

Mental Health Problems, Use of Mental Health Services, and Attrition From Military Service After Returning From Deployment to Iraq or Afghanistan

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IN MARCH 2003, THE UNITED STATES and its coalition partners launched Operation Iraqi Freedom (OIF), the largest sustained ground operation since the Vietnam War. The mental health effects in US military personnel returning from current deployments to Iraq and Afghanistan are of increasing importance to examine and have not been fully explored to date. Previous research conducted after other military conflicts has shown that deployment and exposure to combat result in increased risk of posttraumatic stress disorder (PTSD), major depression, substance abuse, functional impairment in social and employment settings, and the increased use of health care services.¹⁻⁸ A recent study showed that 17% of soldiers and Marines who returned from Iraq screened positive for PTSD, generalized anxiety, or depression, a prevalence nearly twice that observed among soldiers surveyed before deployment.⁹

Despite the high risk of mental health problems among veterans returning from Iraq and Afghanistan, there have been no systematic studies of mental health care utilization among these veterans after deployment. Such studies are an important part of measuring the mental health burden of the current war and ensuring that there are adequate resources to meet the mental health care needs of veterans returning from Iraq

Context The US military has conducted population-level screening for mental health problems among all service members returning from deployment to Afghanistan, Iraq, and other locations. To date, no systematic analysis of this program has been conducted, and studies have not assessed the impact of these deployments on mental health care utilization after deployment.

Objectives To determine the relationship between combat deployment and mental health care use during the first year after return and to assess the lessons learned from the postdeployment mental health screening effort, particularly the correlation between the screening results, actual use of mental health services, and attrition from military service.

Design, Setting, and Participants Population-based descriptive study of all Army soldiers and Marines who completed the routine postdeployment health assessment between May 1, 2003, and April 30, 2004, on return from deployment to Operation Enduring Freedom in Afghanistan (n=16 318), Operation Iraqi Freedom (n=222 620), and other locations (n=64 967). Health care utilization and occupational outcomes were measured for 1 year after deployment or until leaving the service if this occurred sooner.

Main Outcome Measures Screening positive for posttraumatic stress disorder, major depression, or other mental health problems; referral for a mental health reason; use of mental health care services after returning from deployment; and attrition from military service.

Results The prevalence of reporting a mental health problem was 19.1% among service members returning from Iraq compared with 11.3% after returning from Afghanistan and 8.5% after returning from other locations ($P<.001$). Mental health problems reported on the postdeployment assessment were significantly associated with combat experiences, mental health care referral and utilization, and attrition from military service. Thirty-five percent of Iraq war veterans accessed mental health services in the year after returning home; 12% per year were diagnosed with a mental health problem. More than 50% of those referred for a mental health reason were documented to receive follow-up care although less than 10% of all service members who received mental health treatment were referred through the screening program.

Conclusions Combat duty in Iraq was associated with high utilization of mental health services and attrition from military service after deployment. The deployment mental health screening program provided another indicator of the mental health impact of deployment on a population level but had limited utility in predicting the level of mental health services that were needed after deployment. The high rate of using mental health services among Operation Iraqi Freedom veterans after deployment highlights challenges in ensuring that there are adequate resources to meet the mental health needs of returning veterans.

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and Afghanistan. Population-based health services research has generally not been possible in prior wars due to lack of integrated electronic databases. In addition, virtually all studies of the mental health impact of prior wars have been conducted many years after veterans returned from combat.¹⁻⁸

The current war in Iraq and Afghanistan offers a unique opportunity to study the impact of deployment on mental health care utilization immediately after returning from deployment due to the availability of integrated electronic health care databases that are population-based. In addition, data are available from a mental health screening program mandated for all US service members returning from deployment that affords a unique opportunity to study the relationship of screening to subsequent mental health care use. Population-level mental health screening has been controversial. A recent commentary raised a number of questions about the utility of mass population-level screening for deployment-related mental health problems, including the validity of the instruments for this purpose and the potential impact that screening can have on medical resources.¹⁰ To date, there has been no assessment of the lessons learned from the current US military postdeployment screening effort.

The primary objectives of this descriptive study are to determine the relationship between deployment to Iraq and Afghanistan and mental health care utilization during the first year after return and to evaluate lessons learned from the postdeployment mental health screening effort, particularly the correlation between screening results and actual use of mental health services. In addition, this study provides preliminary data on the potential occupational burden of postdeployment mental health concerns, as measured by attrition from service.

METHODS

Source of Data

In April 2003, one month after the ground war began in Iraq, the US De-

partment of Defense mandated that all service members be required to complete a brief Post-Deployment Health Assessment (PDHA) immediately upon return from any deployment using revised Department of Defense Form 2796.¹¹ The purpose of this screening is to review each service member's current health, including mental health or psychosocial issues, possible deployment-related exposures, and to discuss deployment-related health concerns. The PDHA instrument consists of 3 pages of self-administered questions pertaining to deployment location, general health, physical symptoms, mental health concerns, and exposure concerns.¹¹ About a half a page is devoted to questions related to mental health concerns, including posttraumatic stress disorder symptoms, depression, suicidal ideation, aggression, and interest in receiving mental health services. The forms are completed either electronically using handheld devices or on paper surveys immediately before leaving country or within 1 to 2 weeks of returning home. All service members who complete the PDHA instrument are interviewed immediately by a credentialed health care professional (physician, nurse practitioner, or physician assistant) who makes a determination about whether referral for further evaluation is required. The PDHA form presents prompts to help the professional document concerns and referral needs and discuss resources to resolve postdeployment issues.¹¹ Mental health services are available on site to handle immediate referrals (such as for suicidal ideation); most referrals are nonurgent and are scheduled after the service member returns to his/her home base. The completed original PDHA is maintained in the individual's permanent medical record, and a copy is sent to the Army Medical Surveillance Activity for integration into the Defense Medical Surveillance System (DMSS) database. The DMSS, the source of data for this study, is an integrated public health surveillance database that includes data on all health care visits among military per-

sonnel, as well as demographic data (eg, age, sex) and service-related data (ie, date of entry into service, date of separation from service, rank, service component, occupation, and deployment history).¹²

