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Determinants of Utilization and Cost of VHA Care by OEF/OIF Veterans Screened for Mild Traumatic Brain Injury

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ABSTRACT Objective: To determine the demographic and service characteristics that differentially impact utilization and cost of Veterans Health Administration (VHA) services for Operation Enduring Freedom and Operation Iraq Freedom (OEF/OIF) Veterans screened or evaluated for traumatic brain injury (TBI). Setting: We examined Department of Defense (DoD) and VHA administrative records of OEF/OIF Veterans who were screened or evaluated for TBI. Participants: Our study population was OEF/OIF Veterans who separated from DoD in Fiscal Years 2003–2009 and who were screened or evaluated in VHA for TBI between October 2008 and July 2009. Design: We describe the demographics and service characteristics of separated Veterans and those who accessed the VHA. We report the cost of VHA utilization and estimate a probit regression model to assess determinants of VHA utilization and costs by OEF/OIF Veterans screened and evaluated for TBI by VHA. Results: Females and Veterans older than 37 years utilize VHA services more intensely. Across all services, the Reserve Components utilize health services more than the Active Components placing more demand on VHA for services. Conclusion: VHA utilization and costs is impacted by the demographic and service characteristics of Veterans. The variation in Veteran groups incurring higher costs and utilization indicates different usage patterns of VHA services by each group with implications for patient load as the DoD deploys higher numbers of females and the Reserve Components.

INTRODUCTION

The Armed Services, (Army, Navy, Marines, and Air Force) in the U.S. military have both an Active Component (AC) and Reserves/National Guard Components (RC). The federal government activated the RC at unprecedented levels during the engagements in Afghanistan and Iraq for Operation Enduring Freedom and Operation Iraq Freedom (OEF/OIF). Recent estimates of soldiers deployed in service of OEF/OIF indicate that nearly 40% of forces deployed to the theater of war were RC, with 87,525 serving on active duty on December 27, 2011.[1] Approximately 850,000 men and women from the RC have separated from active duty and have transitioned to civilian life since fiscal year (FY) 2003, joining the newest generation of Veterans.[2] As these Veterans are eligible for Veterans Health Administration (VHA) services, the goal of this study was to determine the demographic and service characteristics that differentially impact utilization and cost of Veterans screened or evaluated for TBI in VHA with special attention to RC and women.

The nation has relied heavily on the RCs since the end of the Cold War, with the latest activation for the engagements in and around Iraq and Afghanistan.[2] The National Defense Authorization Act for FY 2005 (P.L.108-375) implies that deployment of the RCs will continue at high rates, underscoring the importance of understanding postdeployment health and health care use patterns of this understudied population.[3]

Females have been actively involved in higher numbers than ever before in military deployments. Under the direct ground combat exclusion assignment rule implemented in

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1994, the Department of Defense (DoD) can assign personnel to all positions for which they are qualified in support units, except that women shall be excluded from assignment to combat units whose primary mission is to engage in direct combat on the ground. OEF/OIF are the first major military engagements necessitating a large number of ground troops since the implementation of the direct ground combat exclusion policy. These engagements are characterized by poorly defined forward and rear battlefield areas resulting in the exposure of women in support units to direct combat.[3,4] Females have comprised 10% to 20% of deployed personnel at different points in time during the current conflicts, and the number of women discharged from the military since 9/11 constitute 21% of all living women Veterans. Since 2003, there have been more than 283,000 deployed female personl, and as of February 2012, more than 20,000 have been deployed. Women have comprised 14.4% of the active duty forces, and 16.9% of those serving in the National Guard (NG) and RC, as of September 30, 2009.[5–9] As women are among the fastest growing demographic of Veterans, it is critical to identify the health care use patterns and costs of this increasing population[10] so that health care organizations, including VHA, a historically male institution, can meet their needs.

Since 2000, there have been nearly 300,000 traumatic brain injuries (TBIs) diagnosed in U.S. service members around the world. Approximately 80% of these TBIs have been mild[11] in severity. In theater, mild TBI can sometimes go undiagnosed, or have a delayed diagnosis, for multiple reasons, including service member reluctance to report medical injuries or mild TBI being overlooked for more apparent injuries that require immediate attention.[12,13] Veterans of OEF/OIF have an increased risk of battle wounds resulting from exposure to explosive mechanisms such as blasts from mines, improvised explosive devices, or roadside bombs.[14] As a result of blasts,[15] the Veterans of OEF/OIF have sustained a greater proportion of injuries to the head and neck than Veterans of previous conflicts.[16] Blast-related TBIs occur in addition to concussions by more traditional means, such as motor vehicle accidents and other blunt trauma, making TBI one of the defining injuries of OEF/OIF. Studies from the Department of Veterans Affairs (VA),[17] the Rand Corporation,[18] and the Army[19,20] have estimated that 7% to 23% of those who served in OEF/OIF have either probable or clinician-confirmed TBI.

