

# Traumatic Brain Injuries: Unreported and Untreated in an Army Population

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**ABSTRACT** Introduction: In 2008, it was reported that 19.5% of service members previously deployed experienced a mild traumatic brain injury (mTBI). Fifty-seven percent of those did not seek medical care. It was suggested that concerns with seeking care involved confidentiality and career issues. Objective: This study addressed mTBI history, medical treatment history, and stigmas associated with mTBI/concussion. Materials and Methods: An anonymous questionnaire was developed. Data collection occurred throughout March 2018 in conjunction with Brain Injury Awareness Month activities. Results: All 5,174 volunteers were Army; 86% male; 87% were between 18 and 34 years old; 89% had <14 years in the military; 35% had a combat deployment; and 10% reported having one or more mTBIs in their military careers. Of the Soldiers who reported a concussion, 52% sought medical care. Of those not seeking care, 64% reported they did not think the injury required care, followed by 18% fearing negative impact on their career. Twenty-eight percent who experienced an mTBI versus 11% who have not reported that there is a stigma associated with an mTBI. Conclusions: Soldiers sometimes failed to report their suspected concussions and did not seek medical care. Educational efforts may increase reporting of and medical screening for potentially concussive events. Future research to determine the ramifications of unreported and untreated mTBIs/concussions is recommended.

## INTRODUCTION

The prevalent use of improvised explosive devices and the increased risk of blast exposure among U.S. service members in today's armed conflicts have made traumatic brain injury (TBI), a signature injury of the wars in Afghanistan and Iraq.<sup>1,2</sup> Soldiers not only receive TBIs in a deployed environment but also in nondeployed locations. A TBI is a blow or jolt to the head that disrupts the normal function of the brain. Included in the definition of a TBI is an alteration of consciousness in which a person may be knocked out briefly or for a longer time or feel confused or see flashes of light or stars. A TBI can be classified as mild, moderate, severe, or penetrating, which is determined at the time of injury.<sup>3</sup> From 2000 to the first quarter of 2018, there have been almost 400,000 diagnosed TBIs with 80% of these being classified as mild.<sup>4</sup> A mild TBI (mTBI) is also known as a concussion and historically has been underreported especially at the early years of the Iraq and Afghanistan wars.<sup>5</sup>

In 2008, the RAND Corporation Center for Military Health Policy Research's study found that 19.5% of ~1.64 million service members previously deployed to Operation Enduring Freedom and Operation Iraqi Freedom reported having experienced a probable TBI. Fifty-seven percent of the probable TBI cases reporting their brain injury had not been evaluated by a physician.<sup>6</sup> Because the study rolled posttraumatic stress disorder and depression with TBI, it was suggested that most of the concerns with seeking care centered on confidentiality issues as well as career issues pertaining to possible negative consequences.<sup>6</sup> In a 2014 study, Hyatt, Davis, and Barroso found that soldiers following combat deployment have indicated challenges to being diagnosed and receiving treatment for TBIs, such as mistrust with the military health care system and providers; absence of impaired function or awareness of TBI at time of injury; trouble navigating the military health care system; and challenges in finding access to specialty care with providers that know what options exist and how to refer soldiers.<sup>7</sup> An additional issue that impacts the culture for improving soldier health with TBI is the stigma within the military about seeking medical services and mental health treatment.<sup>7</sup> Therefore, it is possible that potential mTBIs are not reported for a variety of reasons, and if the injuries are not reported, they remain undocumented in the Military Health System and possibly untreated by medical personnel.