Study Population

We conducted population-based analyses of 303 905 Army soldiers and Marines who completed a PDHA between May 1, 2003, and April 30, 2004, on return from deployments to Operation Enduring Freedom (OEF, Afghanistan), Operation Iraqi Freedom (OIF, Iraq, Kuwait, Qatar), and other locations (eg, Bosnia, Kosovo). Although Air Force and Navy personnel also serve in the combat environment, the majority of ground combat units are Army and Marine. To enhance comparability with existing published data pertaining to the mental health effects of combat,⁹ the study focused on Army and Marine personnel. This is a descriptive study with rates expressed as a function of total person-years of follow-up after deployment. All service members who completed the PDHA screening process were followed up using the DMSS for up to 12 months after deployment or through the date that they left military service if this occurred sooner. The 303 905 service members included in the study contributed a total of 280 907 person-years (11 months per person on average). Of the 303 905 service members included in the study, 50 611 (16.7%) left military service at some time during the 1-year follow-up period. Initial analyses showed that the demographics of the service members and the study findings were similar comparing the data-entered and electronic versions of the PDHA (data not shown). Thus, all data were combined.

Analysis of PDHA

The PDHA includes 2 stem questions for depression modified from a validated instrument widely used in primary care settings, the 2-item Patient Health Questionnaire that includes depressed mood ("felt down, depressed, or hopeless") and anhedonia ("little interest or pleasure in

doing things”).¹³⁻¹⁵ A positive response to either question was considered to be a risk factor for depression.¹⁵

The PDHA includes a 4-item screen for PTSD, developed by National Center for PTSD for primary care settings (Primary care-PTSD screen or “PC-PTSD”).¹⁶ This screen includes 4 questions covering the key domains of PTSD, including re-experiencing trauma, numbing, avoidance, and hyperarousal. Endorsement of any 2 of the 4 questions was considered to be at risk of PTSD. In addition to the above scales, the PDHA also includes 4 questions pertaining to suicide, interpersonal relationships, and interest in receiving care. Individuals who endorsed any of the following were also considered to be at increased risk of a mental health problem: (1) expressing “interest in receiving help for a stress, emotional, alcohol, or family problem” or had sought or intended to seek counseling for a mental health problem, (2) reporting “thoughts that you would be better off dead or hurting yourself in some way” (question modified from 9-item Patient Health Questionnaire), (3) reporting thoughts or concerns about “conflicts with close friends or family,” and (4) feeling that one might “hurt or lose control with another person.” The PDHA does not include screening for anxiety disorders other than PTSD because there is considerable overlap with PTSD and depression. The PDHA also does not include screening for substance abuse because access to alcohol and other substances is very limited in the war-zone.

We assessed the relationship of endorsing a mental health concern with combat experiences included on the PDHA survey. Prior trauma is not assessed on this form. The survey asked 3 questions: (1) “Have you seen anyone wounded, killed or dead during this deployment?” (2) “Have you engaged in direct combat where you discharged your weapon?” and (3) “During this, deployment did you ever feel you were in great danger of being killed?”

From the PDHA, we also identified individuals who were referred by the credentialed health professional for fol-

low-up for a mental health problem, defined as referral for a mental health, combat stress, or family problem. These referrals were correlated with actual health care utilization in military mental health clinics using the DMSS database. To measure occupational burden, mental health concerns were also correlated with attrition from service, defined as leaving military service for any reason (both voluntary and involuntary) during the follow-up period, a definition that has been validated in previous research.^{17,18}

Health Care Utilization

Health care utilization data from DMSS were extracted for each person from the date of his/her PDHA completion

through the 12-month follow-up period. Health care utilization data in DMSS were obtained from all permanent US military medical facilities, as well as care at other health care facilities reimbursed by the military. An electronic record is generated for all hospitalizations and ambulatory visits and includes date of visit; clinic type; diagnoses coded using the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*, and personal identifiers that allow integration with the personnel (denominator) data files. The accuracy of military inpatient electronic data has been shown to be comparable with that of other large health services information systems in the civilian sector.^{19,20}

Table 1. Characteristics of Soldiers and Marines With a Completed Post-Deployment Health Assessment by Deployment Location*

Characteristics	No. (%)		
	Operation Iraqi Freedom (n = 222 620)	Operation Enduring Freedom (n = 16 318)	Other (n = 64 967)
Sex			
Women	23 656 (10.6)	1416 (8.7)	7428 (11.4)
Men	198 964 (89.4)	14 902 (91.3)	57 538 (88.6)
Unknown	0	0	1 (<0.1)
Age, y			
18-24	99 083 (44.5)	5975 (36.6)	20 965 (32.3)
25-29	47 740 (21.4)	3306 (20.3)	10 879 (16.7)
30-39	54 414 (24.4)	4656 (28.5)	19 129 (29.4)
≥40	21 383 (9.6)	2381 (14.6)	13 994 (21.5)
Mean (SD)	28.5 (7.7)	30.3 (8.6)	32.0 (9.6)
Marital status			
Married	107 585 (48.3)	8145 (49.9)	34 247 (52.7)
Other	8945 (4.0)	794 (4.9)	4241 (6.5)
Single	105 934 (47.6)	7365 (45.1)	26 440 (40.7)
Unknown	156 (0.1)	14 (0.1)	39 (0.1)
Service branch			
Army	181 356 (81.5)	15 224 (93.3)	57 349 (88.3)
Marines	41 264 (18.5)	1094 (6.7)	7618 (11.7)
Component			
Active	163 955 (73.6)	10 048 (61.6)	14 697 (22.6)
National Guard	24 214 (10.9)	3779 (23.2)	30 858 (47.5)
Reserves	34 360 (15.4)	2482 (15.2)	19 391 (29.8)
Other or unknown	91 (<0.1)	9 (0.1)	21 (<0.1)
Grade			
Enlisted 1-4	114 249 (51.3)	6676 (40.9)	28 974 (44.6)
Enlisted 5-6	67 704 (30.4)	4970 (30.5)	21 486 (33.1)
Enlisted 7-9	15 578 (7.0)	1694 (10.4)	6411 (9.9)
Officer or Warrant Officer	25 089 (11.3)	2978 (18.2)	8096 (12.5)

*Operation Enduring Freedom involved military personnel serving in Afghanistan; Operation Iraqi Freedom involved those serving in Iraq, Kuwait, or Qatar; and other involved those serving in Bosnia, Turkey, Uzbekistan, Kosovo, on a ship, or other. The Post-Deployment Health Assessment Form DD2796 was completed from May 1, 2003, through April 30, 2004.

