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*Form Approved*  
OMB No. 0704-0188

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<b>1. REPORT DATE (DD-MM-YYYY)</b> 04/03/2018		<b>2. REPORT TYPE</b> poster		<b>3. DATES COVERED (From - To)</b> 03/04/2018-03/08/2018	
<b>4. TITLE AND SUBTITLE</b> Impact of Time to Transport on Clinical Outcomes of Patients with Traumatic Brain Injury (TBI) Following Evacuation from Theater via Critical Care Air Transport Teams (CCATT)				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
				<b>5d. PROJECT NUMBER</b>	
<b>6. AUTHOR(S)</b> Maddry, Joseph K, Maj				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>  17683	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> 59th Clinical Research Division 1100 Willford Hall Loop, Bldg 4430 JBSA-Lackland, TX 78236-9908 210-292-7141				<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> 59th Clinical Research Division 1100 Willford Hall Loop, Bldg 4430 JBSA-Lackland, TX 78236-9908 210-292-7141	
<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> Approved for public release. Distribution is unlimited.					
<b>13. SUPPLEMENTARY NOTES</b> Government Services Chapter of the American College of Emergency Physicians (GSACEP), Lake Tahoe, California, March 4-8, 2018					
<b>14. ABSTRACT</b>					
<b>15. SUBJECT TERMS</b>					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b> Clarice Longoria
<b>a. REPORT</b>	<b>b. ABSTRACT</b>	<b>c. THIS PAGE</b>			<b>19b. TELEPHONE NUMBER (Include area code)</b> 210-268-2201

# Impact of time to transport on clinical outcomes of patients with traumatic brain injury (TBI) following evacuation from theater via Critical Care Air Transport Teams (CCATT)

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## Background

- TBI is a leading cause of death and disability worldwide and is associated with mortality rates as high as 30%.
- Patients with TBI are at high risk for secondary injury; the physiologic effects of aeromedical evacuation are not well understood and may compound these risks.
- The goals of treatment should be the prevention of hypoxia, hypocapnia, hypercapnia, and hypotension. Better outcomes are associated with SpO<sub>2</sub> >90%, systolic blood pressure >90mmHg, and an ETCO<sub>2</sub> of 35-40mmHg.
- In a rodent model of TBI, early exposure to hypoxia and hypobaric conditions were associated with increased inflammation and severity of secondary brain injury.
- It may be more prudent and beneficial to the patient to be transported following necessary procedures and stabilization.

## Objective

The goal of this study was to evaluate the impact of time to transport on clinical outcomes for patients with TBI.



## Methods

- We performed a retrospective review of CCATT medical records of patients with TBI evacuated out of theater to LRMC from January 2007 to May 2014.
- Trained abstractors collected flight information, injury description, labs, vitals, procedures, and outcomes.
- Radiologists examined preflight CTs for TBI.
- Outcome data were obtained from DODTR, to include ventilator days, ICU days, hospital days, and mortality.
- TBI was defined as Abbreviated Injury Scale (AIS) of body region 1 (Head/Neck) ≥3. We defined "time to transport" as the time from injury to discharge from a Role 3 facility (in days).
- In this interim analysis, we calculated descriptive statistics and univariable analyses for time to transport, injuries, and clinical outcomes for this sample of TBI patients.

## Results

### Demographics & Injury description

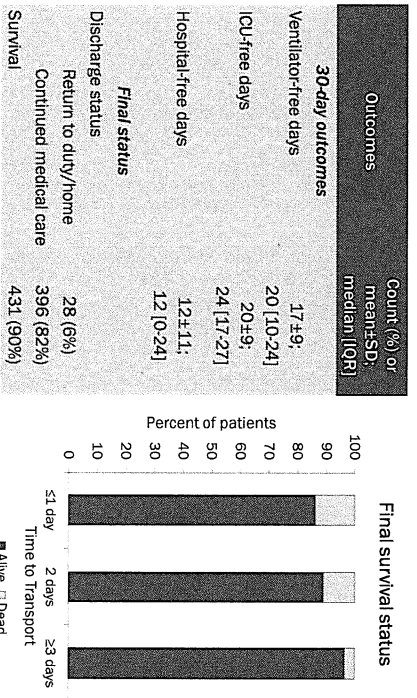
- 482 patients with TBI evacuated out of theater via CCATT, 98% male and 93% US Active Duty.
- Most common mechanism of injury was explosive (68%), followed by GSW (17%).
- Mean composite ISS was 30 (SD 13).
- Median AIS of Head/Neck was 4 (IQR 3-5).

### Flight information

- 25% of patients had an altitude restriction.
- 55% of patients had >1 flight in theater.
- Mean time to transport was 2 days (SD 1).
- 39% were evacuated in ≤1 day.
- 37% were evacuated in 2 days.
- 24% were evacuated in ≥3 days.

### Comparison of outcomes

- Time to transport was not associated with ventilator-free days, ICU-free days, hospital-free days, or discharge status of survivors.
- Longer time to transport was associated with higher survival (p=0.009).



Traumatic Brain Injuries	Count (%)
Intracranial hemorrhage (any type)	256 (53%)
Intraparenchymal hemorrhage	145 (30%)
Subarachnoid hemorrhage	134 (28%)
Subdural hematoma	111 (23%)
Intraventricular hemorrhage	55 (11%)
Epidural hematoma	32 (7%)
Cranial fracture	207 (43%)
Contusion	81 (17%)
Midline shift	58 (12%)
Herniation	39 (8%)
Mass effect	37 (8%)
Compressed fourth ventricle	24 (5%)
Compressed ambient cistern	23 (5%)
Diffuse axonal injury	23 (5%)

Patients may have more than one injury.

## Limitations

- Only univariable analyses have been conducted thus far; the influence of hypoxia and hypobaric were not accounted for.
- Analyses are constrained by sample size and data availability.

## Conclusions & Future Directions

- Most patients are evacuated from theater within two days of injury. Survival was 90% and the majority of patients continued to receive medical care.
- Longer time to transport was associated with higher survival in univariable analysis.
- Future analyses will evaluate the impact of time to transport on clinical outcomes using multivariable analyses (i.e., logistic regression, ANCOVA, hierarchical linear regression).

## Acknowledgements

Dod Joint Program Committee (JPCG)  
 Air Force En route Care Research Center Team  
 CCATT Pilot Unit  
 Joint Trauma System - Department of Defense Trauma Registry

This study was conducted under a protocol reviewed and approved by the Wilford Hall Ambulatory Surgical Center Institutional Review Board. The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army, the Department of the Air Force, or the Department of Defense. Corresponding Author: joseph.k.maddy@mali.mil