A prospective longitudinal study conducted from 2008 to 2013 at Landstuhl Regional Medical Center in Germany and two sites in Afghanistan found adverse clinical outcomes such as posttraumatic stress symptoms, depression, and neurobehavioral impairment 6 to 12 months after sustaining a mild concussive TBI in a substantial majority of U.S. military personnel injured in theater.<sup>8</sup> Another study found about 27% of the mTBI patients screened were found positive for post-

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Presented as a poster at the 2018 Military Health System Research Symposium, August 2018, Kissimmee, FL; abstract # MHSRS-18-0760

The views expressed herein are those of the author(s) and do not reflect the official policy of the Department of the Army, Department of Defense, or the U.S. Government

doi:10.1093/milmed/usz259

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traumatic stress disorder at 6 months post-injury.<sup>9</sup> Emotional symptoms such as depression and anxiety have been found in studies to be more prevalent a year or more after sustaining an mTBI.<sup>10,11</sup> There is a body of literature on mTBI, which suggests that even a single concussion may result in long-term brain changes, atrophy, and an increased risk of developing neurodegenerative diseases such as Alzheimer's and Parkinson's and dementia.<sup>12–17</sup> Not all studies support the risk factor connection between concussion and neurodegenerative diseases<sup>18–20</sup> (see Li et al., 2017 and Jafari et al., 2013 for reviews). Also, mTBI has been found to be associated with an increased risk of suicide attempt, suicide ideation, and suicide in both military and nonmilitary populations.<sup>21,22</sup>

Although previous research has not come to any definite conclusions about the short and long-term ramifications of concussions. The significance of this paper and study is determining if soldiers who believe they have experienced an mTBI/concussion are not reporting it and not seeking medical care. If so, there may be unknown ramifications of this decision. The purpose of this study was to address TBI/concussion and medical treatment history and to investigate if there is a stigma associated with having a TBI in an Army population.

## METHODS

### *Institutional Review Board Review*

This work was conducted under a protocol reviewed and determined to be exempt from the regulatory requirements of 32 CFR 219 based on criteria under 32 CFR §219.101(b)(2) by a Carl R. Darnall Army Medical Center Exempt Determination Official. Reference number is CRDAMC 18-10.

### *Measure*

A 17-item, anonymous questionnaire ([Appendix 1](#)) addressing TBI issues such as (1) if the Soldier had experienced a TBI (ie, Yes or No); (2) where did the TBI occur (ie, deployed or home station); (3) time since the most recent TBI; (4) if they sought medical care for the TBI; (5) where did they get their medical care (if they sought care); (6) why they did not seek medical care (if they did not seek care); (7) do they believe there is a stigma associated with having a TBI and why; and (8) has the stigma decreased, increased, or remained the same. The questionnaire had additional demographic items addressing (1) combat deployment history; (2) gender; (3) age; (4) military status (ie, Active Duty, Reserves, National Guard); and (5) years in the Military. The first question was designed to ensure that only Army personnel completed the questionnaire.

In order to control for potential confusion regarding the subject of the study and to confirm that the study participants understood the subject and the purpose of the study, the questionnaire included the Centers for Disease Control and Prevention's definition on the top of the first page: "The Centers for Disease Control and Prevention defines a TBI as

a disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head or penetrating head injury."<sup>23</sup>

### *Procedure*

The Brain Injury Association of America has designated the month of March to raise awareness of brain injury and to work toward reducing it. The Department of Defense is committed to increasing awareness of TBI<sup>24</sup> and to providing educational and healing resources to health care providers, Service Members, veterans, and their family members. The Defense and Veterans Brain Injury Center's (DVBIC) Regional Education Coordinators (RECs) support the Defense Department's TBI awareness initiative. RECs are responsible for TBI educational services about the prevention, treatment, and rehabilitation of TBI to many individuals including health care providers, Service Members, veterans, and their families. Throughout the year, but particularly during March that is Brain Injury Awareness Month (BIAM), the RECs are engaged in a variety of awareness activities. The questionnaire was designed to complement the REC's activities and the study to be completed within BIAM. The questionnaire was distributed during the BIAM activities across Fort Hood locations such as the Soldier Readiness Processing site, the Copeland Readiness Center, and Post Exchanges. Most of the completed questionnaires were derived from Service Members preparing for deployments through the Soldier Readiness Processing Center.

The REC introduced BIAM, discussed the need for reporting any suspected or potential brain injuries, distributed TBI information including the DVBIC HEADS concussion wallet card to encourage familiarity with mTBI/concussion's major symptoms,<sup>25</sup> and introduced the study staff. Although a script was not read, the introduction to the study and the questionnaire distribution and collection were conducted as similarly as possible. See [Appendix 2](#) for the semi-structured data collection procedures.