We analyzed mental health care diagnostic categories based on the primary diagnosis coded using ICD-9 and type of service, with mental health services defined as psychiatry, psychology, social work, alcohol or substance abuse, and multidisciplinary community mental health clinics. A health care visit for a mental health problem was defined as any visit during which a mental disorder diagnosis (ICD-9-CM category 290-319) was used or an ICD-9-CM V code was assigned that indicated treatment for a mental health problem

(including partner relationship problems; family circumstance problems; maltreatment-related codes; life-circumstance problems; and counseling for mental, behavioral, or substance abuse) using previous described coding algorithms.^{17,18} Only primary diagnoses were analyzed, because clinicians are less consistent in recording more than 1 diagnosis in the electronic record. Tobacco dependence (ICD-9-CM, 305.1) was excluded since tobacco cessation efforts within primary care clinics are not treated as mental health

problems. Annualized rates of utilization were calculated by counting all visits over total person-years. To determine the rate of utilization of services for distinct individuals, only 1 visit for a mental health problem was counted, prioritizing the first visit that involved an ICD-9-CM 290-319 diagnosis code over V code visits.

Institutional Review

This study was conducted under a human-use protocol approved by Walter Reed Army Institute of Research scientific and human use review committees. The protocol did not require informed consent of participants because it was based entirely on the use of existing medical data that are routinely collected for public health surveillance purposes.^{21,22}

Statistical Analyses

We used SAS version 9.1 (SAS Institute Inc, Cary, NC) for all statistical analyses. Because of the extremely large study size that included the entire population, virtually all comparisons would be statistically significant; therefore, comparisons using odds ratios (ORs) with 95% confidence intervals (CIs) and χ^2 testing were only used to confirm important epidemiologically plausible associations, such as the association of deployment location with mental health outcomes. Logistic regression was used to calculate ORs for outcomes adjusted for demographic variables shown in TABLE 1, which are noted in the article as “adjusted OR.”

RESULTS

Prevalence of Mental Health Concerns Reported on the PDHA

A total of 493 888 PDHA forms were completed in the study period by 424 451 individuals. For service members who completed more than 1 PDHA after deployment, which occurred when forms were completed both before leaving the deployment location and just after returning home, only the latest was included in the analysis. Of the 424 451 individuals, 303 905 (71.6%) were Army and Marine service members who

Table 2. Comparison of Deployment Location and Demographics Between Soldiers and Marines Who Completed the Post-Deployment Health Assessment Form and Those Who Were Listed on the Deployment Roster But Had No Form on File*

Characteristics	No. (%)	
	PDHA (n = 303 905)	Roster Only (n = 66 589)†
Deployment location†		
OIF	222 620 (73.3)	48 654 (73.0)
OEF	16 318 (5.4)	5867 (8.8)
Other	64 967 (21.4)	12 068 (18.1)
Sex		
Women	32 500 (10.7)	4544 (6.8)
Men	271 404 (89.3)	62 045 (93.2)
Unknown	1 (<0.1)	0
Age, y		
18-24	126 023 (41.5)	26 487 (39.8)
25-29	61 925 (20.4)	15 272 (22.9)
30-39	78 199 (25.7)	16 801 (25.2)
≥40	37 758 (12.4)	8029 (12.1)
Mean (SD)	29.3 (8.3)	29.5 (7.9)
Marital status		
Married	149 977 (49.3)	34 766 (52.2)
Other	13 980 (4.6)	2592 (3.9)
Single	139 739 (46.0)	29 176 (43.8)
Unknown	209 (0.1)	55 (0.1)
Service		
Army	253 929 (83.6)	43 127 (64.8)
Marines	49 976 (16.4)	23 462 (35.2)
Component		
Active duty	188 700 (62.1)	54 063 (81.2)
National Guard	58 851 (19.4)	6338 (9.5)
Reserves	56 233 (18.5)	6188 (9.3)
Other/unknown	121 (<0.1)	0
Grade		
Enlisted 1-4	149 899 (49.3)	30 124 (45.2)
Enlisted 5-6	94 160 (31.0)	20 128 (30.2)
Enlisted 7-9	23 683 (7.8)	6034 (9.1)
Officer or Warrant Officer	36 163 (11.9)	10 302 (15.5)

Abbreviations: OEF, Operation Enduring Freedom (Afghanistan); OIF, Operation Iraqi Freedom (Iraq, Kuwait, or Qatar); other (Bosnia, Turkey, Uzbekistan, Kosovo, on a ship, or other); PDHA, Post-Deployment Health Assessment.

*Based on PDHA Form DD2796 completed beginning May 1, 2003, through April 30, 2004, and rosters of all returning service members for same dates.

†Using most recent Defense Medical Surveillance System demographic record in the study period.

had returned from OIF (n=222 620, 73.3%), OEF (n=16 318, 5.4%), or other (n=64 967, 21.4%) deployment locations (such as Kosovo and Bosnia). Some differences in demographics were observed by deployment location, with more Marine and active-component units (not reservists) deploying to OIF than other deployment locations (Table 1). The DMSS received PDHAs from 82% of Army and Marine service members who had a record of returning from deployment during the study period, based on checking all of the PDHAs against an additional administrative deployment data roster. The PDHA was less uniformly completed during the first few months of implementation as the program was being established. The 18% of service members who did not have a PDHA record (n=66 589) were very similar to those who had a PDHA by deployment location and demographics, except that service members who did not have a PDHA record were somewhat more likely to be active duty Marines (TABLE 2).

