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Epidemiology of psychiatric disorders sustained by a U.S. Army brigade combat team during the Iraq War☆

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Abstract

Objective: This study was designed to describe the epidemiology of psychiatric illnesses experienced by soldiers in a combat environment, which has been previously underreported.
Methods: A U.S. Army brigade combat team deployed to Iraq during the Iraq War "Troop Surge" was followed by reviewing unit casualty rosters and electronic medical records for psychiatric diagnoses made by treating providers. The main outcome was the incidence rates of psychiatric disease and nonbattle injury (DNBI).
Results: Of the 4122 soldiers deployed, there were 308 psychiatric DNBI casualties (59.8 per 1000 soldier combat-years), which represented 23% of all DNBIs and was second only to musculoskeletal injuries (50% of all DNBI). Most psychiatric DNBI (88%) were treated in theater and returned to duty, 11% were medically evacuated and 1% died. Junior enlisted soldiers, compared with junior officers, and women, compared with men, were at a significantly increased risk for becoming a psychiatric DNBI casualty (77.3 vs. 32.2 per 1000 combat-years, $P<.002$ and 110.8 vs. 55.4 per 1000 combat-years $P<.05$, respectively).
Conclusions: Psychiatric diagnoses are second only to musculoskeletal injuries as a cause for DNBIs sustained in the current combat environment. Most can be treated in theater and permit soldiers to return to duty.
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1. Introduction

Psychiatric disorders have been a major cause of personnel loss from the combat zone during military deployments since antiquity. This has been delineated in great detail in studies of the American Civil War, World War I, World War II, Korean War, Vietnam War and the Persian Gulf War [1–5]. Many recent studies have analyzed the medical aspects of the current Operation Iraqi Freedom and Operation Enduring Freedom Conflicts [6–13]. Several of these studies described the medical evacuation (MEDE-VAC) rates out of the combat theater and in-theater hospitalizations, with the finding that a psychiatric disorder was the primary cause in 6% to 8% of all evacuations and hospitalizations, ranking as the fourth to seventh most common etiology for disease and nonbattle injury (DNBI) [6,7,12,13].

While psychiatric disorders requiring MEDEVAC out of theater and those necessitating hospitalization in theater are certainly important, these typically only represent a fraction of psychiatric disorders in a population. One study of

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outpatient visits found that 6.4% of a cohort of U.S. Marines (97% men) were diagnosed with a mental disorder after returning from deployment [10]. Using screening instruments, another study revealed that U.S. Army soldiers and Marines returning from deployment had a combined prevalence for depression, anxiety and posttraumatic stress disorder (PTSD) of 11% to 17% [8]. Other studies have also focused on the postdeployment period [14–15].

The findings of a significant proportion of service members being evacuated for a psychiatric disorder as well as frequent diagnoses for psychiatric disorders after deployment would suggest that these disorders are quite common in a combat-deployed population. The U.S. Army's Mental Health Advisory Team has reported on selected psychiatric disorders, using anonymous surveys, for soldiers currently serving in Iraq [16]. However, the sampling strategy used (to be feasible in the combat environment) and the lack of record review limit the generalizability of the findings [16]. To our knowledge, there has never been a published study describing the prevalence and burden of psychiatric disorders in an entire large combat-deployed maneuver unit. This study was designed to describe the prevalence, epidemiological characteristics and burden of psychiatric DNBI sustained by a brigade combat team (BCT) during "The Surge" portion of Operation Iraqi Freedom.

2. Methods

With approval of our Institutional Review Board and using only deidentified patient data, a cross-sectional study of a U.S. Army BCT deployed to Iraq for 15 months (1.25 years) during the Iraq War "Troop Surge" was performed. Unit rosters were obtained, and a comprehensive database was created by querying each soldier's electronic medical record and the unit's casualty rosters. There are multiple levels of care from which information is obtained, starting at the point of entry, progressing through all ascending echelons of care and terminating at a military treatment facility in the U.S. Each soldier's electronic medical record was queried for all medical visits occurring during deployment in Operation Iraqi Freedom. Care was taken to eliminate the multiple counting of psychiatric DNBI at different levels of care for the same medical problems, as well as to eliminate counting of follow-up visits for the same or continuing medical problem.