Although deployment-related TBI is less commonly experienced by women than men, available data suggest that approximately 11% of female OEF/OIF Veterans have experienced probable TBI.[17] Moreover, mental and physical health symptoms among women Veterans with deployment-related TBI, such as memory or sleep problems, headaches, anxiety, and depression, have been significant.[21]

VHA policy is to use its national electronic medical record system for clinical reminders to provide a TBI screening to all OEF/OIF Veterans receiving VHA medical care.[22] The screen, which can be performed by any provider, consists of four sequential sets of questions concerning (1) exposure to events that may increase risk of TBI, (2) symptoms that occurred immediately after the event, (3) new symptoms or symptoms that worsened after the event, and (4) current symptoms. Veterans who respond positively to one or more problems in each of the four sections are considered to screen positive for TBI. The VA screening tool has high sensitivity and moderate specificity,[23] and is intended to be inclusive to avoid any potential unidentified cases of TBI. Thus, it is policy for those who screen positive to be offered a referral to a comprehensive TBI evaluation (CTBIE), to be performed within 30 days of a positive TBI screen,[22] so that a clinician with TBI expertise may provide a more thorough assessment.

The CTBIE involves a medical examination, and the evaluating clinician follows a protocol to document deployment experiences, such as type and number of potential TBI-related events and injuries. The evaluation includes completion of the 22-item Neurobehavioral Symptom Inventory,[24,25] for which the patient rates the extent to which he or she has been affected by various health symptoms (e.g., problems with irritability, memory, headaches, feeling dizzy) within the last 30 days. The clinician also documents any suspected/probable symptoms of psychiatric conditions. At the conclusion of the CTBIE, the clinician confirms or rules out a TBI diagnosis and makes appropriate recommendations for follow-up care (Fig. 1).

To the extent the authors were able to ascertain, this study is the first national assessment designed to understand the demographics and utilization of VHA services by the AC and RC, with special attention to gender. The study provides a glimpse at the TBI screening and evaluation processes for RCs in general and female Veterans in particular in relation to utilization and costs incurred by the VHA in providing health care to the population of separated OEF/OIF Veterans. The intent of the study is to use results of the VHA screening and evaluation process to identify VHA utilization for OEF/OIF Veterans by service branch (Air Force, Army, Navy, and Marine), component (NG and RC), gender, rank, and age to understand the utilization patterns and costs incurred by VHA in providing care to each group. Specifically, with particular attention to gender, this study uses data from both VHA and DoD to (1) identify the demographics and service characteristics of OEF/OIF Veterans accessing VHA who have been screened for TBI, (2) understand demographics and service characteristics of Veterans with positive screens for TBI who receive a CTBIE, (3) compute average costs of utilization by services and component for Veterans who were screened or evaluated for TBI, and (4) identify determinants and costs of VHA utilization by Veterans.

METHODS

Study Population

The population for this study is the cohort that includes individuals screened for TBI in VHA between October 1, 2007