The prevalence rates of mental health problems and combat experiences were consistently higher following deployment to OIF than to OEF or other locations (TABLE 3). Overall, 19.1% of soldiers and Marines who returned from OIF met the risk criteria for a mental health concern, compared with 11.3% for OEF and 8.5% for other locations (adjusted OR for OIF compared with other deployment location: 2.72; 95% CI, 2.63-2.80; P<.001 and OEF vs other: adjusted OR, 1.55; 95% CI, 1.46-1.64; P<.001). The 8.5% compares closely with baseline data from another study of soldiers surveyed before they deployed for the first time to Iraq and Afghanistan.⁹ Prevalences of scoring 2 or more on the 4-item PTSD scale were 9.8% for OIF, 4.7% for OEF, and 2.1% for other locations (adjusted OR OIF vs other, 5.51; 95% CI, 5.20-5.83; P<.001 and OEF vs other, 2.52; 95% CI, 2.30-2.76; P<.001).

The percentage of soldiers and Marines who were referred for a mental health problem also differed significantly by deployment location (OIF

4.3%, OEF 2.0%, Other 0.9%; adjusted OR OIF vs other, 5.53; 95% CI, 5.06-6.04; P<.001 and OEF vs other, 2.51; 95% CI, 2.19-2.89; P<.001). Referral to mental health was strongly correlated with screening positive for a mental health problem on the PDHA. Among 42 506 OIF veterans who screened positive, 7797 (18.3%) were referred, compared with 1814 (1.0%) of 180 114 veterans who did not meet the screening criteria (OR, 22.1; 95%

CI, 21.0-23.3; P<.001). The total number of OIF veterans who were referred was 9611 (Table 3).

Among OIF veterans, the prevalence of mental health problems was similar across components (data not shown). Overall 18.4% of active component service members screened positive for 1 of the mental health concerns compared with 21.0% of National Guard members and 20.8% of Reserve component members. There were small

Table 3. Prevalence of Mental Health–Related Outcomes and Combat Experiences Reported on Post-Deployment Health Assessment Form by Deployment Location*

Outcomes	No. (%) of Soldiers and Marines		
	OIF§ (n = 222 620)	OEF (n = 16 318)	Other (n = 64 967)
PHQ-2, depression stem questions, No. of positive responses			
1	10016 (4.5)	412 (2.5)	1239 (1.9)
2	3579 (1.6)	165 (1.0)	519 (0.8)
Primary care–PTSD screen, No. of positive responses to 4-item test			
1	22 324 (10.0)	845 (5.2)	1374 (2.1)
2	11 213 (5.0)	407 (2.5)	637 (1.0)
3	6150 (2.8)	201 (1.2)	360 (0.6)
4	4459 (2.0)	154 (0.9)	398 (0.6)
≥2 (PTSD screen positive)	21 822 (9.8)	762 (4.7)	1395 (2.1)
Suicidal ideation			
Some	2411 (1.1)	107 (0.7)	410 (0.6)
A lot	467 (0.2)	20 (0.1)	86 (0.1)
Interpersonal conflicts			
Yes	6335 (2.8)	291 (1.8)	1111 (1.7)
Unsure	8646 (3.9)	415 (2.5)	1132 (1.7)
Interpersonal aggressive ideation			
Yes	4695 (2.1)	189 (1.2)	713 (1.1)
Unsure	7379 (3.3)	263 (1.6)	744 (1.1)
Any mental health concern†	42 506 (19.1)	1843 (11.3)	5534 (8.5)
Combat experiences			
Any	144 978 (65.1)	7499 (46.0)	4834 (7.4)
Witnessed wounded or killed	110 201 (49.5)	6209 (38.1)	3460 (5.3)
Discharged weapon	39 548 (17.8)	1015 (6.2)	285 (0.4)
Felt in great danger of being killed	111 966 (50.3)	4007 (24.6)	2083 (3.2)
Referred for any medical follow-up	63 186 (28.4)	2614 (16.0)	7648 (11.8)
Referred for mental health problems‡	9611 (4.3)	326 (2.0)	582 (0.9)
Hospitalized during deployment	14 777 (6.6)	593 (3.6)	2684 (4.1)

Abbreviations: OEF, Operation Enduring Freedom (Afghanistan); OIF, Operation Iraqi Freedom (Iraq, Kuwait, or Qatar); other (Bosnia, Turkey, Uzbekistan, Kosovo, on a ship, or other); PHQ, Patient Health Questionnaire; PTSD, post-traumatic stress disorder.

*The Post-Deployment Health Assessment Form DD2796 was completed beginning May 1, 2003, through April 30, 2004.

†Positive response to any of the 8 criteria: little interest or pleasure (a lot); feeling down (a lot); interest in receiving help for stress, emotional distress, family problem (yes); thoughts of hurting self (some or a lot); PTSD screen positive (≥2); thoughts of serious conflicts with others (yes); thoughts of hurting someone or sense of a loss of control with others (yes); and have sought or intend to seek care for mental health (yes).

‡Referred for combat or an operational stress reaction, family problems, or mental health diagnosis based on health professional interview. Most referrals also met criteria for mental health concern on PDHA. For OIF 7797 of 9611 met criteria for mental health concern; for OEF 268 of 326 met criteria; for other 460 of 582 met criteria.

§Operation Iraqi Freedom deployment location compared with other location was significantly associated with all outcomes shown in the table after controlling for demographics listed in Table 1 using logistic regression. Operation Enduring Freedom deployment location compared with other location was significantly associated with all outcomes except suicidal ideation and hospitalization, after controlling for demographics.