A casualty, in military usage, means a service member lost to the theater of operations for any medical reason [17], including battle injuries, noncombat injuries and illness. Combat (battle) injury is defined as "any casualty incurred as the direct result of hostile action sustained in combat or sustained going to or from a combat mission" [18]. Disease and nonbattle injury is therefore defined as any casualty lost to the theater of operations for medical reasons other than a combat injury and typically includes injuries, medical illnesses and psychiatric illnesses.

The DNBI casualty classification is subdivided into soldiers who died from DNBI (died), those treated and medically evacuated (MEDEVAC) and those treated and returned to duty within 72 h (RTD) [19]. DNBI were further categorized into 1 of 12 categories by body system to include head/eyes/ears/nose/throat (HEENT), pulmonary, cardiovascular, gastrointestinal, genitourinary, female reproductive, musculoskeletal, psychiatric, neurologic, dermatologic, hematologic/infectious disease and endocrine. For this study, all soldiers evacuated from theater to Germany or the United States for a primary psychiatric diagnosis were defined as a psychiatric MEDEVAC and all soldiers who had at least one encounter with a provider for a psychiatric diagnosis but neither died nor were MEDEVAC were classified as RTD. The psychiatric DNBI were analyzed and further categorized into the following psychiatric diagnoses: homicidal/suicidal ideation, depression/mood, bipolar, PTSD, acute stress reaction, anxiety, adjustment disorder, sleep disturbance, occupational, personality, psychotic, substance abuse and attention-deficit hyperactivity disorders (ADHD) based solely on the treating provider's International Classification of Diseases, Ninth Revision code. A soldier can be classified as a psychiatric DNBI casualty only once but may be diagnosed with more than one psychiatric disorder. The term occupational disorder was most often used as a diagnosis in cases in which soldiers were seen and evaluated by a military health-care provider and another Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition diagnosis was not given. Examples of occupation disorders included affair with a married officer, phase-of-life problem, harassment, operation stress reaction, interpersonal relationship problem, marital problems and anger management.

Additional factors analyzed included age, sex and rank. The age groups used were 18–23, 24–30, 31–35, and older than 35 years. The rank groups used were junior enlisted (E1–E4, colloquially known as privates, specialists and corporals), senior enlisted (E5–E9, colloquially known as sergeants), warrant officer (WO1–WO5, typically pilots and logistics officers) through junior officer (O1–O3, lieutenants and captains) and senior officers (O4–O6, majors and colonels).

Statistical analysis was performed using SAS (Cary, NC). Significance was set at $P<.05$. The χ^2 test statistic and Poisson regression were used to evaluate whether there was an association between the nominally scaled values of rank group and psychiatric DNBI casualty care statistics, sex and psychiatric DNBI casualty care statistics and psychiatric disorder and DNBI casualty classification as well as to estimate the rate of psychiatric DNBI for each group. The χ^2 statistic was used to assess whether there was any difference between the study groups in the proportions of the risk factor of interest. Fisher's exact test was used when there was no sufficient sample size for the χ^2 statistic. Multivariate Poisson regression analysis was used to estimate the rate of psychiatric DNBI casualty per 1000 person-years, while controlling for sex, rank and age. Poisson regression was

used to calculate incidence rate ratios (IRRs) as well as 95% confidence intervals (CIs) for the demographic categories, using the demographic subset with the lowest incidence rate as the referent category.

3. Results

The study population consisted of 4122 (3797 men and 325 women) BCT soldiers deployed in support of Operation Iraqi Freedom during the specified period. The average age was 27.0 years (range 18–52 years). The median military rank was enlisted grade E4 (SPC). In 4122 deployed soldiers (5152 soldier combat-years at risk), there were 500 combat wounds in 390 combat casualties and 1324 DNBI casualties. Therefore, the majority of casualties sustained by the BCT were a result of DNBI (77.2%). Of the 12 DNBI categories, the most common category of DNBI was musculoskeletal (50% of all DNBI), followed by psychiatric (23%). The combat wounds cohort [20] as well as the nonpsychiatric DNBI cohort [21] was excluded from the remainder of this analysis. Of the 1324 DNBI casualties, 308 were given at least one psychiatric diagnosis, with several soldiers receiving more than one diagnosis. Of the 308 psychiatric DNBI casualties, 3 died as a result of their psychiatric DNBI, 33 were MEDEVAC and 272 (88.3%) were RTD.