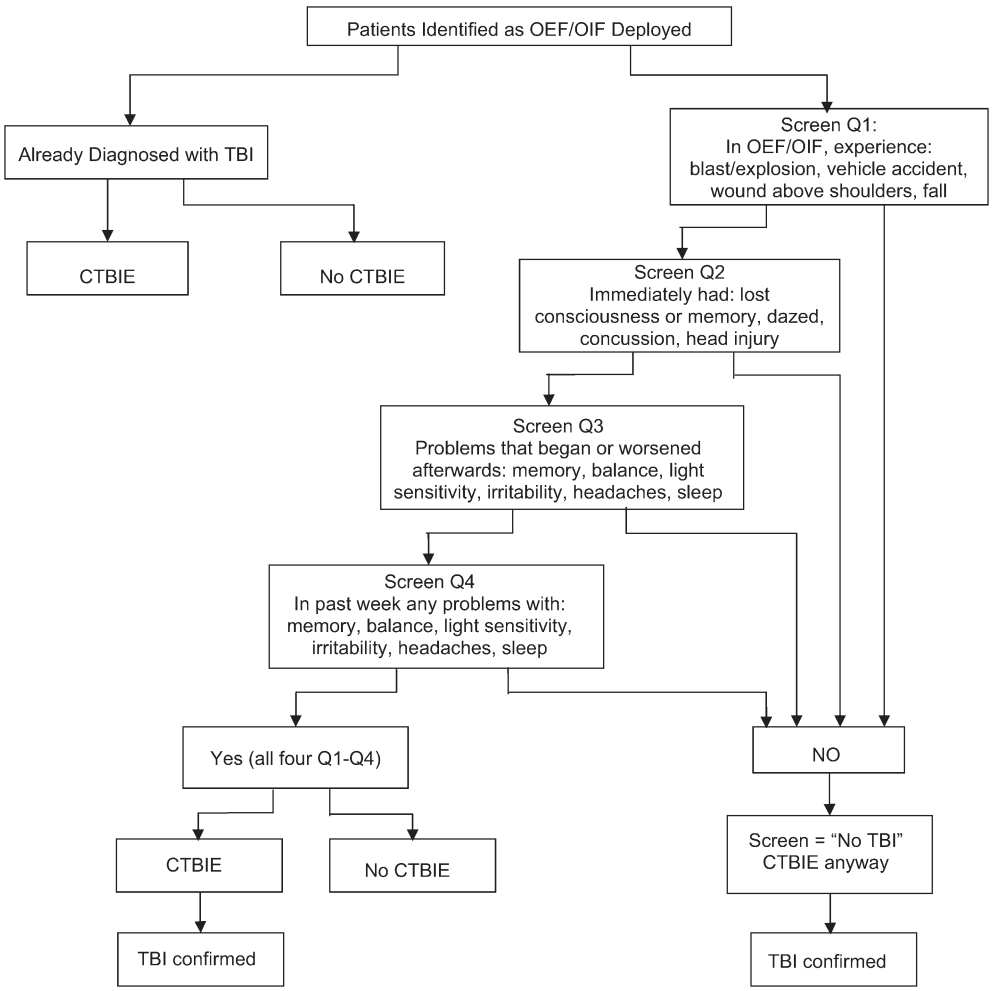

FIGURE 1. VHA TBI screening process.

and March 31, 2009. This sample, with a high degree of confidence, represents the Veterans who served in OEF/OIF and have accessed VHA medical care during those 18 months. This is the first cohort undergoing TBI screening and CTBIE for whom VHA electronic records exist. Since the median number of days in FY 2008–FY 2009 between TBI screening and CTBIE was 38 and the mean was 103, we evaluated CTBIE records through July 31, 2009 to allow up to 120 days for the occurrence of a postscreen CTBIE. We compared characteristics of this study cohort to the population of all service members who separated from DoD between fiscal year FY 2003 and FY 2009 to show how our sample compares to the entire separated OEF/OIF population.

Data Sources

This study includes all service members who separated from duty between FY 2003, which marks the 2-year period of eligibility for VHA services since the commencement of OEF in 2001, and FY 2009, the date the study began. In addition, the study includes all VHA patients with a TBI screening captured in the VA National Patient Care Database patient treatment files from FY 2008 through FY 2009. The study identifies patients who completed a CTBIE during FY 2008–FY 2009. Patients' gender, age, marital status, VHA inpatient and outpatient services, and estimates of VHA costs for utilization in FY 2008 came from VHA data files. Estimates of patient costs were obtained from the VA's Health Economic Resource Center data files.[26,27] Number of separated personnel, military rank, service branch, and component are from the Defense Management Data Center, the Armed Forces archive of personnel data.

Statistical Methods

We first computed descriptive statistics that quantitatively describe and provide simple summaries and information about the data to compare the demographics of the cohort that separated from FY 2003–FY 2009 to the cohort that accessed VHA health care in FY 2008. Utilization and mean costs were compared across services and components for the cohort that was screened for TBI and received the CTBIE.

Finally, because our outcome is binary, we generated a probit model, a type of regression where the dependent variable can only take two values (binary), to understand the determinants of utilization and costs of VHA services for the different branches and components for Veterans who are screened for TBI and receive the CTBIE. Analyses were run using SAS software, version 9.1 (SAS Institute, Cary, North Carolina).

