

## Paramedic CAT (Critically Appraised Topic)

**Title:** Does helicopter based EMS impact patient outcomes in trauma in rural areas?

**Report by:** Hannah Clery

**Clinical Scenario:** You are dispatched code 1A to a male patient with polytraumatic injuries due to a motor-vehicle accident in a rural location. The patient is in critical condition with a decreased level of consciousness and is becoming hemodynamically unstable. You are located 50 minutes from the nearest major trauma centre. The decision to transport using helicopter EMS has been made due to the onboard clinicians having greater qualifications, seemingly faster transport time to hospital, and increased chances of patient survival.

**PICO (Population – Intervention – Comparison – Outcome) Question:** In patient that have sustained traumatic injuries located in rural areas, does helicopter based emergency medical services (HEMS) offer more positive patient outcomes when compared to ground emergency medical services (GEMS)?

**Relevance:** The clinical effectiveness of HEMS regarding its impact on patient outcomes when compared with GEMS, particularly in the rural setting, remains a subject of discussion with numerous studies debating its success in improving mortality rates.

**Search Strategy:** The medical electronic databases Ovid MEDLINE and EMABSE were used to source literature published within the previous 10 years (September 2010 to current September 2020).

The keywords and search headings used included: (helicopter OR aeromedical OR flight OR air) AND (ambulance OR paramedic OR EMS OR emergency medical services OR HEMS) AND (trauma OR injury) AND (rural OR country).

Articles of any study design were included if they examined the impact of HEMS on patient outcomes in trauma in a rural setting, only involved humans in the study, and were written in English language. Refer to Figure 1 for search outcomes.

### Study Results and Analysis

Author, Date	Population: Sample Characteristics	Design	Outcome	Results	Strengths and Limitations
<i>Ford, Mills, Ciccone &amp; Beatty, 2020</i>	There were 1,374 major trauma patients included through Western Australia trauma registries where the location of the incident occurred in the zone of 50 to 250km around	Retrospective	Determine whether survival improves in severely injured rural trauma patients when there is direct HEMS retrieval from	Survivability was significantly greater for patients retrieved by HEMS and transported directly to a tertiary hospital than those who were first taken to a rural hospital.	(-) Used studies that did not contain all of the data variables  (-) Pooled data from multiple studies, which may show inconsistent

	Perth from 2006 to 2015.		an incident scene to a tertiary hospital.	There was a 50% increased risk of death in the indirect patients when including all mechanisms of injury, and a 92% increased risk of death associated with the most common mechanism of injury (motor vehicle accident where the patient was the driver).	results due to differences in healthcare settings  (+) Identified variables that affected the study  (+) Large study zone, time frame, and sample population
<i>Kai, Broady, Davenport &amp; Bernard, 2019</i>	A total of 34,822 rural trauma patients transported by HEMS or GEMS were located using National EMS Information System incident records between January 2017 to December 2017.	Retrospective	Investigate the effect of transport time on clinical decline in both HEMS and GEMS systems in rural trauma patients.	Median dispatch-to-destination time for GEMS transports was 34 minutes and 72 minutes for HEMS transports. Arrival to scene took longer in HEMS transports.  Over half of GEMS patients were transported to the closest trauma facility rather than the appropriate facility, whereas almost all HEMS patients were transported to the appropriate facility.	(-) Major differences in presenting conditions of patients; HEMS patients were in much worse condition and more likely to decline  (-) Potential for bias in the HEMS population due to suspected increased injury severity  (-) Study population was limited to a single region  (-) Only a one-year study  (+) Large sample population  (+) Listed variables that affected the study

Zhu,  
Hollister,  
Opoku &  
Galvagno,  
2018

There were 469 HEMS patients and 580 GEMS patients, aged 15 years and above, included in the study from 1999 to 2012. Patients included were limited to the scene of injury in a rural area of 10 to 35 miles from the verified trauma centre where the study population was transported to.

Retrospective observational

Determine if HEMS is associated with increased survival when trauma patients are transported to a verified trauma centre in a rural setting when compared with GEMS.

When compared with GEMS, HEMS cases had a twofold or more increase in chances of survival, with GEMS mortality being 1.93 times greater than that of HEMS.

There was a 4% mortality rate reported with HEMS, compared with a 7.6% mortality rate reported with GEMS.

(-) Data may have errors due to limiting validation to internal methods and not external validation

(+) Multiple imputation was performed for missing information in original data set

(+) Used advanced statistical techniques to control for confounders and to minimise selection bias

(+) Statistically significant with large study period

(+) At time of the study, there were no other studies done of its kind

Malekpour  
et al., 2017

A total of 4,492 patients over the age of 15 years who were directly transported from the trauma scene via HEMS (2,078) or GEMS (2,414) were included in the study. The study was conducted from 2006 to 2012.

Retrospective

Investigate whether HEMS has a clinical advantage over GEMS in rural trauma through identifying variables associated with survival to discharge.

Mean time from injury to the trauma centre was significantly shorter for HEMS transport; 2 hours 30 minutes, compared with 3 hours 6 minutes for GEMS.