### *Statistical Methods*

Analyses were performed using Stata 15 (StataCorp College Station, TX) and SPSS (version 25). For the descriptive statistics, categorical and binary variables will be presented as numbers with percentages and analyzed using  $X^2$  tests. Odds ratios and 95% confidence intervals were calculated where appropriate, and  $P$  values  $<0.05$  (two tailed) were deemed as statistically significant.

## RESULTS

### *Participant Characteristic*

Participants: [Table I](#) displays the descriptive characteristics of the total sample ( $N = 5,174$ ). All 5,174 volunteers are Army; 83% Active Duty, 8% Reserve, and 9% National

**TABLE I.** Demographics

		Valid Percent
Gender	Male	86.5
	Female	13.5
Age	18–24 years old	48.3
	25–34 years old	38.3
	35 years old or older	13.4
Years in the Military	6 years or less	69.8
	7–13 years	19.1
	14 years or more	11.1
Military status	Active Duty	83.4
	Reserves	7.7
	National Guard	8.9
Combat deployment	No combat deployment	64.7
	1 or more Combat Deployments	35.3

Guard. Eighty-six percent are male; 87% were between 18 and 34 years old; 89% had <14 years in the military; and 65% did not have a combat deployment.

**TBI History Characteristics**

Of the 5,174 soldiers, 517 (10%) reported having one or more TBIs in their military careers. Approximately 56% of the Soldiers reported receiving their most recent TBI in a deployed location, whereas the remaining 44% received their TBI in a home station environment. More Soldiers (54%) reported that their most recent TBI/concussion occurred 3 or more years ago during their military career. Of those who experienced a TBI, 52% sought medical care for the injury, with the majority (34%) seeking medical care at the ER setting. Of those who reported not seeking medical care for their TBI, 64% reported that they did not think the injury required care followed by 18% who were afraid that reporting it would negatively impact their career (Table II).

**Relationship Between Combat Deployments and a History of TBI**

Soldiers with at least one deployment are 5.2 times more likely to have TBI versus nondeployed (aOR = 5.2, 95% CI 4.0–6.7, *P* < 0.001) even though only 56% of the reported TBIs occurred while deployed. As we asked for only the location of the most recent TBI, for those reporting more than one TBI, the location where the additional TBI(s) occurred is not known (Fig. 1).

**Participant Perception of Stigma Associated With Brain Injury (or TBI?)**

Of the total sample, 88% of the Soldiers reported “No” indicating there is not a stigma and the remaining 12% reported “Yes” indicating there is a stigma associated with a brain injury. The individuals who selected “Yes” to the stigma question were further asked to briefly explain. Their explanations were

**TABLE II.** TBI History Characteristics

		Valid Percent
TBI history	1 or more TBIs	10
	No TBI	90
Time since most recent TBI	<6 months	10.7
	6–11 months	7.9
	12 months to 2 years	13
	25 months to 3 years	14.9
	More than 3 years	53.5
Where did TBI occur	Deployed location	55.8
	Home station	44.2
Sought medical care	Yes	51.8
	No	48.2
Medical care location	Emergency room	33.8
	Primary care manager	13.2
	TBI clinic	16
	Neurology clinic	3.8
	Other <sup>a</sup>	25.1
Why did not seek care	Multiple locations	8.1
	Didn’t think the injury required care	63.5
	Afraid that reporting it would negatively impact their career	18
	Did not know where to go to seek care	3.5
	Other <sup>b</sup>	11.8
	Multiple answers	3.1

<sup>a</sup>Other = Aid Station/Medics/TMC/FOB (Forward Operating Base).

<sup>b</sup>Other = TBI was not emphasized at the time (2003–2006), lack of awareness of TBI/mission first/no resources.

reviewed and organized into categories. Most responses (29%) were related to the belief that brain injuries are bad (ie, reduced cognition, less smart). The next two categories were very close; reporting any injury shows weakness (18%) and career/career options would be jeopardized (18%). The final three categories are faking/making it up (11%), TBI equals behavioral health issues (8%), and treatment is complicated or not effective (5%). The remaining responses could not be neatly placed into any of the mentioned categories for example; “I believe it is a serious matter that should be dealt [with]” could have been placed into the “brain injuries are bad” category or the “it” mentioned could be related to the reduction of stigma itself. Other responses such as “I’ve seen it,” “Things happen,” “I don’t know,” and “Cannot explain” seem to not fit in any category.

We wanted to know if the stigma associated with brain injury has lessened, remained the same, or increased. This was broken down into three categories: all responses, those that reported no stigma, and those who reported there was a stigma. Of the Soldiers who reported there is a stigma associated with TBI, 26% believe the stigma lessened, 51.6% believe the stigma has remained the same, and 22.0% believed it has increased (Fig. 2).

Only 12% of the total number of Soldiers reported that they believed there was a stigma attached to brain injury; 28% of Soldiers who had experienced a TBI reported there is a stigma,

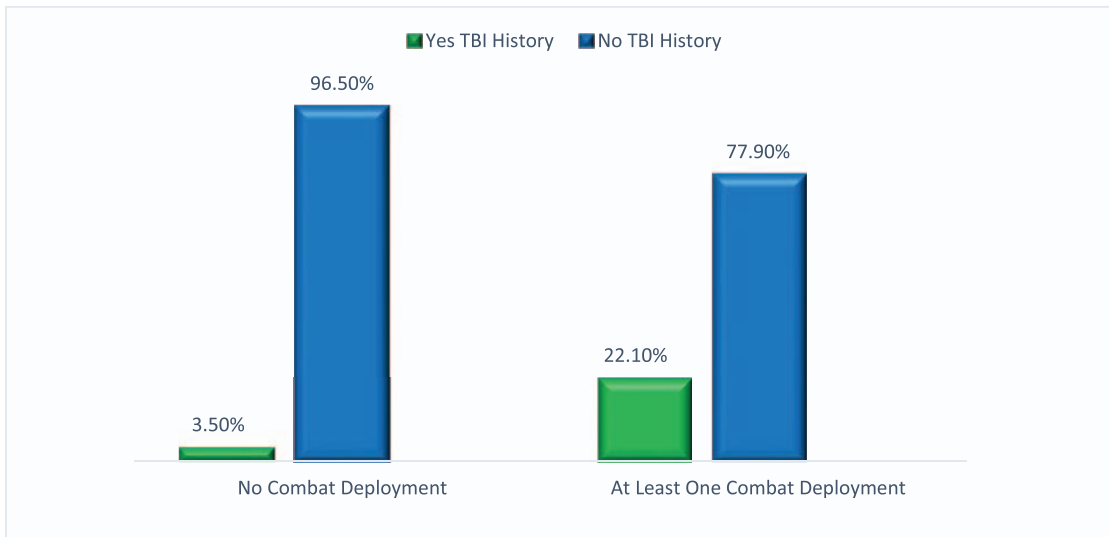


FIGURE 1. Relationship of TBI and combat deployment.

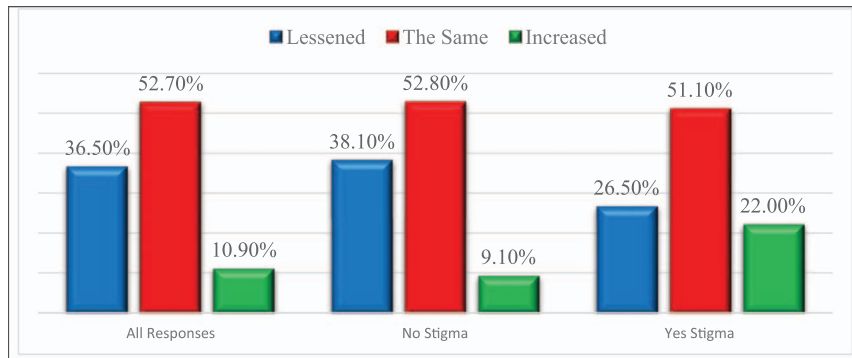


FIGURE 2. Has the stigma associated with TBI lessened, stayed the same, or increased? By all responses, “No” stigma, and “Yes” stigma. “No” stigma and “Yes” stigma indicate the answer to “Is there a stigma associated with a brain injury?”.