RESULTS

Table I presents the demographic data for all 2,022,717 DoD separations from FY 2003 to FY 2009, by service and component. Roughly 755,000 or 37% of Veterans who separated or retired from duty during this period had deployed to OEF/OIF. Approximately 42% (1,103,124) of separated Veterans were from the RC and 18% (409,524) of separated Veterans were female. Army personnel constituted a plurality (931,948 or 46%) of total separated service personnel; the Navy followed at 24% (546,032); the Air Force was at 17% (386,772); and the Marines, 12% (273,028). The Regular Air Force and Navy components had the highest percentages of married personnel at separation. Greater than 50% (678,621) of Marines and Army were less than 30 years old; approximately 40% (355,316) of the Air Force and Navy were less than 30 years old.

The Air Force had the highest (24%) proportion of females who separated, whereas the Marines had the lowest (5%). The highest absolute number of females separating from the military was from the Army (184,182) and the lowest number was from the Marines (16,343). This distribution of Veterans reflected the gender composition of the forces, with the highest percentage of females in the Air Force and the highest absolute numbers in the Army.

Exposure to combat would increase the potential for Veterans' eligibility for VHA services because of injury or disability, and OEF/OIF deployment can be considered a proxy for combat exposure. The total number of service personnel deployed, separated, and earning access to VA health care was 754,557 or 37% of the total separated for the period. The Army constituted 50% of all deployed personnel; Air Force was 14%; Navy was 24%; and Marines were 12%. The percentage of deployed Army to total Army was higher (40%) relative to Navy (37%), Marines (35%), and Air Force (32%). Army deployment numbers were higher in both absolute numbers and percentages: Absolute numbers and percentages for deployments were highest for the Army (375,465 and 50%), followed by the Navy as a distant second, with 178,590 deployed at 24% of total deployment.

TABLE I. Demographics—Population is All Those Separated FY 2003–FY 2009

	Service and Component									
Characteristics	Air Force NG	Air Force Active	Air Force Reserve	Army NG	Army Active	Army Reserve	Marines Active	Marines Reserve	Navy/CG Active	Navy/CG Reserve
Total Separations (*n*)	16,031	237,704	97,521	172,756	508,497	250,695	106,494	144,086	319,313	168,300
OEF/OIF Deployment (*n*)	4,427	86,147	22,059	51,570	263,153	60,742	36,020	51,838	133,188	45,402
Marital Status (%)[a]										
Married	42.1	58	49.4	37.7	48.7	35.4	42.9	38.7	54	40.4
Never Married	49.4	34.5	31.7	56.4	46.2	59	52.6	57.1	45.2	48.3
Gender (%)[b]										
Female	23.2	22.2	27.2	18.2	18.6	23.2	7.5	5.8	15	20.4
Education (Premilitary) (%)										
<HS Graduate	2.1	0.1	0.42	14.7	0.9	5.3	0.3	0.3	1.8	3.4
HS Graduate	26.8	58.7	70.1	62.6	66.4	72.7	88.4	92.7	74.9	72.5
HS Graduate+	57.8	15.1	9.2	9.7	6.5	6.3	2.3	2.4	4.6	6.8
College Graduate	4.6	11.6	12.4	6.3	9	6.5	4.7	3.6	6.3	8.2
College Graduate+	1	12	6.5	1.4	4.2	1.2	2	0.4	2.1	2.3
Rank (%)[c]										
Enlisted	97.8	83.4	83.4	96.8	90.8	95.9	94.2	98	91.2	89.8
Years of Military Service (%)										
0–3	1.8	27.1	1.1	45	46.6	63.5	54.8	29.5	34.5	34.6
4–7	1.7	23.8	3.9	14.1	25.9	21.5	13.2	67.5	15.7	56.1
8+	2.6	48.8	1.1	4.2	27.2	2.9	31.7	2	49.4	8.1
Unknown	94	0.4	93.9	36.7	0.4	12.1	0.3	1	0.5	1.3
Age (%)[d]										
25 or Younger	17.2	22.8	4	31.8	31.4	8.6	42.1	11	22.2	5.1
26–30	22.2	19	34.7	22.1	29.2	36.1	24.9	54.2	24.5	32.2
31–36	26.5	9.6	31.7	19.5	16.4	33.7	13.3	29.1	16.8	32.3
37 or Older	34.1	33.6	29.3	26.6	23	21.2	19.7	5.1	36.3	30.2

[a]Balance is for widowed, divorced, separated, unknown, or interpretable data. [b]Balance is female. [c]Balance is officers/warrant officers. [d]Balance is unknown.