3.1. Psychiatric DNBI Casualty Care Statistics

There were a total of 308 psychiatric DNBI casualties within the BCT, for a psychiatric DNBI casualty incidence rate of 59.8 per 1000 soldier combat-years. The psychiatric DNBI casualty care statistical rates per 1000 combat-years were as follows: died=0.6, MEDEVAC=6.4 and RTD=52.8. Enlisted and noncommissioned officers accounted for 95.1% of the psychiatric DNBI casualties, while commissioned officers accounted for 4.9% (Table 1). The E1–E4 rank group, when compared with the O1–O3/WO1–WO5 rank group, was at a significantly increased risk for being a psychiatric DNBI casualty, 77.3 vs. 32.2 per 1000 combat-

years (P<.002), and for being a psychiatric DNBI casualty RTD, 68.1 vs. 29.7 per 1000 combat-years (P<.007). The results were similar when age groups were used instead of rank categories. The 18- to 23-year-old age group, when compared with the >35-year-old age group, was at a significantly increased risk for being a psychiatric DNBI casualty, 76.7 vs. 41.4 per 1000 combat-years (P<.0028), and for being a psychiatric DNBI casualty RTD, 69.7 vs. 34.2 per 1000 combat-years (P<.0015).

Women were at a higher risk for psychiatric DNBI casualty than men (Table 2). Women comprised 7.9% of the total population at risk but accounted for 14.6% of the total psychiatric DNBI. The incidence rate of psychiatric DNBI casualties was 110.8 per 1000 combat-years among women and 55.4 per 1000 combat-years among men. Women, when compared with men, were at a significantly increased likelihood for being a psychiatric DNBI casualty RTD, 108.3 vs. 48.0 per 1000 combat-years (P<.0001). Conversely, male, compared with female, DNBI casualties were at significantly increased risk for being MEDEVAC, 12.2% (32/263) compared with 2.2% (1/45) (P<.044).

Specific psychiatric diagnoses largely did not differ by rank group (Table 3). When comparing the junior enlisted rank group (E1–E4) to the referent group (junior officer rank group, O1–O3/WO1–WO5), only the overall number of psychiatric diagnoses was statistically different (E1–E4: 110.1 psychiatric diagnoses per 1000 combat-years vs. O1–O3/W01–W05: 44.6 per 1000 combat-years, P<.0001). The largest absolute difference between rank groups for an individual psychiatric diagnosis occurred in the adjustment disorder category. In those soldiers identified with adjustment disorder, the E1–E4 rank group was more commonly diagnosed than the O1–O3/WO1–WO5 rank group, but the difference was not statistically significant (19.6 vs.7.4 adjustment disorder diagnoses per 1000 combat-years, P<.099).

Psychiatric diagnoses also largely did not differ by sex (Table 4). Overall, women had more psychiatric diagnoses than men (145.2 vs. 76.5 psychiatric diagnoses per 1000 combat-years, P<.0001). Additionally, the subanalysis of the various psychiatric diagnoses found that the only statistically significant difference between the sexes was found within the sleep disorder category, where women were more

Table 1

DNBI psychiatric disposition by rank group: incidence rates per 1000 at-risk combat-years (n)

Rank group	n	DNBI died	DNBI MEDEVAC	DNBI RTD	DNBI total
E1–E4	2079	0.8 (2)	8.5 (22)	68.1 (177)*	77.3 (201)*
E5–E9	1665	0.5 (1)	4.8 (10)	38.9 (81)	44.2 (92)
O1–O3/ WO1–WO5	323	0 (0)	2.5 (1)	29.7 (12)*	32.2 (13)*
O4–O6	55	0 (0)	0 (0)	29.1 (2)	29.1 (2)
Total	4122	0.6 (3)	6.4 (33)	52.8 (272)	59.8 (308)

Rates are reported per 1000 combat-years.

