMED-D-13-00241

scores and fewest risk-taking behaviors. In addition, given research demonstrating that premorbid personality characteristics influence the manifestation of trauma responses,²⁵ we also explored the relationships between current diagnostic status and premilitary behaviors linked to impulsivity. We anticipated that the group characterized by the highest impulsivity scores and risk-taking behaviors would report engaging in the most premilitary delinquent behaviors. We also examined the relationship between diagnostic status and specific self-destructive behaviors to test the hypothesis that participants characterized by the highest impulsivity scores and risk-taking behaviors would report engaging in the most self-destructive behaviors. Finally, we evaluated the effects of premilitary delinquent behavior, diagnostic status, and impulsivity on postdeployment risk-taking behaviors.

METHOD

Participants

Participants were 234 veterans taking part in a larger study of risk-taking behaviors (described in detail elsewhere³⁴) at the Minneapolis Veterans Affairs Health Care System (MVAHCS). The study protocol was approved by the Institutional Review Board at the MVAHCS and subjects provided informed consent before participation.

Measures

Participants completed several self-report measures to evaluate symptoms of PTSD, mTBI, impulsivity, risk-taking and self-destructive behavior, and premilitary delinquent behaviors.

PTSD

Symptoms of PTSD were evaluated with the PTSD Checklist-Military Version.⁴⁴ The PTSD Checklist-Military Version is a widely used measure that evaluates the current severity of each of the 17 symptoms of PTSD according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Total scores range from 17 to 85. Cronbach's α in the present sample was 0.98. Consistent with standard practice,^{44,45} a score of 50 or higher on the PCL was considered positive for PTSD. All participants scoring less than or equal to 30 on the PCL were considered negative for PTSD. Individuals scoring in the subthreshold range (scores between 31 and 49) were not included in the present analyses.

mTBI

The Brief Traumatic Brain Injury Screen⁴⁶ was used to screen for the possible presence of a traumatic brain injury. The Brief Traumatic Brain Injury Screen is a 3-item screening tool that evaluates the following: (1) whether an injury occurred (e.g., blast, fall, bullet); (2) whether the individual experienced any alteration in mental state (e.g., dazed, confusion, loss of consciousness, post-traumatic amnesia) as a result of the injury; and (3) whether they are experiencing current symptoms that they attribute to the injury. Consistent

with the definition of mTBI established by the American College of Rehabilitation Medicine,⁴⁷ probable mTBI was defined here as having sustained an injury (criteria 1) that resulted in loss of consciousness or alteration of mental status (criteria 2).

Risk-taking Behaviors

The frequency of several types of risk-taking behaviors were evaluated using a measure designed for the larger study from which these data were derived. As described previously,³⁴ the 42-item scale developed for the study permitted the assessment of a wide range of behaviors that are not captured in existing risk-taking measures but tend to be common and problematic among veterans (e.g., risky driving practices). Items were derived from a review of relevant literature.^{29,48} Participants reported how frequently they engaged in each of the behaviors using a 5-point Likert-type scale ranging from 0 (never) to 4 (very often). Total scores range from 0 to 63. In addition to the total score, scores on four subscales (substance abuse, aggression, risky sexual practices, and thrill seeking) were also evaluated. To assess convergent and divergent validity, we evaluated associations between the risk-taking scale and higher order personality traits including Negative Emotionality, Positive Emotionality, and Constraint derived from the Iowa Personality Questionnaire.⁴⁹ The total score and each of the subscales were positively correlated with Negative Emotionality (all p 's < 0.01) and negatively correlated with Constraint (all p 's < 0.01). In addition, the aggression subscale was negatively correlated with Positive Emotionality ($p < 0.001$) and the thrill-seeking subscale was positively correlated with Positive Emotionality ($p < 0.001$). Internal consistency of the total scale was excellent (Cronbach's $\alpha = 0.92$). The subscales also demonstrated good internal consistency (0.81–0.83).

Impulsivity

Impulsivity was measured with 2 scales from the UPPS.²⁴ Negative Urgency reflects a tendency to engage in impulsive behaviors when in a negative affective state. Sensation Seeking reflects a tendency to seek out new and exciting activities. Both scores demonstrated excellent reliability (Urgency: Cronbach's $\alpha = 0.89$; Sensation Seeking: Cronbach's $\alpha = 0.90$).