Despite having more severe injuries, HEMS patients had higher odds of survival to discharge in the

(-) Single rural level one trauma centre

(-) Presence of confounders

(+) Large study period and sample population

(+) Vast catchment area

(+) Statistically significant

<p><i>Pham, Puckett &amp; Dissanaikie, 2017</i></p>	<p>A total of 288 trauma patients, primarily rural, who were over 18 years of age were included. The study period was from 2005 to 2015 and involved a single level one trauma centre.</p>	<p>Retrospective review</p>	<p>Evaluate HEMS dispatch and on-scene times by investigating survival rates among patients who were transported by air to a level one trauma centre.</p>	<p>setting of rural trauma. There was no difference reported in discharge to home from ED between HEMS and GEMS. Faster on-scene times are associated with decreased mortality, showing a clear linear relationship. The initial 10 minutes of total HEMS transport times were predictive of patient outcomes; if prehospital care could be provided in the first 10 minutes from arrival, patients had increased survivability.</p>	<p>(-) Single rural level one trauma centre and small sample population          (-) Limited data on extrication times and interventions          (-) Not limited to rural patients and did not clearly separate results          (+) Identified valuable times of treatment intervention          (+) Identified variables that may have affected the results</p>
<p><i>Rose, Cummings, Rodning, Brevard &amp; Gonzalez, 2012</i></p>	<p>Patients transported by GEMS or HEMS in the rural setting to an identified level one trauma centre from 2007 to 2008 were included in this study. There were 1,413 patients transferred from a rural scene to the trauma centre: 617 GEMS and 796 HEMS.</p>	<p>Retrospective review</p>	<p>Assess rural trauma HEMS transport utilisation and effect on patient survival in comparison to GEMS.</p>	<p>Mortality rates where more significant in HEMS transports: 12% HEMS compared to 3% GEMS. However, when HEMS and GEMS transports were stratified based on injury severity score, there was no statistical significance.</p>	<p>(-) Statistically insignificant          (-) Severity of patient injury was scored in a way that does not reflect physiological criteria          (+) Identified issues with data collection          (+) Recognised and accounted</p>

### **Comments:**

The majority of the articles reported more favourable results when rural trauma patients were transported by HEMS. This is due to these studies recording more rapid transport times and HEMS patients being transported directly to the appropriate trauma facilities, resulting in overall reduced mortality rates when compared to patients transported by GEMS. Only two of the six articles located found that GEMS improved patient outcomes more than HEMS, however these studies found that there was a greater number of patients not being transported to an appropriate facility, rather a closer one, or that the results were not statistically significant.

There were many factors that influenced the results of these studies. Some articles included patients of varying injury severity, with some patients presenting with much worse conditions on arrival of EMS crews, were not able to control confounding factors, or were limited to single trauma centres in one region. In order to adequately compare the impact on patient outcomes HEMS and GEMS offer in trauma patients in a rural setting, these factors must be accounted for.

### **Consider:**

Based on the relevant articles, a change in practice in the use of HEMS in rural trauma patients is not recommended. As previously stated, a majority of articles found that the involvement of HEMS improved patient outcomes and reduced the risk of mortality. Timely prehospital care and rapid transport times are critical components of trauma systems. Mean time from injury to an appropriate trauma centre was reportedly shorter for HEMS transport, and HEMS patients had higher odds of survival to discharge in the setting of rural trauma when compared with GEMS.

### **Clinical Bottom Line:**

For patients that have sustained traumatic injuries located in rural areas, HEMS offers more improved patient outcomes when compared to GEMS, particularly when prehospital care is provided in the initial 10 minutes of arrival.

### **References**

Ford, D., Mills, B., Ciccone, N., & Beatty, S. (2020). Does direct helicopter retrieval improve survival of severely injured trauma patients from rural western australia? *Air Medical Journal*, 39(3), 183-188. doi:10.1016/j.amj.2020.01.005

Kai, T. R., Broady, M. J., Davenport, D. L., & Bernard, A. C. (2020). The effect of emergency medical system transport time on in route clinical decline in a rural system. *The Journal of Trauma and Acute Care Surgery*, 88(6), 734-741. doi:10.1097/TA.0000000000002675

Malekpour, M., Younus, J. M., Jaap, K., Neuhaus, N., Widom, K., Rapp, M., . . . Wild, J. (2017). Mode of transport and clinical outcome in rural trauma: A helicopter versus ambulance comparison. *The American Surgeon*, 83(12), 1413-1417. doi:10.1177/000313481708301228

Pham, H., Puckett, Y., & Dissanaik, S. (2017). Faster on-scene times associated with decreased mortality in helicopter emergency medical services (HEMS) transported trauma patients. *Trauma Surgery & Acute Care Open*, 2(1), e000122. doi:10.1136/tsaco-2017-000122

Rose, M. K., Cummings, G. R., Rodning, C. B., Brevard, S. B., & Gonzalez, R. P. (2012). Is helicopter evacuation effective in rural trauma transport? *The American Surgeon*, 78(7), 794-797. doi:10.1177/000313481207800720

Zhu, T. H., Hollister, L., Opoku, D., Galvagno, S. M., & Shah, M. N. (2018). Improved survival for rural trauma patients transported by helicopter to a verified trauma center: A propensity score analysis. *Academic Emergency Medicine*, 25(1), 44-53. doi:10.1111/acem.13307

## **Appendix**

Figure 1: PRISMA Flowchart displaying search outcomes and exclusion process used to identify relevant literature