Asterisks within the same column represent significant differences of the psychiatric DNBI casualty care statistic between rank groups, with O1–O3/WO1–WO5 as the referent group, P<.05.

DNBI casualty rates per 1000 combat-years=(DNBI casualty×1000))/(n×1.25).

Table 2

DNBI psychiatric disposition by sex: incidence rates per 1000 at-risk combat-years (n)

Sex	n	Psychiatric DNBI died	Psychiatric DNBI MEDEVAC	Psychiatric DNBI RTD	Psychiatric DNBI total
Female	325	0 (0)	2.5 (1)	108.3 (44)*	110.8 (45)*
Male	3797	0.6 (3)	6.7 (32)	48.0 (228)*	55.4 (263)*
Total	4122	0.6 (3)	6.4 (33)	52.8 (272)	59.8 (308)

Asterisks within the same column represent significant differences of the psychiatric DNBI casualty care statistic between sex, with men as the referent group, P<.05.

Table 3
DNBI psychiatric disorder/diagnosis by rank group: incidence rates per 1000 at-risk combat-years (*n*)

Rank	*n*	*n* Psychiatric disposition	Homicidal/ suicidal ideation	Depression/ mood disorders	Bipolar	PTSD	Acute stress reaction	Anxiety	Adjustment disorder	Sleep disturbance	Occupational disorder	Personality disorder	Psychosis	Substance abuse	ADHD	Total
E1–E4	2079	201	4.6 (11)	13.9 (36)	2.3 (6)	9.6 (23)	6.2 (16)	13.5 (35)	19.6 (50)	16.6 (43)	5.4 (13)	4.2 (11)	1.9 (5)	7.3 (18)	5.0 (12)	110.1 (279)*
E5–E9	1665	92	1.4 (2)	10.6 (21)	0.00 (0)	10.1 (21)	1.9 (4)	5.8 (12)	6.7 (14)	13.0 (27)	1.0 (2)	0.5 (1)	1.4 (3)	1.4 (3)	1.4 (3)	55.3 (113)
O1–O3/ WO1–WO5	323	13	2.5 (1)	7.4 (3)	0.00 (0)	2.5 (1)	0.0 (0)	5.0 (2)	7.4 (3)	14.9 (6)	2.5 (1)	0.0 (0)	0.0 (0)	0.0 (0)	2.5 (1)	44.6 (18)*
O4–O6	55	2	0.0 (0)	0.00 (0)	0.00 (0)	14.6 (1)	0.0 (0)	14.6 (1)	0.0 (0)	14.6 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	43.6 (3)
Total	4122	308	3.1 (14)	11.8 (60)	1.2 (6)	9.3 (46)	3.9 (20)	9.7 (50)	13.2 (67)	14.9 (77)	3.3 (16)	2.3 (12)	1.6 (8)	4.3 (21)	3.3 (16)	81.9 (413)

Asterisks within the same column represent significant differences of the psychiatric diagnosis between the rank groups, with O1–O3/WO1–WO5 as the referent group, *P*<.05.

Table 4
DNBI psychiatric disorder/diagnosis by sex: incidence rates per 1000 at-risk combat-years (*n*)

Sex	*n*	*n* Psychiatric disposition	Homicidal/ suicidal ideation	Depression/mood disorders	Bipolar	PTSD	Acute stress reaction	Anxiety	Adjustment disorder	Sleep disturbance	Occupational disorder	Personality disorder	Psychosis	Substance abuse	ADHD	Total
Female	325	45	2.5 (1)	27.1 (11)	2.5 (1)	9.9 (4)	4.9 (2)	14.8 (6)	22.2 (9)	46.8 (19)*	9.9 (4)	0.0 (0)	0.0 (0)	4.9 (2)	0.0 (0)	145.2 (59)*
Male	3797	263	3.2 (13)	10.5 (49)	1.1 (5)	9.3 (42)	3.8 (18)	9.3 (44)	12.4 (58)	12.2 (58)*	2.7 (12)	2.5 (12)	1.7 (8)	4.2 (19)	3.6 (16)	76.5 (354)*
Total	4122	308	3.1 (14)	11.8 (60)	1.2 (6)	9.3 (46)	3.9 (20)	9.7 (50)	13.2 (67)	14.9 (77)	3.3 (16)	2.3 (12)	1.6 (8)	4.3 (21)	3.3 (16)	81.9 (413)

Asterisks within the same column represent significant differences of the psychiatric diagnosis between sex, *P*<.05.

