

Prevalence and Costs of Co-Occurring Traumatic Brain Injury with and without Psychiatric Disturbance and Pain among Afghanistan and Iraq War Veteran VA Users

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ABSTRACT:

Background: Traumatic Brain Injury (TBI) is the “signature injury” in the Afghanistan and Iraq Wars (OEF/OIF). Patients with combat-related TBI also have high rates of psychiatric disturbances and pain.

Objectives: Determine the prevalence of TBI alone and TBI with other conditions and the average cost of medical care for veterans with these diagnoses.

Methods: Observational study using national inpatient, outpatient and pharmacy data from Veterans Health Administration (VHA) datasets. Costs are estimated from utilization related to care within the VHA system. Participants were all OEF/OIF VHA users in 2009.

Results: Among 327,388 OEF/OIF veterans utilizing VHA services in 2009, 6.7% were diagnosed with TBI. Among those with TBI diagnoses, 89% were diagnosed with a psychiatric diagnosis (the most frequent being PTSD at 73%), and 70% had a diagnosis of head, back or neck pain. The rate of comorbid PTSD and pain among those with and without TBI was 54% and 11%, respectively. The median annual cost-per-patient was nearly four-times higher for TBI-diagnosed veterans as compared to those without TBI (\$5,831 versus \$1,547). Within the TBI group, cost increased as diagnostic complexity increased, such that those with TBI, pain and PTSD demonstrated the highest median cost per patient (\$7,974).

Conclusion: The vast majority of VHA patients diagnosed with TBI also have a diagnosed mental disorder and more than half have both PTSD and pain. Patients with these comorbidities incur substantial medical costs and represent a target population for future research aimed at improving health care efficiency.

INTRODUCTION:

Over two million United States (US) service members have been deployed at least once to Afghanistan or Iraq war zones since 2002, 57% of whom have since discharged from the military and assumed veteran status. Approximately half of these veterans have accessed services through the US Department of Veterans Affairs (VA), Veterans Health Administration (VHA), making the VA the single largest provider of healthcare services to US Afghanistan and Iraq veterans. Because information on VA patients' service utilization is stored in national databases, VA data from across the US can be summarized to better understand the healthcare needs and demands of various veteran populations, including that of Afghanistan and Iraq war veterans. Similar to veterans of previous wars,^{1,2} Afghanistan and Iraq war veterans carry a high burden of mental disorders, with Posttraumatic Stress Disorder (PTSD) being the most common.³⁻⁵ Veterans of the current wars have also experienced increased exposure to explosive munitions, such as improvised explosive devices, that can cause physical injury to multiple body systems or organs, including the brain.^{6,7} Just as in civilian contexts, the vast majority of military related TBI is mild in severity. Survey findings suggest that 15% to 20% of those formerly deployed to Afghanistan and Iraq may have sustained mild TBI.^{8,9} Also not surprising given the nature of warfare, pain is another high frequency problem in Afghanistan and Iraq veterans who use VA services,¹⁰ including those with combat-related TBI.^{11,12}

There are important gaps in the scientific literature on deployment-related medical problems in Afghanistan and Iraq veterans. First, little is known about the rate of co-occurrence of TBI, psychiatric disorders and pain. The few notable exceptions are based on limited samples of one US region¹³ or one VA TBI/polytrauma clinic.¹⁴ These studies report high rates of comorbid

PTSD and pain in Afghanistan and Iraq veterans diagnosed with TBI but their generalizeability is questionable. Another important gap is lack of information in the peer reviewed literature on cost of medically treating deployment-related TBI. One study estimated lifetime costs of treating combat-related TBI and the associated loss in quality of life in OIF veterans.¹⁵ This study has been criticized for grossly overestimating the rate of severe TBI in the population.¹⁶ The other available study created estimates for 2005 using cost estimates based on civilian populations and did not examine costs of treating individuals with deployment-related TBI who have comorbidities.¹⁶ Information on the actual medical costs of TBI and high frequency comorbidities in Veterans returning from Afghanistan and Iraq is needed not only for resource allocation within the VA but also may lead to identification of high cost patient subgroups that can be further studied and possibly targeted for interventions or system wide improvements to reduce unnecessary costs.