whereas 11% of Soldiers who have not experienced a TBI reported there is a stigma associated with a TBI. Soldiers who have experienced at least one TBI are 2.8 times more likely to report there is a stigma associated with TBI versus Soldiers who have not (aOR = 2.8, 95% CI 2.2–3.6,  $P < 0.001$ ). More females (15%) than males (12%) reported there is a stigma associated with TBI ( $P < .03$ ) (Fig. 3).

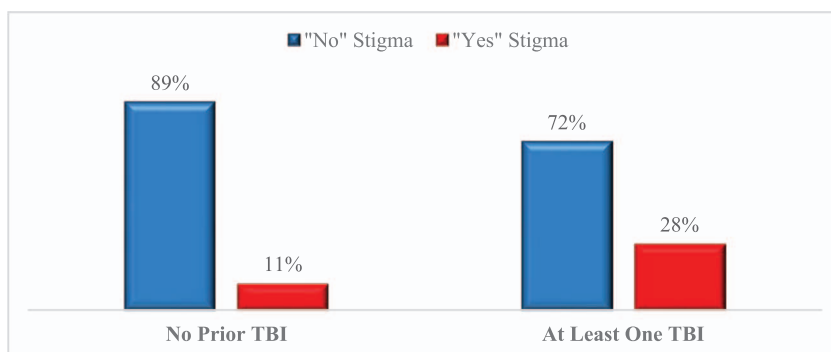
## DISCUSSION

It was reported in 2008 that 43% of the service members experiencing an mTBI/concussion sought medical treatment.<sup>6</sup> In our study, we found that about half of the Soldiers (48%) who reported experiencing an mTBI did not seek medical care. The difference of 43% found in 2008 to 52% found in this study appears to indicate that there has been progress in educating soldiers to seek treatment for suspected mTBIs. There is the potential for more growth as in this study, we found the most common reason stated for not seeking medical care was that they did not think the injury required care. It is

possible that the injury may not have required medical care as we have no medical evidence that the injury did require care. However, in accordance with Army policies, potentially concussive events including but not limited to “Involvement in a vehicle collision or rollover” or “A blow to the head during activities such as training, sporting/recreational activities, combatives, or accidents” require medical screening.<sup>26–28</sup>

In 2012, the Department of Defense instructed its services to “Develop and support effective training plans for the following: (1) early detection of potentially concussive events for line leadership and Service members and (2) medical personnel on the use of mTBI/concussion algorithms in accordance with Service policies.”<sup>29</sup> TBI training is service specific, and therefore, the Army, Navy, Marines, and Air Force will have their own mTBI training plans (ie, Army Regulation 350-1,<sup>30</sup> US Marine Corps TBI Program<sup>31</sup>). However, during the data collection phase of the study, the Soldiers were asked unofficially by showing hands how many had any mTBI/concussion training. This was usually met by a sparsity of hands. Although not scientific, it is an indication along with





**FIGURE 3.** Comparison of perception of stigma by TBI history. “No” stigma and “Yes” stigma indicate the answer to “Is there a stigma associated with a brain injury?”.

the results of this study that many soldiers may not know that their injury requires medical screening or treatment because they have not had the training or if they have had the training, they have not retained it or in the confusion of having their “bell rung” they forgot. One possible solution to reduce the number of unreported mTBIs is to ensure service members know that they should seek medical care after experiencing a potentially concussive event.

This study found that Soldiers with at least one deployment are 5.2 times more likely to report having had an mTBI compared to those who have never been on a deployment. It appears that deployment is a risk factor for reporting having an mTBI even though only 56% of the mTBIs reported occurred while deployed. Studies on the relationship to deployment and having a diagnosed mTBI have shown that deployment increases the risk of sustaining an mTBI immediately following deployment and decreasing over the next year; however, the risk remained 1.7 times higher than before deployment.<sup>32,33</sup> These studies focused on diagnosed mTBIs and therefore did not capture the mTBIs that were not reported or they were not able to confirm with medical records.