Table I also provides details for each component of the services, the NG and RC. The RC of the Army (45%) and Marines (58%) constituted a high percentage of separations for these services. These components were approximately 32% of the separations for the Air Force and 35% for the Navy. The separated RC of all the services tended to be older than 30 years, and on average older than the AC on separation.

The demographics for the population screened or evaluated for TBI when accessing VHA care are presented in Table II. Approximately 330,000 personnel were screened or evaluated for TBI. Army Veterans constituted a higher percentage of people screened and evaluated for TBI (64%) than their percentage representation in the separation demographics (46%). Percentages of Marines screened and evaluated were about the same as the percentage for the separated cohort. Navy and Air Force were screened at lower percentages as their separated cohorts. A higher percentage of married people were screened across the services. Females screened at significantly lower rates for the Army and lower rates across the other services and their RC. The lower female rates may be due to the fact that females were not placed in direct combat because of the direct combat assignment rule but may be indirectly exposed to combat in the course of their duty, thus, potentially lowering their exposure.[28] In January 2013, then Secretary of Defense Leon Panetta announced that the DoD would rescind the policy that had excluded women from serving in direct ground combat positions. It is unclear what the effect on women will be as the military services review about 53,000 positions in combat units and 184,000 specialty positions that had been previously closed to women. Air Force AC were screened or evaluated for TBI at 22% of Air Force personnel deployed and 8% of total Air Force personnel separated from FY 2003–FY 2009; Army at 32% of deployed and 17% of separated from FY 2003–FY 2009; Marines at 28% of deployed and 10% of separated from FY 2003–FY 2009; and Navy at 17% of deployed and 7% of separated from FY 2003–FY 2009.

Since the RC can be mobilized and then demobilized, a calculation of percentages for those screened and evaluated to separated and deployed is not relevant to the current study since they are probably not a fixed cohort of separations. Air Force RC screened and evaluated are a very small percentage of the total number of Veterans screened and evaluated with the Air Force NG at 1% and RC at 2%; Army NG represent 22% and RC 16%; Marines RC 11% and the Navy RC 6%. It is not clear if the difference between RC and AC reflects a difference in the role that the RC have in combat or the possibility that the RC access health care service outside of the VHA and thus are not as likely to be subjected to the automatic screen.[22]

The mean age of Veterans who were screened and evaluated for TBI at the VHA differs by service and component. The youngest cohort is the Marine RC at 26.5 years. In addition, the Marine RC average age was less than that of the Active Marine component (31.8 years). The Navy RC average age was also less than the Navy Regular component. However, the Air Force and Army AC average age is lower than their RC.

TABLE II. Demographics—Population is All Those Who Are Screened or evaluated (CTBIE) for TBI From October 1, 2007 to July 31, 2009

	Service and Component									
Characteristics	Air Force NG	Air Force Active	Air Force Reserve	Army NG	Army Active	Army Reserve	Marines Active	Marines Reserve	Navy/CG Active	Navy/CG Reserve
N	4,031	18,706	7,576	71,921	84,601	53,432	10,260	36,137	22,041	20,950
Marital Status (%)										
W/D/S	13.6	15.9	16.7	12.6	15.6	13.9	15.4	9.8	16.9	15.2
Married	56.8	48.6	48.5	52.3	45.5	49.7	49.9	31	51.5	38.2
Never Married	29.5	28.6	33.3	34.7	35.9	35.8	32	58.4	28	45.8
Unknown	0.1	6.9	1.6	0.4	2.9	0.6	2.7	0.8	3.7	0.8
Gender (%)										
Male	86.2	79	80.9	90.7	87.1	84.1	96.2	96.4	84.8	83.3
Female	13.8	20.9	19.1	9.3	12.9	15.9	3.8	3.6	15.2	16.7
Mean Age (2008)										
Age	39.3	35.3	38	34.9	31.2	36.3	31.8	26.5	36.7	32.1
SD	11	9.3	11.6	10.1	8	10.6	8.3	4.2	9	8.6
Education (Premilitary) (%)										
<HS Graduate	0.3	0.1	0.2	2	3.1	3.8	2.3	2.1	3.7	3.6
HS Graduate	5.2	59.8	67.5	58.8	63.5	59.2	79.5	90.6	74.7	77
HS Graduate+	63.4	20.7	13	15.8	6.4	11.1	3.5	2.8	5.9	7.8
College Graduate	9.5	9.8	7.3	9.2	7.2	11	5.2	3.2	6.2	6.1
College Graduate+	2.8	7.9	3	1.9	2.2	3.9	1.7	0.4	1.4	1.1
Unknown	18.7	1.7	8.9	12.2	17.6	11	7.8	1	8	4.4
Rank (%)										
Enlisted	91.2	89.7	93.9	93.2	93.4	89.8	93.1	98.2	93.1	95.8
Officer	8.8	10.3	6.1	6.8	6.6	10.2	6.9	1.8	6.9	4.2