Table 4. Number and Rate of Psychiatric Hospitalizations in First Year After Post-Deployment Health Assessment*

	No. of Hospitalizations (Rate per 1000 Person-Years)†
Distinct individuals hospitalized	
Mental disorders, ICD-9-CM 290-319	
OIF‡	1214 (5.9)
OEF	45 (2.9)
Other	126 (2.1)
Total psychiatric hospitalizations	
Mental disorders, ICD-9-CM 290-319	
OIF	1506 (7.3)
OEF	53 (3.4)
Other	146 (2.4)

Abbreviations: ICD9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; OEF, Operation Enduring Freedom (Afghanistan); OIF, Operation Iraqi Freedom (Iraq, Kuwait, or Qatar); other, (Bosnia, Turkey, Uzbekistan, Kosovo, on a ship, or other)

*Post-Deployment Health Assessment Form DD2796 completed beginning May 1, 2003, through April 30, 2004.

†Rate per 1000 person-years (222 620 OIF military contributing 205 201 person-years, 16 318 OEF military contributing 15 367 person-years, 64 967 from other deployment locations contributing 60 339 person-years).

‡For psychiatric hospitalization of OIF vs other, the odds ratio was 2.82 (95% confidence interval, 2.34-3.41), $P < .001$; OEF vs other, the OR was 1.42 (95% confidence interval, 1.00-2.03), $P = .04$.

differences by sex; 23.6% of women reported a mental health concern compared with 18.6% of men.

Exposure to a combat situation was correlated with screening positive for PTSD among OIF veterans. Of 21 822 service members who screened positive for PTSD (≥ 2 on the PTSD scale) after returning from OIF, 17 364 (79.6%) reported witnessing persons being wounded or killed or engaging in direct combat during which they discharged their weapon compared with 95 894 (47.8%) of 200 798 who screened negative for PTSD (OR for PTSD, 4.26; 95% CI, 4.12-4.41; $P < .001$).

Although we had no direct data on combat-related injuries in the DMSS, the PDHA included a question about having been hospitalized during deployment, which may serve as a surrogate for injuries. Hospitalization was significantly associated with deployment location (Table 3) and reporting a mental health concern on the PDHA. Among 14 777 OIF veterans who were hospitalized, 5174 (35.0%) reported a mental health problem and 1394 (9.4%) were referred to mental health compared with 37 332 (18.0%) and 8217 (4.0%), respectively, of 207 843 OIF veterans not hospitalized (OR, 2.46; 95% CI, 2.37-2.55; $P < .001$ mental health problem and OR, 2.53; 95% CI, 2.38-2.69; $P < .001$ referred).

Referral to Mental Health Care and Rates of Utilization of Mental Health Services

Operation Iraqi Freedom veterans used inpatient and outpatient mental health services at higher rates after deployment than OEF veterans and service members who deployed to other locations (TABLE 4 and TABLE 5). Among 222 620 OIF veterans, 68 923 (31.0%) were documented to have had at least 1 outpatient mental health care visit within the first year postdeployment (Table 5). The annualized rate of utilization of mental health services among OIF veterans was 346.2 individuals per 1000 persons per year (35% of persons per year). This included a total 118.9 individuals per 1000 (12% per year) who accessed services for a mental health problem (including 84.1 per 1000 per year for a ICD-9 290-319 mental disorder diagnosis and 34.8 per 1000 per year for a v code mental health problem) and 227.3 per 1000 per year who were seen in a mental health clinic but did not receive a mental health problem diagnosis (Table 5). Typically they received a general health examination or ill-defined condition code. Operation Iraqi Freedom veterans who accessed mental health services averaged 3.4 episodes of care per person per year (1166.3 total visits among 346.2 persons per 1000 per year; Table 5). Among the

68 923 total OIF veterans who accessed mental health services in the year after deployment, only 5216 (7.6%) had a referral to mental health recorded on their PDHA form. Of the 68 923, 8224 (11.9%) had their first visit on the same day as the PDHA, 6133 (8.9%) within the first week, 17 406 (25.3%) within 1 to 4 weeks, 14 444 (21.0%) in the second month, and 22 716 (33.0%) greater than 2 months after the screening.

Of 9611 soldiers and Marines from OIF who had a referral indicated on the PDHA for a mental health reason, 5216 (54.3%) were seen in a mental health clinic during the follow-up period, including 2978 (57.1% of those seen) who received a diagnosis of a mental health problem. An additional 192 were seen in a primary care or other clinic and received a diagnosis of a mental health problem. Thus, 5408 (56.3%) of the 9611 OIF service members referred through the PDHA screening process were documented to have received mental health care. A similar utilization rate among referrals was observed for OEF veterans (48.2%) and those who returned from other deployments (51.4%).

Additional analyses were conducted on mental health care utilization rates for all active component Army and Marine service members (regardless of deployment history) for calendar years 2000 through 2004 (average $n = 656\ 000$ per year). The number of individuals who accessed mental health services per 1000 per year increased over time: 145.3 in 2000, 175.3 in 2001, 199.8 in 2002, 218.8 in 2003, and 222.3 in 2004 (χ^2 for trend $P < .001$). The total mental health visits per 1000 per year also increased: 687.1 in 2000, 783.3 in 2001, 858.4 in 2002, 853.3 in 2003, and 887.5 in 2004 (χ^2 for trend $P < .001$).

Attrition From Military Service

Those who screened positive for a mental health concern were significantly more likely to leave service for any reason during the year after deployment than those who screened negative for all deployment locations (TABLE 6). Operation Iraqi Freedom veterans were sig-

nificantly more likely to leave military service (17.3%) than were OEF veterans (13.7%; OR, 1.33; 95% CI, 1.27-1.39; $P < .001$) or veterans of other deployments (15.0%; OR, 1.19; 95% CI, 1.16-1.22; $P < .001$). The DMSS data system does not include accurate data on the reason for leaving service, so these differences reflect the rate of attrition for any reason, including voluntary separation due to the end-of-service obligation.