Premilitary Delinquent Behaviors⁵⁰

Participants were asked to indicate whether or not they had engaged in various delinquent behaviors before joining the military. Items included being suspended or expelled from school, getting into fights at school, getting into trouble because of alcohol or drugs, and being incarcerated. Each item was considered individually in analyses.

Self-destructive Behaviors

Three items from the risk-taking scale were used to evaluate group differences in the frequency of self-destructive behaviors. The items were: (1) thinking about suicide; (2) cutting/burning

yourself; and (3) intentionally driving a vehicle into another object. Responses were transformed into dichotomous (Yes/No) variables for subsequent analyses.

Data Analyses

A one-way analysis of variance (ANOVA) with post hoc comparisons was used for the primary analyses evaluating group differences in impulsivity and risk-taking behaviors. For analyses for which the homogeneity of variances assumption was violated, the Welch ANOVA and Games-Howell post hoc tests were used. Otherwise, the F-test and Tukey post hoc tests were used. χ^2 tests were used to analyze differences in the distributions of premilitary delinquency and self-destructive behaviors across groups. Regression analyses were used to evaluate the effects of premilitary delinquency, diagnostic status, and impulsivity on postdeployment risk-taking and self-destructive behaviors.

RESULTS

The sample included a total of 234 veterans who were primarily male (92.3%) and Caucasian (79.9%). Most participants served in the Army or Army National Guard (58.7%), with the Navy, Air Force, and Marines relatively equally represented among the remaining participants. The mean age of participants was 53.38 (SD = 14.47; range = 18–87). The largest percentage of participants were from the Vietnam era (37.9%), followed by Operation Enduring Freedom/Operation Iraqi Freedom (18.7%), and post-Vietnam (15.0%). Nearly half of participants were married (49.1%); 20.5% described themselves as single and another 20.5% were divorced. The vast majority of participants (73.1%) completed the survey from a mental health setting. Participants were categorized into the following groups: control (no PTSD, no mTBI; *N* = 82); PTSD (*N* = 69); mTBI (*N* = 6); PTSD + mTBI (*N* = 77).

The results from the primary analyses comparing risk-taking behaviors and impulsivity across groups are presented in Table I. As expected, the co-occurring PTSD + mTBI group endorsed significantly more risk-taking behaviors and Negative Urgency than the control group and significantly more risky substance use, aggressive behavior, and Negative Urgency than the mTBI group. An identical pattern was

found for the PTSD group compared to the control group and the mTBI group. Counter to expectations, the co-occurring PTSD + mTBI group did not endorse significantly more impulsivity and risk-taking behaviors than the PTSD group. That is, individuals with PTSD, regardless of TBI status (i.e., PTSD; PTSD + mTBI), tended to engage in more risky behaviors and more impulsive behaviors in the context of negative affective states than controls and those with mTBI only. The control group and mTBI group did not significantly differ from each other. Across all four groups, thrill-seeking behaviors were the most frequently reported risk-taking behaviors. There were no group differences in Sensation Seeking.

The distributions of premilitary delinquent and self-destructive behaviors for the control, PTSD, and PTSD + mTBI groups are presented in Table II. The mTBI group was excluded from analyses because of the small number of individuals in that group. Regarding premilitary delinquent behaviors, the χ^2 test was significant for getting into fights at school, premilitary incarceration, and getting into trouble prior to the military because of drugs. Follow-up $2 \times 2 \chi^2$ tests revealed that compared to the control group, the PTSD group was significantly more likely to have been incarcerated ($\chi^2 [1, 150] = 7.06, p = 0.008$) and had premilitary drug-related problems ($\chi^2 [1, 151] = 5.38, p = 0.020$). Also, compared to the control group, the PTSD + mTBI group was significantly more likely to have gotten into fights in school ($\chi^2 [1, 158] = 6.38, p = 0.012$) and had premilitary drug-related problems ($\chi^2 [1, 159] = 5.23, p = 0.022$). In terms of self-destructive behaviors, the χ^2 test was significant for thinking about suicide and intentionally driving into another object. Follow-up $2 \times 2 \chi^2$ tests revealed that compared to the control group, the PTSD group was significantly more likely to report thinking about suicide ($\chi^2 [1, 143] = 29.88, p = 0.000$) and driving a vehicle into another object ($\chi^2 [1, 145] = 7.70, p = 0.006$; Fisher’s exact test, $p = 0.005$). Similarly, compared to the control group, the PTSD + mTBI group was significantly more likely to report thinking about suicide ($\chi^2 [1, 153] = 33.157, p = 0.000$) and driving a vehicle into another object ($\chi^2 [1, 153] = 6.75, p = 0.009$; Fisher’s exact test, $p = 0.008$).