TABLE III. VHA Utilization by Services and Component—for Veterans Who Were Screened or Evaluated (CTBIE) for TBI FY 2008

	Service and Component									
Measure of Utilization	Air Force NG	Air Force Active	Air Force Reserve	Army NG	Army Active	Army Reserve	Marines Active	Marines Reserve	Navy/CG Active	Navy/CG Reserve
Inpatient										
Percentage With VA IP Days	2.6	2.7	2.4	3.1	4.3	3.4	5.1	2.8	3.4	2.6
Mean IP Days (If > 0)	15.2	20.6	19.6	21.4	29.3	24	32.8	25.1	27.5	21.5
Mean Budget Amount ($)	15,160	17,609	14,606	16,374	23,150	17,380	29,096	17,545	22,543	17,051
Outpatient										
Percentage With VA OP Days	67.6	73.6	75.3	73	73.3	78	73.9	69.8	74.4	67
Mean OP Days (If > 0)	8.3	8.2	8.8	9.4	10.3	9.9	10.8	8.2	9.4	8.1
Mean Budget Amount ($)	2,459	2,670	2,553	2,903	3,158	2,949	3,327	2,508	2,911	2,468

Table III presents the utilization rates for inpatient care, outpatient care, and average costs incurred by Veterans at VHA for FY 2008. The data indicate that a significant percentage of Veterans who were screened and evaluated for TBI utilized VHA services. However, Veterans from the Army and Marines AC had the highest percentages of inpatient VHA care for FY 2008 (4.3% and 5.1%). They also incurred the highest average costs for both inpatient and outpatient care among those who received any care. Army AC average costs for those who used the care were $23,150 for inpatient care and $3,158 for outpatient care; Marines' inpatient costs for the same year were $29,096 and outpatient costs, $3,327. Interestingly, Air Force and Army RC had the highest number of days of clinic visits, 75.3 days and 78 days, respectively. This pattern suggests repeated visits for rehabilitation, tests, or some other type of recurrent care. Average costs for the RC outpatient care were still lower than the costs incurred by the AC. Air Force AC had the lowest utilization and costs for all the services examined here, and Air Force RC had the lowest utilization among all the RC. This may indicate that the patterns and purpose of usage of VHA services may vary between the different components. In addition, the deployment patterns and age of the Veterans in each component may influence their VHA utilization patterns.

Table IV presents results from a probit regression in terms of percentages by determinants of costs incurred at VHA by four categories: overall costs that include any and every cost incurred by Veterans at VHA (i.e., inpatient, outpatient, pharmacy costs); outpatient costs for all outpatient clinic visits, including laboratory tests, etc; costs for acute (medical or surgical) inpatient care in a VHA hospital; and nonacute costs that include nursing home costs, rehabilitation care, and inpatient stays for psychiatric or substance use disorders. Females incurred higher overall and outpatient costs with respect to the male reference group and lower acute and nonacute inpatient costs, potentially indicating different patterns of VHA services utilization between the females and males. Costs incurred by

TABLE IV. Determinants of VHA Health Service Cost by Veterans Screened or Evaluated (CTBIE) for TBI FY 2008