COMMENT

This is the first analysis of data collected as part of the US Department of Defense mass population-level screening for mental health problems among service members returning from ground combat operations in Iraq and Afghanistan. Among soldiers and Marines who returned from Iraq, 19.1% screened positive for a mental health concern compared with 11.3% after Afghanistan, and 8.5% after other deploy-

ments. These rates paralleled reported combat experiences and emphasize the fact that the need for mental health services is likely to vary as a function of combat exposure.

The most important finding of this study was the high rate of utilization of mental health services documented among OIF veterans in their first year after returning from deployment compared with veterans returning from other locations. Population-based

Table 5. Number and Rate of Accessing Outpatient Services for Mental Health Problems in First Year After Post-Deployment Health Assessment by Type of Service, Primary Diagnosis, and Deployment Location*

	Service Type, No.			Rate per 1000 Person-Years§
	Mental Health Services†	Primary Care and Other Services‡	Total	
Distinct individuals seen in outpatient clinics				
Operation Iraqi Freedom				
Mental disorders¶	15 465	1784	17 249	84.1
Mental health V-code problem	6807	329	7136	34.8
Seen in MHC but did not receive a MH diagnosis	46 651	NA	46 651	227.3
Total seen in MHC or treated for mental health problem	68 923	2113	71 036	346.2
Operation Enduring Freedom				
Mental disorders¶	903	92	995	64.7
Mental health V-code problem	453	40	493	32.1
Seen in MHC but did not receive a MH diagnosis	1818	NA	1818	118.3
Total seen in MHC or treated for mental health problem	3174	132	3306	215.1
Other location				
Mental disorders¶	1645	259	1904	31.6
Mental health V-code problem	485	47	532	8.8
Seen in MHC but did not receive a MH diagnosis	12 197	NA	12 197	202.1
Total seen in MHC or treated for mental health problem	14 327	306	14 633	242.5
Total outpatient visits				
Operation Iraqi Freedom				
Mental disorders¶	81 825	11 372	93 197	454.2
Mental health V-code problem	34 999	1340	36 339	177.1
Seen in MHC but did not receive a MH diagnosis	109 786	NA	109 786	535.0
Total visits in MHC or treated for mental health problem	226 610	12 712	239 322	1166.3
Operation Enduring Freedom				
Mental disorders¶	5360	434	5794	377.0
Mental health V-code problem	2255	81	2336	152.0
Seen in MHC but did not receive a MH diagnosis	5041	NA	5041	328.0
Total visits in MHC or treated for mental health problem	12 656	515	13 171	857.1
Other location				
Mental disorders¶	7074	1041	8115	134.5
Mental health V-code problem	2090	147	2237	37.1
Seen in MHC but did not receive a MH diagnosis	26 121	NA	26 121	432.9
Total visits in MHC or treated for mental health problem	35 285	1188	36 473	604.5

Abbreviations: MHC, mental health clinic; MH, mental health; NA, not applicable; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom.

*Post-Deployment Health Assessment Form DD2796 completed beginning May 1, 2003, through April 30, 2004.

†Outpatient mental health clinics include psychiatry, psychology, community mental health, substance abuse, and social work.

‡All other medical, nonmental health specific clinics.

§ Rate per 1000 person-years (222 620 OIF military contributing 205 201 person-years, 16 318 OEF military contributing 15 367 person-years, 64 967 other military contributing 60 339 person-years).

||Comparing those being treated for mental disorder, the odds ratio (OR) those serving in OIF vs other was 2.87 (95% confidence interval [CI], 2.73-3.03), $P < .001$; for those serving in OEF vs other, the OR was 2.25 (95% CI, 2.07-2.45); $P < .001$; and those receiving any mental health care among those serving in OIF vs other, the OR was 1.59 (95% CI, 1.55-1.62), $P < .001$.

¶Mental Health disorder diagnoses were based on, *International Classification of Diseases, Ninth Revision, Clinical Modification*, codes 290-319.

health services research has been difficult in prior wars due to the lack of availability of integrated electronic health records. This study shows that approximately one third of OIF veterans accessed mental health services in their first year after deployment, 12% per year received a diagnosis of a mental health problem, and an additional 23% per year were seen in mental health clinics but did not receive a diagnosis. It is not clear why there was such high use of mental health services without a mental illness diagnosis. It is possible that less descriptive diagnostic codes are being used among service members returning from deployment to reduce the stigma of receiving a mental health diagnosis.⁹ In addition, mental health professionals on site during

the PDHAs may have counted workload incurred by helping in the screening process itself since approximately 11% of the initial visits occurred on the same day as the screening. Nevertheless, even if these were excluded, the rates of utilization of mental health services were markedly higher among OIF veterans than OEF and other veterans, or compared with baseline rates.¹⁷ Rates of mental health care use for the entire Army and Marine population have shown linear increases over time since 2000, providing further evidence that the war is burdening the health care system at large. These findings highlight the challenges in assuring that staffing levels of mental health services are sufficient to meet the needs of returning veterans.

This article also provides important findings about the US military's deployment mental health screening effort. A recent commentary questioned the utility of mass population-level screening for deployment mental health concerns.¹⁰ The screening techniques for mental disorders included on the PDHA combine scales adapted from primary care settings but were not yet validated as a useful tool at a mass-population level for assessment of mental health problems resulting from exposure to war. The findings from this article support the construct validity of the items included on this screen, particularly the strong linear relationships of mental health problems with deployment location and combat exposure.

In a recently published study of 1709 combat soldiers and Marines surveyed 3 to 4 months after returning from OIF deployment,⁹ investigators reported that 12% to 20% met screening criteria for PTSD, depending on what cutoff was used on the standardized instrument. This compares with 4.8% to 9.8% in this population-level screening using either 2 or 3 items out of the 4-item PTSD screen as a cutoff. Although the rates differed, these 2 studies showed highly comparable trends in the relationship of PTSD symptoms with deployment location and combat experiences. There are several likely reasons for the differences in rates in these 2 studies, including the different scales used, whether the surveys included identifiers, and particularly differences in the timing of the surveys. A recent report indicated that service members are more than 2 times as likely to report mental health concerns 3 to 4 months after returning from deployment compared with reporting immediately on return,²³ and this has led to a decision to expand the scope of the current US military screening program to include a repeat measure at 90 to 180 days after deployment.²⁴

Although the findings from this article suggest that the individual mental health questions on the PDHA in-

Table 6. Attrition From Military Service After Post-Deployment Health Assessment by Mental Health Risk and Service*

Left Military Service	Mental Health Risk, No. (%)†		
	No	Yes	Total
Operation Iraqi Freedom, No. of service members‡	180 114	42 506	222 620
No	150 601 (83.6)	33 404 (78.6)	184 005 (82.7)
Yes within year, mo	29 513 (16.4)	9 102 (21.4)	38 615 (17.3)
<1	501 (0.3)	233 (0.5)	734 (0.3)
1-<3	3080 (1.7)	878 (2.1)	3958 (1.8)
3-<6	10 882 (6.0)	3 126 (7.4)	14 008 (6.3)
6-<12	15 050 (8.4)	4 865 (11.4)	19 915 (8.9)
Operation Enduring Freedom, No. of service members‡	14 475	1 843	16 318
No	12 630 (87.3)	1 459 (79.2)	14 089 (86.3)
Yes within year, mo	1 845 (12.8)	384 (20.8)	2 229 (13.7)
<1	39 (0.3)	17 (0.9)	56 (0.3)
1-<3	180 (1.2)	60 (3.3)	240 (1.5)
3-<6	535 (3.7)	112 (6.1)	647 (4.0)
6-<12	1 091 (7.5)	195 (10.6)	1 286 (7.9)
Other, No. of service members‡	59 433	5 534	64 967
No	50 938 (85.7)	4 262 (77.0)	55 200 (85.0)
Yes within year, mo	8 495 (14.3)	1 272 (23.0)	9 767 (15.0)
<1	512 (0.9)	107 (1.9)	619 (1.0)
1-<3	1 052 (1.8)	199 (3.6)	1 251 (1.9)
3-<6	2 599 (4.4)	343 (6.2)	2 942 (4.5)
6-<12	4 332 (7.3)	623 (11.3)	4 955 (7.6)

Abbreviations: CI, confidence interval; OR, odds ratio.

*Attrition is defined as leaving military service for any reason during 12-month follow-up.

†Post-Deployment Health Assessment Form DD2796 completed beginning May 1, 2003, through April 30, 2004. Mental health risk was defined as a positive response on any of the Post-Deployment Health Assessment mental health items as defined in the "Methods" section.

‡For attrition by mental health risk "Yes" vs "No" among Operation Iraqi Freedom, the OR was 1.39 (95% CI, 1.35-1.43); for Operation Enduring Freedom, 1.80 (95% CI, 1.59-2.04); and for those returning from other deployment locations, 1.79 (95% CI, 1.67-1.91). For attrition by deployment location, comparing Operation Iraqi Freedom with Operation Enduring Freedom, the OR was 1.33 (95% CI, 1.27-1.39) and comparing Operation Iraqi Freedom with other deployment locations, the OR was 1.19 (95% CI, 1.16-1.22).

strument had good construct validity, several findings highlight the problems with population screening, in which screening tools may have limited predictive value for individuals. The screening program appeared to have low sensitivity because only 7.6% of service members seen in mental health clinics in their first year after return from deployment were referred through the PDHA process. In addition, among OIF service members who reported mental health concerns on the PDHA, fewer than 20% were referred by the interviewing professional. Presumably, in many instances the symptoms were considered sufficiently mild to be managed conservatively either through routine primary care or through reevaluation at a later date. This suggests that the screening instrument applied immediately on return from deployment has low specificity and positive predictive value. Positive predictive value is highly dependent on the prevalence of the disorders, and the predictive value would be expected to be lower for screening tests applied on return from deployment compared with 3 to 4 months later.

Collectively these data suggest that the mental health portion of the PDHA screening provides an indicator of deployment-related mental health concerns on a population level but may have limited utility in predicting which individuals will use services, at least as the screening is being used now, immediately on return from deployment. One of the risks of any population-screening program is overburdening the medical system due to increased referrals,¹⁰ but in this case the majority of mental health care after return from deployment did not appear to be linked to the screening. The level of mental health care use after deployment was far above what would be predicted by the screening program. It will be important to see whether the repeat screening program being implemented 90 to 180 days after deployment, when the prevalence of mental health problems is likely to be higher, will result in a stronger relationship to mental health care utilization.

An encouraging finding is that 56% of OIF veterans and a similar percentage of veterans from other deployments who were referred to mental health care were documented to have received a mental health evaluation either in the primary care or specialty mental health care setting. This is somewhat higher than what has been reported in civilian studies,²⁵ and it is likely that the rate of utilization is higher because services may also be received through sources that are not captured in the clinic utilization data, such as chaplains, employee or family assistance programs, or during visits for other primary care health concerns.

In addition to the burden on the health care system, this study showed that reported mental health concerns on the postdeployment assessment were correlated with attrition from service. Studies conducted prior to OIF and OEF have documented that mental disorders are the leading medical correlate with attrition from military service.^{17,18,26} Findings in this study confirm that mental health problems associated with combat deployment also have important occupational effects. Although attrition included voluntary as well as involuntary reasons for separation, this definition has been validated in previous research as a general measure of the occupational impact of mental health problems.^{17,18,26} The attrition associated with high rates of mental health concerns and high use of services has important implications for projecting mental health needs in the Veterans Affairs health care system.

One important observation is that two thirds of service members who accessed mental health care did so within 2 months of returning home. This is encouraging in the context of current public health efforts to increase earlier identification and treatment of mental health problems.²⁷ However, it is not clear that utilization of services paralleled expected prevalence and need, based on studies that have shown increased rates of mental health problems 3 to 4 months after deployment.^{9,23} This suggests that

there are still considerable barriers to care, as also noted in a study that showed that more than 60% of veterans of the Iraq war who screened positive for PTSD, generalized anxiety, or depression did not seek treatment.⁹

There are limitations in using large administrative data systems to draw conclusions about the impact of combat deployment on mental health care utilization. Mental health problems treated in primary care settings may not be coded under the primary diagnosis, and service members may receive care from civilian professionals not connected with the military health care system. Thus, this study likely underestimates the total utilization of services for mental health problems. There are also limitations in not being able to examine utilization of services for specific diagnoses because much of the care in the military mental health care system is not coded under traditional mental disorder codes¹⁸ and clinicians may not always record all secondary diagnoses.

