

# Risk for Subsequent Mishaps among Airmen with Mild Traumatic Brain Injury

Casserly R. Whitehead, MPH<sup>1</sup>; Timothy S. Webb, MS, PhD<sup>2</sup>; Timothy S. Wells, DVM, MPH, PhD<sup>2</sup>; Suzanne H. Baktash, MPH<sup>2</sup>; Tracy J. Eicher, MD<sup>3</sup>; Clifford N. Otte, MPAS<sup>2</sup>; Sarah O. Fortuna, MD<sup>2</sup>; Russell K. Gore, MD<sup>2</sup>; Edward J. Boyko, MD, MPH<sup>4</sup>; Charles Maynard, PhD<sup>4</sup>; Bruce R. Burnham, DVM, MPH<sup>5</sup>; Philip Kemp, MS<sup>5</sup>

<sup>1</sup>InfoSciTex Corporation, Dayton, OH; <sup>2</sup>Vulnerability Analysis Branch, Air Force Research Laboratory, Wright-Patterson AFB, OH; <sup>3</sup>88<sup>th</sup> Medical Group, Wright-Patterson AFB, OH; <sup>4</sup>Epidemiologic Research and Information Center (ERIC), VA Puget Sound, Seattle WA <sup>5</sup>US Air Force Safety Center, Kirtland AFB, NM



## Introduction

- Mild Traumatic Brain Injury (mTBI) results from trauma to the head, such as that occurring from motor vehicle or industrial accidents, or sports injuries
- United States Air Force members (Airmen) and other individuals with mTBI may suffer from cognitive deficits placing them at increased risk for subsequent mishaps

## Background

- mTBI is an important concern among US service members who are exposed to such hazards as blast injuries, sports injuries, and trauma associated with motor vehicle accidents
- mTBI is often diagnosed among troops serving in Iraq and Afghanistan
- Even mild brain trauma may lead to long-term mechanical and biomechanical damage that can negatively impact performance
- The study objective was to determine if Airmen with mTBI were at greater risk for subsequent mishaps that may be indicative of decreased cognition as a result of the mTBI injury



Photo courtesy of www.af.mil/photos/mediagallery

## Methods

- This study included Airmen who had served on active duty for at least six months between Oct 1, 2001- Sep 30, 2008 and whose electronic personnel data was linked to medical and safety center data, also in electronic format
- Airmen were excluded if they had been diagnosed with an mTBI or an unspecified head injury within 2 years prior to entrance into the study
- Exposed individuals were Airmen with an ER-diagnosed mTBI during the study period
- Study outcomes were restricted to mishaps occurring more than two days post-mTBI or injury, to ensure proper temporal relationship and exclude same-event diagnoses
- Comparison groups included all other study members without a head injury, and an ER-diagnosed injured comparison group that was used to reduce possible biases associated with entry into the medical system as a result of an mTBI
- Statistical analyses included univariate methods to determine differences in demographic and military specific data, and Cox's proportional hazards modeling to calculate adjusted hazard ratios and 95% confidence intervals while controlling for varying lengths of follow-up

## Results

- There were 522,080 Airmen who met study criteria, and 3,606 with an ER-diagnosed mTBI
- 100 individuals had sustained both an mTBI and a subsequent mishap during the study period
- Compared to those without mTBI, Airmen with an mTBI were more likely to be male, white (non-Hispanic), never married, enlisted, and born during or after 1976 (Table 1)