	Overall $N = 319454$ β (SE)	Outpatient $N = 319215$ β (SE)	Acute Inpatient $N = 6910$ β (SE)	Nonacute Inpatient $N = 9162$ β (SE)
Female—Reference is Male	0.143* (0.006)	0.162* (0.006)	–0.071** (0.033)	–0.102** (0.041)
Age—Reference is 26–30				
<25	0.001 (0.008)	–0.026* (0.008)	0.024 (0.044)	–0.171*** (0.038)
31–36	0.069* (0.007)	0.063* (0.007)	–0.001 (0.040)	0.057 (0.040)
>37	0.272* (0.008)	0.264* (0.007)	0.092** (0.041)	0.125* (0.043)
Service Component—Reference Army Active				
Air Force Active	–0.000744	–0.085* (0.008)	–0.047 (0.053)	–0.013454
Air Force NG	–0.026 (0.035)	–0.029 (0.033)	–0.019 (0.055)	–0.08272
Air Force Reserve	–0.00468	–0.004104	–0.039 (0.105)	–0.0445
Army NG	0.005 (0.010)	0.008 (0.009)	0.045 (0.049)	–0.007144
Army Reserve	–0.001584	–0.00132	–0.056 (0.047)	–0.055 (0.048)
Marines Active	0.072* (0.0123)	0.058* (0.012)	–0.028 (0.069)	0.144** (0.063)
Marines Reserve	–0.00235	–0.00224	–0.058 (0.060)	–0.139** (0.058)
Navy Active	–0.000288	–0.000512	0.001 (0.043)	–0.00845
Navy Reserve	–0.003157	–0.0028	–0.019 (0.055)	–0.130** (0.065)
Officer—Reference Enlisted	–0.001573	–0.001265	–0.083 (0.085)	0.206** (0.110)
Years of Service—Reference 0–3				
4–7	–0.000228	–0.011*** (0.006)	–0.013 (0.034)	0.076* (0.033)
8+	–0.001602	–0.000984	–0.082 (0.045)	0.0871*** (0.049)
Unknown	–0.002192	–0.00189	–0.069 (0.080)	0.222* (0.081)

***$p < 0.1$; **$p < 0.05$; *$p < 0.01$.

Veterans older than 37 are higher in every category than all other age groups and the reference group. Officers had substantially higher costs than enlisted personnel in the nonacute inpatient category, and lower costs in all other categories.

An examination of service components indicated higher costs incurred by the reference group, Army AC, compared to all other service groups. For overall and outpatient costs incurred, Marine AC was the only component with a positive and significant coefficient, indicating higher costs. The Army NG had a positive but nonsignificant coefficient, indicating no difference in costs with the Army AC, and the remaining components had significant negative coefficients, indicating lower costs compared to the Army AC. In the costs incurred for acute inpatient care, none of the components had a significant coefficient, and all coefficients were negative except for Army NG and Navy Active. For nonacute inpatient costs, all coefficients were significant, but only the Marine AC coefficient was positive.

Table V presents a probit regression analysis in term of percentages of demographic and component determinants of VHA utilization (either inpatient or outpatient) by Veterans screened for TBI and who completed a CTBIE in FY 2008. The data are presented in terms of coefficients that quantify how strong the association is with the reference group listed before each set of data.

The number of Veterans utilizing VHA after being screened or evaluated is 113,907 in FY 2008. The coefficient for females utilizing the VHA compared to males is significant and positive, indicating higher utilization by females. Females are 14% more likely than males to utilize VHA if they are screened and evaluated for TBI, controlling for age and other characteristics. Utilization of VHA services was higher as the age of the Veteran increased. Veterans less than 25 years old had less utilization than the reference group (26 to 30 years old). Veterans between the ages of 31 to36 and older than 37 had higher utilization than the reference group. Officers, compared to the enlisted as a control group, had lower utilization of VHA than the enlisted (reference group).

Air Force, Army, Marines, and Navy RC (with Army AC as reference group) had higher utilization of VHA services than Army AC. Army NG had higher utilization than the reference group. All RCs had higher ratios than their corresponding AC. The only exception was the ratio for Air Force NG, which was not significant.

TABLE V. Determinants of VHA Health Service Utilization by Veterans Screened and Evaluated (CTBIE) for TBI FY 2008

	N = 113907 β (SE)
Female—Reference is Male	0.143* (0.011)
Age—Reference is 26–30	
25 or Less	–0.00257
3 1–36	0.118* (0.011)
37 or Over	0.206* (0.012)
Officer—Reference Enlisted	–0.00132
Years of Service—Reference 0–3	
4–7	–0.000702
8+	–0.001937
Unknown	–0.025 (0.026)
Service Component—Reference Army Active	
Air Force Active	0.058* (0.013)
Air Force NG	0.003 (0.049)
Air Force Reserve	0.117* (0.034)
Army NG	0.167* (0.014)
Army Reserve	0.164* (0.013)
Marines Active	0.017 (0.017)
Marines Reserve	0.215* (0.014)
Navy Active	–0.014 (0.013)
Navy Reserve	0.096* (0.017)

***$p < 0.1$; **$p < 0.05$; *$p < 0.01$.

DISCUSSION

Of over 2 million service personnel who separated from DoD between FY 2003 and FY 2009, 37% were deployed in support of OEF/OIF who were likely eligible for accessing VHA services after separation. A consistent picture emerged regarding the AC and RC for the Army. They contributed to the highest percentages of those who separated from DoD; were deployed to OEF/OIF; and, as Veterans, accessed VHA and received TBI screening and evaluation. In addition, their absolute numbers overwhelmed the numbers from other branches of the Armed Forces. Regarding costs incurred in utilizing VHA services for Veterans screened and evaluated for TBI, on average, Army and Marines AC and RC incurred the highest inpatient and outpatient costs. The fact that we observed the highest cost among Army and Marines (controlling for other factors) is not surprising and likely reflects increased psychological and medical health care needs related to a higher level of direct combat exposure.