Additional analyses were completed to assess the effects of premilitary behaviors, impulsivity, and PTSD status on

TABLE I. Descriptive Statistics for Risk-taking Behaviors and Impulsivity by Study Group

	Control (1) Mean (SD)	PTSD (2) Mean (SD)	TBI (3) Mean (SD)	PTSD + TBI (4) Mean (SD)	Welch/F	<i>p</i>	Post Hoc Comparison
Substance	2.66 (3.31)	5.05 (6.30)	1.33 (1.63)	4.81 (4.75)	7.70 ^a	0.001	2/4 > 1/3
Aggression	1.41 (2.08)	4.89 (4.51)	2.17 (2.40)	6.79 (5.51)	27.41 ^a	<0.000	2/4 > 1/3
Sex	2.05 (2.71)	4.25 (4.46)	0.67 (1.63)	4.58 (5.39)	9.89 ^a	<0.001	2/4 > 1
Thrill	5.65 (6.19)	11.61 (9.10)	5.67 (5.28)	13.26 (10.26)	13.78 ^a	<0.001	2/4 > 1
Risk Total	4.53 (4.59)	10.14 (7.98)	3.87 (1.76)	11.34 (8.17)	21.57 ^a	<0.001	2/4 > 1/3
Urgency	26.08 (6.94)	31.34 (9.13)	27.80 (7.01)	32.91 (8.33)	10.48 ^b	<0.001	2/4 > 1
Sensation	29.81 (9.43)	29.62 (8.55)	29.40 (12.11)	29.73 (8.94)	0.01 ^b	0.999	—

α for pairwise comparisons set to 0.01. ^aWelch, Games-Howell. ^bF-test, Tukey post hoc.

TABLE II. Diagnostic Status, Premilitary Delinquency, and Self-destructive Behaviors

	Control N (%)	PTSD N (%)	PTSD + TBI N (%)	χ^2	<i>p</i>
Premilitary Delinquency					
Fights in School	27 (33.3)	28 (42.4)	41 (53.2)	6.39	0.041
Suspensions/Expulsions	13 (15.9)	14 (20.6)	20 (26.0)	2.47	0.290
Incarceration	11 (13.8)	22 (31.9)	13 (16.9)	8.38	0.015
Trouble—Alcohol	22 (26.8)	26 (38.2)	28 (36.4)	2.61	0.272
Trouble—Drugs	22 (26.8)	31 (44.9)	24 (44.2)	6.97	0.031
Self-Destructive Behavior					
Thinking About Suicide	23 (29.5)	49 (75.4)	57 (76.0)	44.32	0.000
Cutting/Burning	3 (3.9)	3 (4.6)	7 (9.3)	2.31	0.316
Intentionally Drive Into Object	0 (0)	6 (9.2)	6 (8.1)	7.39	0.025

postdeployment risk-taking and suicidal ideation. First, correlational analyses indicated that all of the premilitary delinquent behaviors were significantly correlated with postdeployment risk-taking total score (r 's = 0.17–0.35; all p 's < 0.01); only predeployment incarceration ($r = 0.15$, $p = 0.02$) and premilitary drug use ($r = 0.23$, $p = 0.001$) were significantly correlated with postdeployment suicidal ideation. Next, multiple linear regression was used to simultaneously evaluate the effect of premilitary delinquent behaviors, Urgency, and PTSD status on risk-taking behaviors. Results of the analyses indicated that premilitary drug use, Urgency, and PTSD status were all highly significant (all p 's < 0.001) predictors of postdeployment risk-taking behaviors ($R^2 = 0.32$, $F(7, 205) = 13.70$, $p < 0.001$). Logistic regression was used to evaluate the effects of those predictor variables on the presence of absence of suicidal ideation. Results indicated that only premilitary drug use behaviors (Wald = 4.34, Exp(B) = 2.16, $p = 0.037$) and PTSD status (Wald = 26.70, Exp(B) = 5.95, $p < 0.001$) were significant predictors of postdeployment suicidal ideation. Results of the regression analyses remained virtually unchanged when age and marital status were entered as covariates.