The belief that there is a stigma associated with an mTBI is relatively low; however, the fact that Soldiers who reported have had an mTBI are more likely to believe there is a stigma compared to those who have not had an mTBI is interesting. We can only speculate on why this is so. It is possible that when a Soldier experiences a TBI, they are treated differently by the people around them. Friends, family, leadership, or even medical personnel may inadvertently influence the concussion sufferer’s perception of their injury. When the interactions are positive, it is likely that there will not be a belief that there is a stigma. The opposite is also true when the interactions are negative. It is likely that a medical condition like an mTBI that cannot be seen or verified may lead to more negative interactions thus potentially explaining why Soldiers who have experienced an mTBI are more likely to report a stigma.

There is much that is not yet confirmed about the short and long-term impacts of mTBI/concussions. We recommend further educational efforts to encourage soldiers to report

potentially concussive events. Reporting potentially concussive events is important for (1) clarifying if what soldiers believe to be a concussion is confirmed to be a concussion by medical screening; (2) determining the absolute number of mTBIs; and (3) accurate research establishing a baseline to determine the short and long-term ramifications of mTBIs.

### Limitations

The use of an anonymous questionnaire is a great way to get candid responses and collect a large sample size. Questionnaire research is based on the items in the questionnaire. In order to ensure that the questionnaire did not collect privately identifiable information, there was not a lot of specificity in the items. Plus, it is possible that we failed to account for all possible answers and therefore missed out on some information. We inserted the “other” category with the fill in the blank option to control for this. This was, however, only a 17-item questionnaire.

Self-report is always difficult as it relies on the perception of the reporter. We could not verify the mTBIs through any medical records so that the absolute numbers of mTBIs or those reporting not ever having an mTBI are not known.

Our inclusion of the questionnaire with BIAM activities and explaining what a stigma was may have had a priming effect. In part, this was by design as we wanted to ensure the potential volunteers understood what was meant by an mTBI/concussion and the word “stigma” and that they would be able to answer the questions from an educated position. We do not feel that it had a substantial influence on the results, but it is something to consider for future studies. The percentage of individuals reporting sustaining a concussion is similar to those previously reported, for example, 19% to 22%<sup>6</sup> of previously deployed soldiers reporting an mTBI, and the percentage of individuals reporting a stigma was relatively low and was confirmed through a fill in the blank explanation.

Lastly, the use of Army Soldiers only may limit the generalizability of our results outside of our population to civilians or to other military services.

## CONCLUSIONS

Only 10% of our sample of 5,174 soldiers reported having one or more mTBIs in their military careers. Thirty-five percent of our sample had at least one combat deployment. Having at least one combat deployment was found to be a risk factor for reporting a concussion although just over half (56%) of the concussions reportedly occurred in a deployed location. Of those who reported an mTBI, 52% sought medical care for the injury. Of those who reported not seeking medical care for their suspected concussion, 64% reported that they did not think the injury required care followed by 18% who were afraid that reporting it would negatively impact their career. The belief that there is a stigma associated with an mTBI is relatively low. Soldiers who reported that they have had an mTBI were found to be more likely to report there is a stigma compared to those who have not had an mTBI. The top three categories for explaining the stigma are brain injuries are bad (ie, reduced cognition, less smart), reporting any injury shows weakness, and career or career options would be jeopardized. The ramifications of the unreported and potentially untreated mTBIs in the civilian and military populations are not yet known. Education efforts to familiarize service members about reporting requirements for potentially concussive events are recommended.

## SUPPLEMENTARY MATERIAL

Supplementary material is available at *MILMED* online.

## ACKNOWLEDGEMENTS

We also thank the III Corps for their support of this study, the staff at the recruitment locations, and the Soldiers who volunteered to participate in this study.

## FUNDING

This study was supported internally through the Defense and Veterans Brain Injury Center.

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