Despite these limitations, this study provides new data showing the strong relationship between combat duty and a variety of mental health outcomes and most importantly high mental health care utilization in the first year after deployment. The findings have important implications for estimating the level of mental health services that may be needed in military, Veterans Affairs, and civilian practice settings that care for returning veterans. Additional research is needed beyond a year after deployment to determine the long-term burden that this war will have on the mental health care system.

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Acquisition of data: Auchterlonie.

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REFERENCES

1. The Centers for Disease Control Vietnam Experience Study Group. Health status of Vietnam veterans, I: psychosocial characteristics. *JAMA*. 1988;259:2701-2707.
2. Helzer JE, Robins LN, McEvoy L. Post-traumatic stress disorder in the general population: findings of the Epidemiologic Catchment Area survey. *N Engl J Med*. 1987;317:1630-1634.
3. Jordan BK, Schlenger WE, Hough R, et al. Lifetime and current prevalence of specific psychiatric disorders among Vietnam veterans and controls. *Arch Gen Psychiatry*. 1991;48:207-215.
4. The Iowa Persian Gulf Study Group. Self-reported illness and health status among Gulf War veterans: a population-based study. *JAMA*. 1997;277:238-245.
5. Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry*. 1995;52:1048-1060.
6. Prigerson HG, Maciejewski PK, Rosenheck RA. Population attributable fractions of psychiatric disorders and behavioral outcomes associated with combat exposures among US men. *Am J Public Health*. 2002;92:59-63.
7. Prigerson HG, Maciejewski PK, Rosenheck RA. Combat trauma: trauma with highest risk of delayed onset and unresolved posttraumatic stress disorder symptoms, unemployment, and abuse among men. *J Nerv Ment Dis*. 2001;189:99-108.
8. 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;157:141-148.
9. Hoge CW, Castro CA, Messer SC, et al. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med*. 2004;351:13-22.
10. Rona RJ, Hyams KC, Wessely S. Screening for psychological illness in military personnel. *JAMA*. 2005;293:1257-1260.
11. US Department of Defense. Enhanced post-deployment health assessment process (DD Form 2796). Available at: http://www.pdhealth.mil/dcs/dd_form_2796.asp. Accessed December 10, 2005.
12. Rubertone MV, Brundage JF. The Defense Medical Surveillance System and the Department of Defense serum repository: glimpses of the future of public health surveillance. *Am J Public Health*. 2002;92:1900-1904.
13. Spitzer RL, Kroenke K, Williams JBW. Validation and utility of a self-report version of PRIME-MD: the PHQ Primary Care Study. *JAMA*. 1999;282:1737-1744.
14. Whooley MA, Avins AL, Miranda J, Browner WS. Case-finding instruments for depression: two questions are as good as many. *J Gen Intern Med*. 1997;12:439-445.
15. Kroenke K, Spitzer RL, Williams JBW. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care*. 2003;41:1284-1292.
16. Prins A, Ouimette P, Kimerling R, et al. The Primary Care PTSD Screen (PC-PTSD): development and operating characteristics. *Prim Care Psychiatry*. 2004;9:9-14.
17. Hoge CW, Lesikar SE, Guevara R, et al. Mental disorders among US military personnel in the 1990's: association with high levels of health care utilization and early military attrition. *Am J Psychiatry*. 2002;159:1576-1583.
18. Garvey-Wilson AL, Hoge CW, Messer SC, Lesikar SE, Eaton KM. Diagnoses in behavioral health clinics: impact on perceived burden of mental health. In: American Psychiatric Association. *Syllabus and Proceedings from the 2003 APA Annual Meeting*; May 17-22, 2003; 23.
19. Meyer GS, Krakauer H. Validity of Department of Defense standard inpatient data record for quality management and health services research. *Mil Med*. 1998;163:461-465.
20. Dlugosz LJ, Hocter WJ, Kaiser KS, et al. Risk factors for mental disorder hospitalization after the Persian Gulf War: US Armed Forces, June 1, 1991-September 30, 1993. *J Clin Epidemiol*. 1999;52:1267-1278.
21. Department of Health and Human Services. Code of federal regulations, title 45, public welfare: part 46: protection of human subjects. Available at: <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm>. Accessed December 8, 2005.
22. Medical tracking for members deployed overseas. 10 USC. Armed forces general military law, medical and dental care, Chapter 55, §1074f (1997).
23. Bliese PD, Wright KM, Adler AB, Thomas JL. *Validation of the 90 to 120 Day Short Form Psychological Screen (Research Report #2004-002)*. Heidelberg, Germany: US Army Medical Research Unit-Europe; 2004.
24. Winkenwerder W. Post-deployment health reassessment [memorandum]. Washington, DC: Department of Defense; March 10, 2005. HA Policy 05-011. Available at: <http://www.pdhealth.mil/dcs/pdhra.asp>. Accessed December 10, 2005.
25. Grunebaum M, Lubner P, Callahan M, Leon AC, Olfson M, Portera L. Predictors of missed appointments for psychiatric consultations in a primary care clinic. *Psychiatr Serv*. 1996;47:848-852.
26. Hoge CW, Toboni HE, Messer SC, Bell N, Amoros P, Orman DT. The occupational burden of mental disorders in the US military: psychiatric hospitalizations, involuntary separations, and disability. *Am J Psychiatry*. 2005;162:585-591.
27. New Freedom Commission on Mental Health. *Achieving the promise: transforming mental health care in America. Final report*. Rockville, Md: EPT Health and Human Services; 2003. Publication SMA-03-3832.