To address these evidence gaps, we examined the prevalence and VA healthcare costs of clinician-diagnosed TBI with and without comorbid psychiatric disturbance (particularly focusing on PTSD) and pain among the Afghanistan and Iraq war veterans who received VA medical services in 2009.

METHODS:

Overview and Study Population

This observational study of Afghanistan and Iraq War veterans was conducted as part of a US VHA Quality Enhancement Research Initiative project to describe the prevalence of comorbidities and service utilization among veterans with TBI. The focus of this project was to provide a one year summary for fiscal year (FY) 2009 (October 1, 2008 to September 30, 2009). The study population consisted of all patients who used inpatient or outpatient care in VHA in FY2009. The institutional review board of the Minneapolis VA Health Care System approved the study, including a Health Insurance Portability and Accountability Act waiver of authorization.

Data Sources

Our cohort contains all Afghanistan and Iraq War veterans identified through the Decision Support Services (DSS) outpatient files as patients in FY2009. We then extracted all FY2009 demographic and eligibility data associated with the cohort from the Planning Services and Support Group annual enrollment file as well as urban/rural designation from the patient geocode file.¹⁷ Data from FY2009 National Patient Care Database patient treatment files and outpatient care files were used to identify which patients in our cohort have been diagnosed with various conditions, specifically TBI, PTSD, mental health and substance abuse disorders. Estimates of FY2009 patient costs were obtained from the VA's Health Economic Resource Center data files. These estimates of per patient average cost are based on hypothetical Medicare reimbursement levels.^{18,19}

We used International Classification of Diseases –9th Revision– Clinical Modification (ICD-9) codes used by VA for TBI surveillance: 310.2, 800-801.9, 803.0-804.9, 850.0-854.1, 905.0, 907.0, 950.1-950.3, 959.01, 959.9, V15.52.^{20,21} We excluded diagnosis codes only present on lab, radiology or telephone visits, since we believed these codes were less likely to be assigned by someone trained to appropriately diagnosis TBI.

We assessed diagnoses for Head,^{22,23} Neck²³ and Back Pain,^{22,23} as used previously. We also extracted ICD-9 codes for PTSD (309.81), Depression (296.2–296.35, 296.5–296.55, 296.9, 300.4, 311), Anxiety Disorder not PTSD (300.0x, 300.2x, 300.3x), Bipolar Disorder (296.00-296.16, 296.4x, 296.56, 296.6x, 296.8x), Psychoses (295.x, 297.x, 298.x), Substance Abuse not Nicotine Dependence (303.xx, 304.xx, 305.0, 305.2, 305.3, 305.4x, 305.5, 305.6, 305.7, 305.8, 305.9), and any Mental Health Disorder (codes: 290.0–319.0 except 310.2 “Post-Concussion Syndrome” and 305.1 “Tobacco Use Disorder”).

Statistical Methods –Descriptive statistics were calculated to compare demographic characteristics and co-occurring 2009 mental health and head, neck or back pain diagnoses by TBI diagnosis status. Average costs were compared across groups of veterans defined by different combinations of 2009 TBI, mental health and pain diagnoses. Average costs were reported as medians with the corresponding inter-quartile range.

RESULTS:

We identified 327,388 OEF/OIF veterans who used VHA services in 2009. The veterans were on average 35.3 years of age ($SD \pm 9.7$ years). Of these veterans, 6.7% received a TBI diagnosis at some point during the year (Table 1). Patients with a TBI diagnosis were on average slightly younger (32.9 vs. 35.5 years old) and more likely to be male (95% versus 87%) compared with patients without a TBI diagnosis. Also patients with a TBI diagnosis were slightly less likely to be a new user of VA services that year (29% vs. 31%).