Post Hoc Analyses

We evaluated a potential cohort effect on risk-taking behaviors and impulsivity. We first split participants into a Vietnam era and older cohort ($n = 133$) and a post-Vietnam era and younger cohort ($n = 83$) (note that some participants are not included in analyses because of missing cohort data) and used t tests to evaluate cohort differences on each of the five risk-taking variables and the two impulsivity variables. Given the number of comparisons, we used a Bonferroni-corrected significance value of 0.003 (0.05/7 comparisons). Results indicated that sensation-seeking (younger cohort $M \pm SD$: 32.53 \pm 9.02 vs. older cohort $M \pm SD$: 28.57 \pm 8.58) and risky sexual behavior (younger cohort $M \pm SD$: 4.68 \pm 4.67 vs. older cohort $M \pm SD$: 2.97 \pm 4.24) were the only variables that significantly differed across cohorts (Sensation Seeking: $t(203) = 3.57$, $p < 0.001$; risky sexual behavior: $t(209) = 2.75$, $p = 0.007$). For each cohort, we repeated the ANOVA evaluating group differences on these variables. Because of the

small number of individuals in the mTBI group when split by cohort, analyses were conducted for the controls, PTSD, and PTSD + mTBI participants only. Using a Bonferroni-corrected significance level of 0.025 (0.05/2), there were no significant group differences on either Sensation Seeking (p 's > 0.19) or risk taking (p 's \geq 0.04) for either cohort. The results suggest that the primary effects are not due to cohort effects.

DISCUSSION

The present study evaluated associations between PTSD and mTBI on impulsivity and a wide range of risk-taking behaviors. As expected, veterans who screened positive for both PTSD and mTBI demonstrated more Negative Urgency and risk-taking behaviors than controls or those who screened positive for mTBI alone. However, contrary to expectations, the PTSD group exhibited equally high rates of Negative Urgency and risk-taking behaviors as the combined PTSD + mTBI group. Thus, it appears that PTSD, rather than mTBI, is the driving force behind impulsivity and risk-taking behaviors in the present sample. These findings are consistent with prior research demonstrating similar deficits in response to inhibition among those with PTSD and PTSD + mTBI relative to controls⁵¹ as well as other research highlighting similarly increased aggression, risk taking, problematic alcohol use, and reckless driving behaviors in PTSD and PTSD + mTBI groups relative to controls.³¹ Finally, others have found that after controlling for PTSD symptoms, mTBI alone is generally not associated with postdeployment psychosocial outcomes.⁵²

One possible explanation for these striking findings is that some individuals may be predisposed to engage in behaviors or situations that increase the likelihood of developing PTSD and related disorders. Indeed, the present study found that individuals screening positive for PTSD or PTSD + mTBI were more likely than the control group to have engaged in premilitary delinquent behaviors including engaging in fights at school, activities that led to incarceration, and drug-related problems. These types of behaviors are exemplars of the externalizing dimension of psychopathology,⁵³ which has been associated with an externalizing subtype of PTSD.⁵⁴

Specifically, individuals with PTSD who are characterized by low levels of premorbid constraint (i.e., disinhibition) have a tendency to be impulsive, aggressive, antisocial, and engage in problematic substance use. Thus, premorbid disinhibition may have given rise to premilitary delinquent behaviors and contributed to postmilitary impulsive and risk-taking behaviors in the current sample of veterans screening positive for PTSD. Regression analyses indicated that, of the premilitary delinquent behaviors evaluated, drug use in particular was highly significantly associated with postdeployment risk-taking behaviors. Associations between premilitary delinquent behaviors, mTBI, postdeployment risk taking, and impulsivity could not be evaluated in the present study given the small mTBI-only sample, but further research regarding premorbid disinhibition and postmilitary outcomes among those with mTBI is warranted.

Notably, both theoretical^{55,56} and empirical^{57,58} works also link disinhibition, or the highly related construct of impulsivity, to suicide-related behaviors. In the present study, the PTSD groups (i.e., PTSD, PTSD + mTBI) were not only characterized by greater levels of the Negative Urgency facet of impulsivity and risk-taking behaviors than the mTBI and control groups but were also more likely than the control group to have thought about suicide and purposely driven a vehicle into another object. Thus, premorbid disinhibition may place people on a track toward later involvement in risky or other highly problematic behaviors that ultimately result in psychopathological and self-destructive outcomes. Although suicidal ideation and behaviors were not evaluated in the present sample of veterans with mTBI only, given the small sample size, recent findings have indicated that the incidence of suicidal ideation and behavior increases with the number of TBIs regardless of PTSD symptoms.⁴² Individuals with TBI and high premorbid disinhibition may be particularly at risk for engaging in postdeployment self-destructive behaviors.

It is notable that there were no group differences on Sensation Seeking in the present sample, particularly in light of the robust group differences in Negative Urgency. By joining the military and potentially putting one's life at risk, veterans in general may be relatively high on the sensation-seeking dimension, masking any group differences by diagnostic status that might be present in a nonveteran sample. Furthermore, a recent longitudinal study evaluating risk propensity and Sensation Seeking in veterans with and without PTSD or probable TBI before and after deployment found a significant increase in sensation-seeking postdeployment, regardless of diagnostic status.³¹ That is, military experiences may serve to level the playing field in terms of Sensation Seeking. Finally, Sensation Seeking has been primarily linked with disorders such as antisocial and borderline personality disorder²⁴ and may be less likely than Negative Urgency to vary significantly between those with and without PTSD and mTBI. Indeed, consistent with contemporary theories of impulsivity, the different pattern of findings for Negative Urgency and Sensation Seeking highlight the multidimensional nature of impulsivity.

There are several noteworthy limitations that must be considered in conjunction with the present findings. First, there were very few people with mTBI only in the present sample, limiting our ability to adequately evaluate group differences between the mTBI group and the other study groups. However, the limited number of participants with mTBI only in the present study is consistent with other literature demonstrating high rates of co-occurrence between PTSD and mTBI in veterans.^{59,60} On a related note, individuals with moderate and severe TBI were not included in the present study; therefore, the relatively low impulsivity and risk-taking scores reported in the mTBI group may not generalize to patients with more significant TBIs. Second, other potentially relevant facets of impulsivity were not included in the present study. Specifically, Whiteside and Lynam²⁴ identified two additional facets of impulsivity—(Lack of) Premeditation and (Lack of) Perseverance—that could be related to PTSD or mTBI. A fifth facet of impulsivity, Positive Urgency, has also been identified.⁶¹ Future studies aimed at evaluating impulsivity in PTSD and mTBI would benefit from including all impulsivity facets to parse out the relationships between various dimensions of impulsivity and psychiatric status. Third, the analyses are based on self-report data, and thus participants are most appropriately considered to have screened positive (or negative) for PTSD and/or mTBI rather than to have met criteria. In the absence of thorough assessments to confirm diagnostic status of mTBI and PTSD, the results from the present sample are most appropriately considered preliminary and warrant further testing. Finally, other disorders that are highly comorbid with PTSD (e.g., depression) or related to impulsivity and risk-taking behaviors (e.g., ADHD) were not evaluated in the present study and thus could not be ruled out as potentially important factors contributing to postdeployment impulsivity and risk-taking behaviors.

In summary, the present study is the first to explicitly evaluate various types of risk-taking behaviors and two facets of impulsivity in a sample of veterans with and without PTSD and/or mTBI. The findings highlight associations between impulsivity, risk-taking behaviors, and PTSD (with or without mTBI) and suggest continuity across the lifespan in terms of a predisposition to engage in impulsive and/or risky behaviors that may ultimately contribute to premature mortality.

REFERENCES

1. Tanielian T, Jaycox LH (editors): *Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery*. Santa Monica, CA, Rand Corporation, 2004.
2. Eisen SA, Griffith KH, Xian H, et al: Lifetime and 12-month prevalence of psychiatric disorders in 8169 male Vietnam War era veterans. *Mil Med* 2004; 169: 896–902.
3. Hoge CW, Auchterlonie JL, Milliken CS: Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA* 2006; 295: 1023–32.
4. Kang HK, Natelson BH, Mahan CM, Lee KY, Murphy FM: Post-traumatic stress disorder and chronic fatigue syndrome-like illness among

- Gulf War veterans: a population-based survey of 30,000 Veterans. *Am J Epidemiol* 2003; 157: 141–8.
5. Kehle SM, Ferrier-Auerbach AG, Meis LA, Arbsi PA, Erbes CR, Polusny MA. Predictors of postdeployment alcohol use disorders in National Guard soldiers deployed to Operation Iraqi Freedom. *Psychol Addict Behav* 2012; 26: 42–50.
 6. Schlenger WE, Kulka RA, Fairbank JA, et al: The prevalence of post-traumatic stress disorder in the Vietnam generation: a multimethod, multisource assessment of psychiatric disorder. *J Trauma Stress* 1992; 5: 333–63.
 7. Soni A: The Five Most Costly Conditions, 1996 and 2006: Estimates for the U.S. Civilian Noninstitutionalized Population. Statistical Brief #248. Rockville, MD, Agency for Healthcare Research and Quality, July 2009. Available at http://www.meps.ahrq.gov/mepsweb/data_files/publications/st248/stat248.pdf; accessed August 1, 2013.
 8. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA: Mild traumatic brain injury in U.S. soldiers returning from Iraq. *N Engl J Med* 2008; 358: 453–63.
 9. Schwab KA, Ivins B, Cramer G, et al: Screening for traumatic brain injury in troops returning from deployment in Afghanistan and Iraq: Initial investigation of the usefulness of a short screening tool for traumatic brain injury. *J Head Trauma Rehabil* 2007; 22: 377–89.
 10. Warden DL, Ryan LM, Helmick KM, Schwab K, French LM, Lu W: War Neurotrauma: the Defense and Veterans Brain Injury Center (DVBIC) experience at Walter Reed Army Medical Center (WRAMC). *J Neurotrauma* 2005; 22: 1178.
 11. Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB: Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry* 1995; 52: 1048–60.
 12. Kim E, Lauterbach EC, Reeve A, et al: Neuropsychiatric complications of traumatic brain injury: a critical review of the literature (a report by the ANPA Committee on Research). *J Neuropsychiatry Clin Neurosci* 2007; 19: 106–27.
 13. Thomas JL, Wilk JE, Riviere LA, McGurk D, Castro CA, Hoge CW: Prevalence of mental health problems and functional impairment among active component and National Guard soldiers 3 and 12 months following combat in Iraq. *Arch Gen Psychiatry* 2010; 67(6): 614–23.
 14. Vanderploeg RD, Curtiss G, Luis CA, Salazar AM: Long-term morbidities following self-reported traumatic brain injury. *J Clin Exp Neuropsychol* 2007; 29: 585–98.
 15. Boscarino JA: Posttraumatic stress disorder and mortality among U.S. Army Veterans 30 years after military service. *Ann Epidemiol* 2006; 16: 248–56.
 16. Brown AW, Leibson CL, Malec JF, Perkins PK, Diehl NN, Larson DR: Long-term survival after traumatic brain injury: a population-based analysis. *NeuroRehabilitation* 2004; 19: 37–43.
 17. Watanabe KK, Kang HK. Military service in Vietnam and the risk of death from trauma and selected cancers. *Ann Epidemiol* 1995; 5: 407–12.
 18. Hoyert DL, Xu JQ. Deaths: Preliminary Data for 2011. *National Vital Statistics reports*; Vol. 61, no 6. Hyattsville, MD, National Center for Health Statistics, 2012. Available at http://www.cdc.gov/nchs/data/nvsr/nvsr61_06.pdf; accessed April 4, 2013.
 19. Kotler M, Iancu I, Efroni R, Amir M: Anger, impulsivity, social support, and suicide risk in patients with posttraumatic stress disorder. *J Nerv Ment Dis* 2001; 189: 162–7.
 20. Oquendo M, Brent DA, Birmaher B, et al: Posttraumatic stress disorder comorbid with major depression: factors mediating the association with suicidal behavior. *Am J Psychiatry* 2005; 162: 560–66.
 21. Lezak MD: *Neuropsychological Assessment*, Ed 3: London, Oxford University Press, 1995.