RC had higher utilization of VHA services than AC, but incurred lower mean costs and lower determinants of cost. A possible explanation for the seeming contradiction may be that Reservists have ongoing concerns about being granted continued access to VHA services. Utilizing VHA and establishing a record of utilization may be a means of ensuring future access to VHA. In addition, the RC may be accessing VHA services before transitioning back to their civilian jobs where they may receive services from private insurance carriers. The final group with high utilization of services and costs across all categories was Veterans older than 37 years. Interestingly, the average age for the RC tended to be higher than that of the AC for each service. Elevated utilization and costs may reflect health issues of aging Veterans and their increased need for health care.

We find that following a CTBIE, being a female OEF/OIF Veteran was strongly associated with increased utilization of VHA services. These gender differences are consistent with patterns of VHA services use that have been documented among the general VHA patient population.[10,29] In contrast to males who incurred higher inpatient costs, female Veterans incurred higher overall and outpatient VHA costs. This may be the result of females utilizing VHA for different services

than their male counterparts. For example, female VHA patients have been shown to use more primary and mental health care services than male VHA patient.[10,29] Similarly, service utilization may be higher because females may present to CTBIE with more complex clinical profiles than males. Research indicates that females with confirmed TBI are more likely to have comorbid mental health diagnoses (e.g., PTSD with depression) as well as more neurobehavioral symptoms than their male counterparts,[21] which may impact the types and amounts of services received subsequent to a CTBIE. Regardless of the exact reasons, there is a clear indication that there are gender differences in the types and amount of services used.[20] This is an important area for more nuanced inquiry in future research efforts.

This study had several strengths, especially because its population included all service members from all military services and components who separated from DoD, thus providing a complete summary of potential differences in TBI health care needs related to military duties. In addition, it allowed us to capture differences in demographics and probable combat exposure. The participants in the study provided a good overview of DoD separations and of Veterans accessing VHA at a critical time when the pace for military operations has increased rapidly.[27] This allows for generalizations across both DoD and VHA to enable estimates of costs and health care needs for future operations and generations of Veterans. The study focus on OEF/OIF comes at a time following DoD policy changes in deployment and increased utilization of the RC and females, and may facilitate planning for Veteran care across the two institutions charged with their care. Finally, comparison between this study and prior work is difficult because of the differences in methodology since the units of analysis for this study do not depend on a survey or questionnaire where response, completion, recall errors, information biases, and follow-up rates are issues.[28,29]

The study was limited in that the separation data for the RC is only a single time point of assessment, and additional reactivation and deployments cannot be determined.[30,31] An additional limitation is the absence of a measure of symptom incidence and severity. Thus, we are not able to comment on particular symptom and health profiles of Veterans, and the extent to which utilization is associated with diagnoses. There is ongoing discussion about, in the absence of medical documentation, the extent to which the VA TBI screening and evaluation processes can accurately diagnose a TBI-related event that happened months to years before evaluation, and the degree to which TBI symptoms persist over time. This debate goes beyond the scope of this article. Lastly, since the RC may have access to health care options other than VHA, there may be other factors that determine their selection of VHA services.

Data used in this study does not allow an assessment of combat exposure and intensity. It is important that future research incorporate information about deployment locations and occupation and assignment information to understand geographical and occupational factors that affect cost and utilization patterns of health care. This is particularly true for understanding changes in women's health needs and health care utilization following changes in policy that now allow women to serve in combat roles. In addition, the potential for multiple deployments for the RC raise important questions about cumulative effects of repeated and prolonged deployments on demand for health care. This research could have significant implications for policymakers and clinicians as they seek to formulate and refine policies and health care for RC given their increasing numbers and expanded role in supporting military operations. In addition, the study does not account for terms of service to provide a level of granularity to fully access the implications to the VHA. Finally, differences in health care needs between service components and genders highlight the importance of targeting subgroups of Veterans to improve health care interventions and create opportunities for directed incremental health reform.

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