Prevalence of Diagnoses

Diagnoses of mental health conditions, nicotine dependence and pain were frequently found in the overall OEF/OIF population of VHA users (Table 2), however all of these conditions were much more prevalent among veterans with a diagnosis of TBI compared to veterans without a TBI diagnosis. The biggest difference was the greater than four-fold increased prevalence of combined PTSD and pain diagnoses in veterans with TBI. This combination of diagnoses was actually found in the majority of veterans with a TBI diagnosis, 54% versus only 11% in veterans without a TBI diagnosis.

Average Costs

The median annual cost-per-patient was nearly four-times higher for TBI-diagnosed veterans as compared to those without TBI (\$5,831 versus \$1,547). Not surprisingly, as clinical complexity increased so too did the cost of medical care. Within the TBI group, increases in median costs were noted as diagnostic complexity increased (Table 3), such that those with TBI and pain (\$3,931) or TBI and PTSD (\$5,053) incurred more health-related costs than those with TBI alone (\$2,391). Those with TBI, pain and PTSD demonstrated the highest median cost per patient

(\$7,974). We also included average costs for veterans with a diagnosis of pain and/or PTSD, but not TBI for comparison.

DISCUSSION:

We found that in 2009, 22,053 (6.7%) of the 327,388 Afghanistan and Iraq war veterans who used VA health care carried a diagnosis of TBI. The 6.7% prevalence of TBI diagnosis in Afghanistan and Iraq veterans that we observed is smaller than that reported in survey studies.^{8,9} However, comparison between this study and prior work is limited by differences in methodology. Importantly, prior work was based on veteran or service member self-report in the contexts of written or telephone surveys.^{8,9} Clinical interview with a specialist is considered the gold standard for TBI diagnosis because of the difficulty obtaining accurate information on TBI history through brief self-report measures.^{24,25} Self-report measures, therefore, may overestimate the rate of TBI compared with clinical assessment just as they have been found to over-estimate the rate of PTSD relative to gold standard interviews.²⁶ On the other hand, clinical assessment is also subject to error and medical diagnoses may be underreported in VA records.²⁷ Additionally, some Afghanistan and Iraq war veterans who use VA may have TBI that has not been identified. VA policy requires that all Afghanistan and Iraq veterans are screened for deployment-related TBI and those who report trauma exposure with altered consciousness and peritraumatic and current neurobehavioral symptoms are referred for a comprehensive TBI evaluation.²⁸ The VA is currently reporting that about 95% of these veterans are successfully screened and that about 75% of those who screen positive undergo comprehensive evaluation.²⁹ TBI may be present in a proportion of those who have not been screened, those who screen negative because their symptoms have resolved, and those who screen positive but do not follow-up with a TBI

evaluation. In sum, while our findings describe the proportion of Afghanistan and Iraq war VA users with TBI diagnosis in 2009, they do not describe the actual prevalence of TBI in the population of all Afghanistan and Iraq war veterans.

Importantly, among those veterans with clinician diagnosed TBI, we find that mental health, particularly PTSD, and pain-related co-morbidity is the norm. The fact that we observed this pattern in this large national dataset consisting of all US Afghanistan and Iraq war veterans who used the VA confirms and extends prior research. A prior study of veterans screened for TBI in one US region found a similar rate of diagnosed mental disorders in veterans diagnosed with TBI after a positive screen.¹³ Further, studies based on small clinical samples seen in specialized TBI clinics have reported a high rate of TBI, pain and PTSD co-morbidity.^{13,14}

We observed not only that these patients are clinically complex, but also that their annual VA medical care is costly and that medical costs increased as clinical complexity increased. The median annual cost per patient for the 3.6% of the population of Afghanistan and Iraq war veterans with clinician diagnosed TBI, PTSD and pain who used VA in 2009 was eight times higher than the median annual costs per patient for the 53% who did not have any of these problems. The finding that a minority of the population accounts for the majority of the medical costs is not new. Nevertheless, the pattern of findings underscores the importance of targeting this subgroup of Veterans in future health services studies to determine whether interventions are needed to improve healthcare efficiency, as it has also long been known that using diagnoses to

identify high cost patients is an early step in creating interventions targeted toward improving case management.³⁰