 22. Newcombe VFJ, Outtrim JG, Chatfield DA, et al: Parcellating the neuroanatomical basis of impaired decision-making in traumatic brain injury. *Brain* 2011; 134: 759–68.
 23. Tellier A, Marshall SC, Wilson KG, Smith A, Perugini M, Stiell IG: The heterogeneity of mild traumatic brain injury: where do we stand? *Brian Inj* 2009; 23: 879–87.
 24. Whiteside SP, Lynam DR: The Five Factor Model and impulsivity: using a structural model of personality to understand impulsivity. *Pers Individ Diff* 2001; 30: 669–89.
 25. Miller MW: Personality and the etiology and expression of PTSD: a three-factor model perspective. *Clin Psychol Sci Pract* 2003; 10: 373–93.
 26. Tull MT, Jakupcak M, McFadden ME, Roemer L: The role of negative affect intensity and the fear of emotions in posttraumatic stress symptom severity among victims of childhood interpersonal violence. *J Nerv Ment Dis* 2007; 195: 580–7.
 27. Alexander MP: Neuropsychiatric correlates of persistent postconcussive syndrome. *J Head Trauma Rehabil* 1992; 7: 60–9.
 28. Rapoport MJ, McCullagh S, Streiner D, Feinstein A: The clinical significance of major depression following mild traumatic brain injury. *Psychosomatics* 2003; 44: 31–37.
 29. Zuckerman M: *Behavioral Expression and Biosocial Bases of Sensation Seeking*. Cambridge, Cambridge University Press, 1994.
 30. Kilgore WDS, Cotting DI, Thomas JL, et al: Post-combat invincibility: violent combat experiences are associated with increase risk-taking propensity following deployment. *J Psychiatr Res* 2008; 42: 399–402.
 31. Kelley AM, Athy JR, Cho TH, Erickson B, King M, Cruz P: Risk propensity and health risk behaviors in U.S. army soldiers with and without psychological disturbances across the deployment cycle. *J Psychiatr Res*. 2012; 46: 582–89.
 32. Jakupcak M, Conybeare D, Phelps L, et al: Anger, hostility, and aggression among Iraq and Afghanistan war veterans reporting PTSD and subthreshold PTSD. *J Trauma Stress* 2007; 20: 945–54.
 33. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Arch Gen Psychiatry* 2005; 62: 593–602.
 34. Strom TQ, Leskela J, James LM, et al: An exploratory examination of risk-taking behavior and PTSD symptom severity in a veteran sample. *Mil Med* 2012; 177: 390–96.
 35. Orcutt HK, King LA, King DW: Male-perpetrated violence among Vietnam veteran couples: relationships with veteran's early life characteristics, trauma history, and PTSD symptomatology. *J Trauma Stress* 2003; 16: 381–90.
 36. Teten AL, Schumacher JA, Taft CT, et al: Intimate partner aggression perpetrated and sustained by male Afghanistan, Iraq, and Vietnam veterans with and without posttraumatic stress disorder. *J Interpers Violence* 2010; 25: 1612–30.
 37. Freeman TW, Roca V, Kimbrell T: A survey of gun collection and use among three groups of veteran patients admitted to Veterans Affairs hospital treatment programs. *South Med J* 2003; 96: 240–43.
 38. Sacks MB, Flood AM, Dennis MF, Hertzberg MA, Beckham JC: Self-mutilative behaviors in male veterans with posttraumatic stress disorder. *J Psychiatr Res* 2008; 42: 487–94.
 39. O'Jile JR, Ryan LM, Parks-Levy J, Betz B, Gouvier WD: Sensation seeking and risk behaviors in young adults with and without a history of head injury. *Appl Neuropsychol Adult* 2004; 11: 107–12.
 40. Parry-Jones BL, Vaughn FL, Cox WM: Traumatic brain injury and substance misuse: a systematic review of prevalence and outcomes research (1994–2004). *Neuropsychol Rehabil* 2006; 16: 537–60.
 41. Brenner LA, Homaifar BY, Adler LE, Wolfman JH, Kemp J: Suicidality and veterans with a history of traumatic brain injury: precipitating events, protective factors, and prevention strategies. *Rehab Psychol* 2000; 54: 390–97.
 42. Bryan C, Clemans TA: Repetitive traumatic brain injury, psychological symptoms, and suicide risk in a clinical sample of deployed military personnel. *JAMA Psychiatry* 2013; 70: 686–91.
 43. Rao V, Rosenberg P, Bertrand M, et al: Aggression after traumatic brain injury: prevalence and correlates. *J Neuropsychiatry Clin Neurosci* 2009; 21: 420–29.
 44. Weathers F, Litz B, Herman D, Huska J, Keane T. The PTSD checklist: reliability, validity, and diagnostic utility. Annual Meeting of the International Society of Traumatic Stress Studies, San Antonio, TX, 1993.

45. U.S. Department of Veterans Affairs, National Center for Posttraumatic Stress Disorder: Using the PTSD Checklist. Available at www.ptsd.va.gov/professional/pages/assessments/assessment-pdf/pcl-handout.pdf; accessed August 1, 2013.
46. Schwab KA, Baker G, Ivins B, Sluss-Tiller M, Lux W, Warden D: The Brief Traumatic Brain Injury Screen (BTBIS): investigating the validity of a self-report instrument for detecting traumatic brain injury (TBI) in troops returning from deployment in Afghanistan or Iraq. *Neurology* 2006; 66: A235.
47. Kay T, Harrington D, Adams R, et al: Definition of mild traumatic brain injury. *J Head Trauma Rehabil* 1993; 8: 86–7.
48. Pat-Horenczyk R, Peled O, Miron T, Brom D, Villa Y, Chemtob C: Risk-taking behaviors among Israeli adolescents exposed to recurrent terrorism: provoking danger under continuous threat? *Am J Psychiatry* 2007; 164: 66–72.
49. Donnellan MB, Conger RD, Burzette BG: Criterion-related validity, self-other agreement, and longitudinal analyses for the Iowa Personality Questionnaire: a short alternative to the MPQ. *J Res Pers* 2005; 39: 458–85.
50. Miller MW, Kaloupek DG, Dillon AL, Keane TM: Externalizing and internalizing subtypes of combat-related PTSD: a replication and extension using the PSY-5 scales. *J Abnorm Psychol* 2004; 113: 636–45.
51. Swick D, Honzel N, Larsen J, Ashley V, Justus T: Impaired response inhibition in veterans with post-traumatic stress disorder and mild traumatic brain injury. *J Int Neuropsychol Soc* 2012; 18: 1–10.
52. Polusny MA, Kehle SM, Nelson NW, Erbes CR, Arbisi PA, Thuras PA: Longitudinal effects of mild TBI/PTSD comorbidity on post-deployment outcomes in National Guard soldiers deployed to Iraq. *Arch Gen Psychiatry* 2011; 68: 79–89.
53. Krueger RF, McGue M, Iacono WG: The higher-order structure of common DSM mental disorders: internalization, externalization, and their connections to personality. *Pers Individ Diff* 2001; 20: 1245–59.
54. Miller MW, Grief JL, Smith AA: Multidimensional personality questionnaire profiles of veterans with traumatic combat exposure: externalizing and internalizing subtypes. *Psych Assess* 2003; 15: 205–15.
55. Joiner TE Jr: *Why People Die by Suicide*. Cambridge, MA, Harvard University Press, 2005.
56. Mann JJ, Wateraux C, Haas GL, Malone KM: Toward a clinical model of suicidal behavior in psychiatric patients. *Am J Psychiatry* 1999; 156: 181–89.
57. Mathias CW, Dougherty DM, James LM, et al: Intolerance to delayed rewards in girls with multiple suicide attempts. *Suicide Life Threat Behav* 2011; 41: 277–86.
58. Nock MK, Kessler RC: Prevalence of and risk factors for suicide attempts versus suicide gestures: analysis of the National Comorbidity Survey. *J Abnorm Psychol* 2006; 115: 616–23.
59. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA: Mild traumatic brain injury in U.S. soldiers returning from Iraq. *N Engl J Med* 2008; 358: 453–63.
60. Lew HL, Vanderploeg RD, Moore DF, et al: Overlap of mild TBI and mental health conditions in returning OIF/OEF service members and veterans. *J Rehabil Res Dev* 2008; 45: xi–xvi.
61. Cyders MA, Smith GT, Spillane NS, Fischer S, Annus AM, Peterson C: Integration of impulsivity and positive mood to predict risky behavior: development and validation of a measure of positive urgency. *Psychol Assess* 2007; 19: 107–18.