Table 5
DNBI psychiatric disorder/diagnosis by disposition: incidence rates per 1000 at-risk combat-years (n)

Psychiatric DNBI diagnosis	Psychiatric DNBI casualty disposition			
	Died	MEDEVAC	RTD	Total
Homicidal/suicidal ideation	0.6 (3)	1.9 (10)	0.2 (1)	2.7 (14)
Depression/mood disorder	0.0 (0)	1.4 (7)	10.3 (53)	11.6 (60)
Bipolar	0.0 (0)	0.6 (3)	0.6 (3)	1.2 (6)
PTSD	0.0 (0)	1.4 (7)	7.6 (39)	8.9 (46)
Acute stress reaction	0.0 (0)	0.2 (1)	3.7 (19)	3.9 (20)
Anxiety	0.0 (0)	0.2 (1)	9.5 (49)	9.7 (50)
Adjustment disorder	0.0 (0)	0.2 (1)	12.8 (66)	13.0 (67)
Sleep disturbance	0.0 (0)	0.8 (4)	14.2 (73)	14.9 (77)
Occupational disorder	0.0 (0)	0.0 (0)	3.1 (16)	3.1 (16)
Personality disorder	0.0 (0)	0.4 (2)	1.9 (10)	2.3 (12)
Psychosis	0.0 (0)	1.4 (7)	0.2 (1)	1.6 (8)
Substance abuse	0.0 (0)	1.0 (5)	3.1 (16)	4.1 (21)
ADHD	0.0 (0)	0.0 (0)	3.1 (16)	3.1 (16)
Total	0.6 (3)	9.3 (48)	70.3 (362)	80.2 (413)

commonly diagnosed than men (46.8 vs. 12.2 sleep disorder diagnoses per 1000 combat-years, $P<.022$). The top two sleep diagnoses, insomnia (76%) and mismatch sleep wake cycle (9%), accounted for 85% of all sleep diagnoses, and there were no diagnoses of obstructive sleep apnea. The diagnoses within the sleep disturbance category included the following: insomnia (56), mismatch sleep–wake cycle (7), nonorganic sleep disorder (6), sleep disturbance (3), somnambulism (2), nightmares (2), narcolepsy (1).

Service members with a diagnosis within the sleep disorder category commonly had additional psychiatric comorbidities. Twenty-eight of 77 (36%) service members with a sleep disorder diagnosis were evaluated for another psychiatric comorbidity, including depression, PTSD, acute stress reaction, substance abuse, anxiety, adjustment disorder, occupational disorder, bipolar, ADHD and psychosis. Forty-nine of the service members were diagnosed with a

sleep disturbance as the sole diagnosis and 28 (36%) service members with a sleep disturbance diagnosis had one or more additional psychiatric disorders as a comorbidity. Fifty-nine (145.2) women had a psychiatric disorder diagnosis, 19 (46.8) of which were sleep disturbance, while 263 (59.8) men had a psychiatric disorder diagnosis, 58 (12.2) of which were sleep disturbance. Of the 19 women with a sleep disturbance diagnosis, 8 (42.1%) had an additional psychiatric disorder diagnosis comorbidity compared with the 58 men with a sleep disturbance diagnosis, of which 20 (34.5%) had an additional psychiatric disorder diagnosis comorbidity. Unfortunately, the shift schedule of the individuals with a sleep disorder was not available for analysis.

For all but three diagnostic categories, more than 75% of casualties were RTD (Table 5). The only exceptions were homicidal/suicidal ideation (93% MEDEVAC or died DNBI), psychosis (88% MEDEVAC or died DNBI) and bipolar disorder (50% MEDEVAC or died DNBI). Conversely, for two diagnoses, occupational disorder and ADHD, all were RTD. Further, those service members diagnosed with acute stress reaction, anxiety and adjustment disorder were RTD at least 95% of the time.

To further explore the relationships of rank and sex with psychiatric diagnoses, a multivariate Poisson regression analysis was performed (Table 6). With junior officers as the referent category, the junior enlisted rank group had a significantly increased adjusted IRR for becoming a psychiatric DNBI casualty, 2.43 (95% CI 1.39–4.27), while controlling for sex. Similar results were seen when using age instead of rank. With the age group older than 35 years old as the referent category, the 18- to 23-year-old age group had a significantly increased adjusted IRR for becoming a psychiatric DNBI casualty, 1.80 (95% CI 1.21–2.69), while controlling for sex. Women, compared with men, had a significantly increased adjusted IRR for becoming a psychiatric DNBI casualty, 1.91 (95% CI 1.39–

Table 6
Poisson regression analysis

Demographic	Observed		Unadjusted		Adjusted	
	Diagnosis	Person-years	Rate	Rate ratio (95% CI)	Rate	Rate ratio (95% CI)
Age						
18–23 years old	141	1838	76.73	1.86 (1.24–2.77)	97.91	1.80 (1.21–2.69)
24–30 years old	109	1976	55.05	1.33 (0.88–2.00)	71.39	1.31 (0.87–1.98)
31–35 years old	29	634	45.76	1.11 (0.66–1.85)	59.99	1.10 (0.66–1.85)
>35 years old	29	701	41.35		54.34	
Rate per 1000 person-years, >35-year-old referent category, adjusted for sex						
Rank groups						
E1–E4	201	2599	77.34	2.40 (1.37–1.44)	98.65	2.43 (1.39–4.27)
E5–E9	92	2081	44.20	1.37 (0.77–2.45)	58.05	1.43 (0.80–2.56)
O1–O3/WO1–WO5	13	404	32.20		40.52	
O4–O6	2	69	29.09	0.90 (0.20–4.00)	39.58	0.98 (0.22–4.33)
Rate per 1000 person-years, O1–O3/WO1–WO5 rank group referent category, adjusted for sex						
Sex						
Male	263	4746	55.41		40.05	
Female	45	406	110.77	2.00 (1.46–2.74)	76.29	1.91 (1.39–2.63)
Rate per 1000 person-years, male referent category, adjusted for rank						

2.63), while controlling for rank. Significant main effects were noted for the variables of sex and rank group (*P*<.002), indicating that female sex and junior enlisted rank group are important risk factors for becoming a psychiatric DNBI casualty. Thus, female junior enlisted soldiers (E1–E4) have the highest risk of becoming a psychiatric DNBI casualty.

4. Discussion

Our study found that psychiatric casualties accounted for nearly one quarter of all DNBI casualties during a 15-month deployment by a BCT in support of Operation Iraqi Freedom, with a rate of 59.8 psychiatric causalities per 1000 combat-years. As 88% of these casualties were RTD, they would not have been accounted for by previous research methods that solely rely upon hospital admissions rates, MEDEVAC data and death certificates. The most common psychiatric disorders included sleep disturbances, adjustment disorder, depression/mood disorder, anxiety and PTSD. Junior enlisted soldiers and women had a higher risk for becoming a psychiatric DNBI compared with the junior officer/warrant officer rank group and men, respectively.

Our study contributes to the evolving understanding of psychiatric DNBI casualties, particularly when compared with other categories of DNBI. By studying a large single combat-deployed military maneuver unit, we showed that psychiatric disease is second only to musculoskeletal injuries as a cause for DNBI. Previous research, which relied on evacuation and hospitalization data, found that psychiatric disorders were the fourth to seventh most common cause for DNBI [6,7,12,13]. The differences in our findings are likely explained by the fact that this was a comprehensive analysis of one unit over an entire deployment and included all cases of psychiatric DNBI that were RTD. A previous review also noted that most psychiatric disorders were RTD, although the nature of the review prevented incidence rates from being calculated or compared with other causes of DNBI [22]. Thus, only a direct method that follows a single unit, as our study did, can account for the full spectrum of psychiatric casualties and can accurately compare the rates of psychiatric disease with other causes of DNBI. Further research in this area will need to employ a similar technique in order to allow for comprehensive and accurate incidence rates of psychiatric disorders.

Only one previous study analyzed psychiatric disorders in detail in U.S. service members evacuated from Operation Iraqi Freedom and Operation Enduring Freedom [11]. The authors showed that most evacuations were for adjustment disorders (37%), mood disorders (22%), personality disorders (16%) and anxiety disorders (includes PTSD, 15%) [11]. A U.K. study found just over half of evacuations were for adjustment disorders [23]. Our study found that homicidal/suicidal ideation (not a discrete category in the previous studies), mood disorders, PTSD and psychosis had the highest rates of MEDEVAC. Thus, both U.S. studies found that mood disorders and anxiety accounted for many of the MEDEVAC causalities, but our study had fewer adjustment disorder casualties evacuated. This might be explained due to the timing of the studies (evacuations from 2001 to 2004 vs. 2006 to 2007 in our study). As the war has progressed, a number of variables could account for these differences, including changing treatment protocols for these disorders, the percentage of soldiers who are combat veterans and thus are either more able to adapt to the psychological rigors of war or would be classified as having PTSD rather than an adjustment disorder and possibly a higher premium placed on retaining soldiers within the combat zone in order to minimize personnel attrition.

This study's findings of lower ranking, younger and female soldiers having an increased risk of psychiatric disease are consistent with previous literature. One large national community survey (8000 participants) found that individuals age 15 to 24 years were 1.7 times more likely to have major depression than the referent group of those older than age 45 years and women were 1.6 times more likely than men to have major depression [24]. Another large multicenter study, which was partially conducted in a military hospital, and two single-center military clinic studies also found that patients diagnosed with psychiatric disorders tended to be younger and female [25–27]. Thus, our findings of higher rates of psychiatric disorders in younger soldiers and female soldiers offer additional support that these subgroups are particularly susceptible to psychiatric disorders.

We acknowledge the limitations in the current study. While we took great care to capture all casualties and assign diagnoses as accurately as possible, misclassification is still a possibility. The U.S. Army recently reconfigured its structure, making the BCT the basic deployable unit of maneuver. We only studied a single BCT, so it is possible that this unit was not representative of all units in the U.S. Army. Specifically, as previous research has shown that DNBI rates vary with the intensity of combat [5], units with more or less combat exposure than the unit in our study may have different rates of psychiatric DNBI, suggesting that replication of this study in other units would be informative. Additionally, female soldiers accounted for only 7.9% of the total population at risk yet accounted for 14.6% of the total number of soldiers with a psychiatric diagnosis. While this number is high, it may not represent the true incidence of psychiatric disorders among female soldiers given the small subgroup sample size within a single BCT. Other factors, such as potential provider reluctance to record psychiatric disorders in the medical record and lack of information on previous deployment and dwell time since this last deployment [16] may effect our results, particularly as we could not analyze the effects of the latter two factors on age and sex. Lastly, despite the large study size, the frequency of individual psychiatric diagnoses was small, which limited the power to detect differences in diagnoses among age groups or between sexes. In particular, while the suicide rate

in this study was four times higher than a historical control (0.58 deaths per 1000 combat-years in the present study vs. 0.125 per 1000 years described in the military population from 1980 to 1992 [28]), there were only three events, thus limiting statistical comparisons.

In conclusion, psychiatric casualties are second only to musculoskeletal injuries as a cause for DNBI in a combat maneuver unit, but most will be returned to duty within 72 h. Research that relies solely on either hospitalization or evacuation data introduces a significant selection bias and will greatly underestimate the burden of psychiatric casualties. The psychological toll of combat is unquestionable, and U.S. Army soldiers deployed in the current conflict have extremely high suicide rates relative to the suicide rate of U.S. soldiers serving when there is not a major armed conflict. Military commanders and mental health-care providers need to plan for adequate resources to treat the substantial number of psychiatric DNBI casualties as well as to attempt to identify those soldiers who are at a high risk for committing suicide. This is particularly relevant to units deployed with high proportions of junior enlisted or female soldiers, as both these groups are at higher risk for becoming a psychiatric casualty.

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