There are limitations to this research. First, findings are based on administrative data and therefore may be biased by errors in documentation. Second, we did not have available information on diagnoses of the 54% of Afghanistan and Iraq war veterans from the US who did not use VA in 2009. Third, our average cost estimates are based only on estimates of VHA health care utilization and we do not provide estimates on the overall societal cost of TBI which would include patient, family or non-VHA service-related costs as well as non-health care-related costs such as reduced productivity. Last, we did not examine patterns of utilization that account for this increased costs or health outcomes, such future research is needed.

Conclusions:

Less than 7% of Afghanistan and Iraq war veterans who used the VA in 2009 carried a TBI diagnosis. However, among this group of patients with a TBI diagnosis, the vast majority also had a clinician-diagnosed mental disorder and approximately half of those with clinician diagnosed TBI had both PTSD and pain. Annual medical costs for veterans with TBI were four times greater than those without TBI and costs increased as clinical complexity increased.

Patients with these comorbidities incur substantial medical cost and represent a target population for future research aimed at improving health-care efficiency.

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Tables 1: Demographic Characteristics of Iraq/Afghanistan Veterans with and without TBI Diagnosis

	Total	TBI	No TBI
	N=327,388	N=22,053	N=305,335
Age (Mean)	35.3	32.9	35.5
Age (STDEV)	9.7	8.3	9.7
Male	88%	95%	87%
Race			
White	44%	43%	44%
Non-White	16%	12%	16%
Unavailable	40%	45%	40%
Ethnicity			
Hispanic	8%	8%	8%
Non-Hispanic	53%	47%	53%
Unavailable	40%	45%	39%
Urban/Rural			
Urban	59%	58%	59%
Rural	37%	39%	36%
Highly Rural	1%	1%	1%
Unavailable	4%	1%	4%
New VA User	31%	29%	31%

Table 2 Rate of Mental Health and Pain Diagnoses in Iraq/Afghanistan War Veterans with and without TBI

	Total	TBI	No TBI
	N=327,388	N=22,053	N=305,335
Diagnoses in FY2009			
Any Mental Health	42%	89%	39%
PTSD	28%	73%	24%
Depression	21%	45%	20%
Anxiety	11%	22%	10%
Bipolar Disorder	1%	2%	1%
Psychosis	1%	2%	1%
Substance Disorder	9%	20%	8%
Nicotine Dependence	15%	24%	14%
Any Head/Back/Neck Pain	33%	70%	30%
Headache	12%	47%	9%
Back Pain	25%	45%	23%
Neck Pain	6%	15%	5%
TBI-Memory Problems	1%	11%	<1%
Combined Diagnoses			
Mental Health and Any Pain	20%	64%	17%
PTSD and Any Pain	14%	54%	11%

Table 3. Average VHA Medical Costs for Iraq/Afghanistan War Veterans in 2009 by Diagnosis Group

ICD 9 Diagnoses	Proportion of OEF/OIF Veterans seen in VHA 2009	2009 VHA Median Costs (IQR)
No TBI, Pain or PTSD	52.7%	\$978 (\$439-\$2,074)
Pain	17.9%	\$1,974 (\$953-\$3,890)
PTSD	12.2%	\$2,763 (\$1,345-\$5,426)
Pain + PTSD	10.5%	\$4,978 (\$2,655-\$9,283)
TBI	0.7%	\$2,391 (\$1,112-\$4,770)
TBI + Pain	1.1%	\$3,931 (\$2,139-\$6,899)
TBI + PTSD	1.3%	\$5,053 (\$2,770-\$9,075)
TBI, Pain and PTSD	3.6%	\$7,974 (\$4,559-\$14,332)

VHA = Veterans Health Administration; IQR = Interquartile Range; TBI = Traumatic Brain Injury; PTSD = Posttraumatic Stress Disorder; OEF/OIF = Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom