Helicopter EMS Transport is associated with Reduced Mortality in Injured Adults

Ernest E. Sullivent, III, M.D.
Master of Public Health Capstone Project
Medical College of Wisconsin
Public Health Importance

- Injury is leading cause of death for persons aged 1-44 years in U.S.
- 174,000 injury deaths in 2005 in U.S.
- Helicopter emergency medical services (HEMS) have evolved in attempt to reduce time between injury and definitive care
- Mortality studies to date show mixed results; improved outcome has not been consistently demonstrated
Historical Background

- First helicopter ambulance program by U.S. military in Korean conflict
  - 20,000 transports by only 12 helicopters
- Helicopter ambulance use greatly expanded in Vietnam conflict
  - 800,000 transports
  - Average time to treatment <1 hr
- Police helicopters first used by Maryland Shock Trauma Unit in 1967
Civilian Helicopter Ambulance

- First civilian use by West Germany for autobahn accidents in 1967
- First U.S. privately funded hospital-based service initiated 1972
- 1980:
  - <50 aircraft and 25,000 transports/yr
- 2007:
  - 830 aircraft and 275,000 transports/yr
HEMS Advantages

• Shorter time period to treatment, especially with longer distances
• Higher level of expertise in prehospital personnel
• Higher level of care than available with some ground ambulance
• Can access patient in difficult terrain
• Keeps local EMS available in areas of sparse EMS coverage
HEMS Disadvantages

• Costs
  – Aircraft cost up to $5.7M
  – Annual operating costs up to $1M

• Over-utilization
  – No national guidelines regarding use

• Safety concerns
  – 1972-2008: 264 crash fatalities
  – 2008 highest fatalities of any year (29 deaths in 13 crashes)
Objective

- To analyze the association between outcome (mortality) and the mode of EMS transport (ground vs. helicopter) in a large national study
Methods: Sample

- 2007 National Trauma Data Bank (NTDB) research data set
- Injured adults aged ≥18 years transported by HEMS or ground ambulance from injury scene
- Records with missing age, gender, Injury Severity Score (ISS), or clinical data for Revised Trauma Score (RTS) excluded
- Facilities with >20% incomplete records excluded
- Study data set contained 48,974 adults in 95 U.S. trauma centers
Methods: Measures

- Demographic: age, gender
- Clinical
  - ISS (anatomical score) (higher score more severely injured)
  - RTS (physiological score) (lower score more severely injured)
- EMS transport mode: helicopter vs. ground
- Outcome: in-hospital mortality
Methods: Statistical Analysis

- Mortality compared in helicopter vs. ground ambulance transport
- Categorical variables: demographic, clinical, transport type, mortality
- Continuous variables: age, ISS, RTS
- Adjusted odds ratios (OR) with 95% confidence intervals (CI) calculated using logistic regression controlling for potential confounders (age, gender, ISS, RTS)
Results

• Overall mortality 4.1%
  – Ground 3.7%, helicopter 6.1%
  – Males 4.7%, females 3.0%
  – Age $\geq 55$ 4.9%, age $<55$ 3.7%
  – ISS $\geq 15$ 15.5%, ISS $<15$ 0.8%
  – RTS <6 38.2%, RTS $\geq 6$ 1.3%

• Males 65% of all transports, 72% of HEMS
• 84% transported by ground, 16% by helicopter
• Severely injured transported by HEMS more than less severely injured (29% vs. 12%)
Results

• Odds of death 26% higher in those transported by ground vs. helicopter (OR=1.26, 95% CI=1.08-1.48) (p=0.0028)

• Males have higher odds of death (OR=1.49, CI=1.29-1.71)

• Mortality increases with
  – Age (OR=1.04, 95% CI=1.04-1.05, per year)
  – ISS (OR=1.09, 95% CI=1.08-1.09, per ISS unit)

• Mortality decreases with
  – RTS (OR=0.45, 95% CI=0.43-0.46, per RTS unit)
Limitations

- Records with missing demographic or clinical information not used
- Facilities missing physiologic data in >20% records not used
- Trauma centers not nationally representative
- Individual hospital characteristics not taken into account
- Distance and transport time not controlled for
- Mechanism of injury data not available
Conclusion

• HEMS associated with reduced mortality compared to ground ambulance
• Higher odds of death in males
• Odds of death increases with each year of age and each unit of ISS, decreases with each unit of RTS
Acknowledgements

• E. Brooke Lerner, Ph.D.
• Vikas Kapil, DO, MPH, FACOEM
• Jessica Gillis, MPH
• Beverly Carlson