## Results (cont.)

Table 1. Descriptive Data, Airmen with and without mTBI, 2001 - 2008

Characteristic*	Comparison group		
	mTBI n = 3,606	Full n = 518,474	ER-Injured n = 14,466
Gender			
Male	3,012 (83.5)	412,696 (79.6)	11,051 (76.4)
Female	594 (16.5)	105,778 (20.4)	3,415 (23.6)
Race/ethnicity			
White non-Hispanic	2,743 (76.1)	373,209 (72.0)	10,539 (72.9)
Black non-Hispanic	418 (11.6)	79,083 (15.3)	2,009 (13.9)
Other / unknown	445 (12.3)	66,182 (12.8)	1,918 (13.3)
Birth year			
Before 1965	197 ( 5.5)	89,653 (17.3)	1,528 (10.6)
1966 – 1975	540 (15.0)	110,111 (21.2)	2,906 (20.1)
1976 or later	2,869 (79.6)	318,710 (61.5)	10,032 (69.4)
Rank			
Enlisted	3,452 (95.7)	438,520 (84.6)	13,409 (92.7)
Officer	154 ( 4.3)	79,954 (15.4)	1,058 ( 7.3)
Marital Status			
Currently married	1,012 (28.1)	222,841 (43.0)	5,382 (37.2)
Never married	2,494 (69.2)	273,898 (52.8)	8,862 (58.9)
No longer married	100 ( 2.8)	21,735 ( 4.2)	559 ( 3.9)
Deployed			
Never	1,785 (49.5)	289,832 (55.9)	6,819 (47.1)
Once	1,047 (29.0)	130,320 (25.1)	4,095 (28.3)
Twice or more	774 (21.5)	98,322 (19.0)	3,552 (24.6)

\*Differences were tested with the Pearson chi-square test of association; *p*-value ≤ 0.002 for all.

- Airmen with mTBI were at increased risk for subsequent mishaps when compared to the full cohort, but no significant differences were noted when compared to the ER-diagnosed injured cohort (Table 2)

Table 2. Hazard Ratios for Mishaps Among Airmen With and Without mTBI

Characteristic	mTBI n	Full cohort HR (95% CI)*	ER-Injured HR (95% CI)*
Type of mishap			
Private motor vehicle	15	1.56 (0.92, 2.66)	0.65 (0.32, 1.31)
Govt. motor vehicle	2	2.61 (0.64, 10.62)	-
Sports / recreation	45	1.81 (1.32, 2.49)	0.80 (0.54, 1.19)
Industrial	20	1.73 (1.00, 3.00)	0.33 (0.15, 0.73)
Other	18	1.66 (1.02, 2.73)	0.45 (0.24, 0.84)
Duty status			
On duty	26	1.62 (1.03, 2.55)	0.35 (0.18, 0.67)
Off duty	68	1.73 (1.35, 2.21)	0.69 (0.50, 0.94)
Mishap severity			
Lost time case	58	1.60 (1.24, 2.08)	0.75 (0.54, 1.04)
Treated / released	13	2.82 (1.54, 5.17)	2.33 (0.58, 9.41)
No lost time	16	1.28 (0.72, 2.28)	0.21 (0.08, 0.53)
Other	3	8.38 (2.24, 31.27)	-

Abbreviations: HR, Hazard Ratio; CI, Confidence Interval

\* Adjusted for gender, marital status, race/ethnicity, birth year, deployment, education, rank, career filed, duty status, previous mishap and injury severity.



Photo courtesy of www.af.mil/photos/mediagallery

## Discussion

- This is one of the first large studies to utilize electronic data to calculate associations between mTBI and subsequent risk for mishap
- Airmen with mTBI appear to be at increased risk for subsequent mishaps compared to the full cohort
- The relations between mTBI, other significant injuries, and subsequent risk for mishap need further study to better understand causal pathways

## Conclusion

- In a population with equal access to health care, risk for subsequent mishaps may be due to differences shared among those who seek emergency care for injuries:
  - Differential participation in sports activities
  - Risk-taking behaviors
  - Occupations
- Conflicting findings based upon comparison group suggest that increased risk for subsequent mishaps is likely not the result of decreased cognition, as may be expected among those with mTBI

This study was conducted in accordance with all applicable federal regulations governing the protection of human subjects in research as approved by Air Force Research Laboratory/Wright Site Institutional Review Board (Protocol F-WR-2009-0066-H)