To Air is Human

Chuck Burnell, MD, FACEP, FAAEM
Objectives

- Review current evidence based recommendations for Helicopter Emergency Medical Services utilization
- Understand the risk to benefit analysis used in HAA transport decision making
- Review Air Med aircraft configurations and flight crew
Current Evidence for Helicopter Air Ambulance Transport
Question is no longer: “Is there a benefit?"

- When adjusted for bias, a clear benefit appears for both adult and pediatric patient populations.
- Application of regression models and TRISS methodology both consistently show a survival benefit for severely injured patients (ISS > 15).
- HAA transport of rural trauma shows survival equal to ground transport of urban trauma.
Pre-hospital Trauma HAA transport to a Trauma Center

- Now we ask: “Which patients will benefit?”
  - Trauma is very heterogeneous
  - The problem is developing tools to identify which patients benefit the most from helicopter transport
- National Data shows aggregate benefit for trauma victims transported to a trauma center
- At local level, an individual benefit may also exist by bringing a higher level of experience, expertise or capability to the patient
- Studies looking at HAA transport time find a greater than predicted survival rate when matched to ground transport time out to 30 minutes
Selected Reading


Largest HAA study to date showed a 22% improvement in mortality for all ages and MOI using a nationwide sample from the National Trauma Databank

Secondary finding: “Overtriage” was < 15%

- 258,387 patients in study
  - 16% HAA, 84% GEMS
  - 43.5 % required ICU admission versus 22.9% OR 2.58 95%CI (2.53 -2.64)
  - 20.8% versus 7.4% required Mechanical Ventilation OR 3.30 95% CI (3.21 - 3.40)
  - HAA Positive Predictor of Survival OR 1.22 95% CI (1.17-1.27)
  - Positive predictor of discharge to home OR 1.05

TRISS based study comparing the outcome of 271 urban and 141 rural blunt trauma victims in Utah.

**Found no difference in survival** even though trauma in the rural setting is usually associated with worse outcomes. HAA appears to be an “equalizer.”
An Evidence-based Guideline for the Air Medical Transportation of Prehospital Trauma Patients

- 2013 guideline designed to provide evidence-based recommendation on the mode of transport for all prehospital trauma victims
  - Recognizes paramedic and non-physician EMS providers as decision makers in the field
  - Includes all types of trauma
  - Includes pediatric and adult victims
- Uses GRADE methodology
  - All data is low or very low quality due to lack of controlled, randomized studies

Recommendations:

1. Use anatomic, physiologic and situational components to make transport decision
   - Strong, Low quality

2. Not require on-line medical direction for patients that meet recommendation 1
   - Strong, Low quality

3. Use HAA to transport patients that meet recommendation 1 to a trauma center if there will be a significant time savings *
   - Weak, Low quality

   a. * Brown, et al (2016) found survival benefit without time savings...
2011 Guidelines for Field Triage of Injured Patients

**Step 1 - Measure vitals and assess LOC**
- GCS ≤ 13
- Bp < 90 mmHg
- Resp. < 10 or > 29 per min or need for ventilatory support (< 20 if < 1 year old)

**Step 2 - Assess anatomy of Injury**
- Penetrating injury to head, neck, torso or extremities prox to knee or elbow
- Chest wall instability or deformity
- 2 or > proximal long bone fx
- Crushed, degloved, mangled or pulseless extremity
- Amputation prox. to wrist/ankle
- Pelvic Fx.
- Open or depressed skull Fx
- Paralysis

Yes to any question in Step 1 or 2 - Transport to Level 1 Trauma Center
2011 Guidelines for Field Triage of Injured Patients

Step 3 - Assess MOI and evidence of high-energy impact

- Falls
  - Adults > 20 ft.
  - Children > 10 ft. or 2 or 3 times height

- High-risk MVA
  - Intrusion including roof 12 in occupied or 18 inches anywhere
  - Ejection or partial ejection
  - Death in same vehicle
  - Vehicle telematics

- Auto v. Pedestrian/ Bicycle
  - Thrown, run-over or significant (> 20 mph) impact
  - Motorcycle crash > 20 mph

If yes to any item, transport to a trauma center which does not have to be Level I
Step 4 - Assess Special patient or system considerations

- Older Adults
  - Risk significantly greater for >55 years
  - SBP < 110 may represent hypotension after age 65
  - Low energy impact may result in severe injury

- Children
  - Preferable to triage to Pediatric capable trauma center

- Anticoagulant and Bleeding disorders
  - High risk of rapid deterioration

- Burns
  - No other trauma - Burn center
  - With + trauma mechanism, Trauma Center

- Pregnancy > 20 weeks

- EMS Provider Judgement

Transport to a trauma center or hospital capable of timely and thorough evaluation and initial management of potentially serious injury
Meets any criteria from 2011 Guideline for Field Triage

NO

Meets any criteria in steps 1 or 2?

YES

NO

Significant time savings over GEMS?

YES

NO

Can be transported directly to TC by GEMS given system factors?

HAA

GEMS

YES
2016 research may change the time recommendation


Matched HAA to GEMS response and scene time cohorts and looked at survival over similar prehospital transport times. Helicopter transport showed a significant survival benefit for transport times between 6 and 30 minutes even when there was no time savings when compared to GEMS.

Theorizes that benefit may be due to skill levels, provider experience or greater treatment modality?
Air Medical Triage Tool (AMPT)

- AMPT developed in 2015 from 14 years of retrospective data with almost 250,000 records
- Prehospital trauma patients with AMPT score of < 2 did not benefit from HAA
- Scores ≥ 2 showed a HAA survival benefit of over 31%
- Externally validated in 2017 using a different data set

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS &lt; 14</td>
<td>1</td>
</tr>
<tr>
<td>Resp rate &lt; 10 or &gt; 29</td>
<td>1</td>
</tr>
<tr>
<td>Unstable chest wall</td>
<td>1</td>
</tr>
<tr>
<td>Suspected Hemothorax or Pneumothorax</td>
<td>1</td>
</tr>
<tr>
<td>Paralysis</td>
<td>1</td>
</tr>
<tr>
<td>Multisystem Trauma (&gt;2 regions)</td>
<td>1</td>
</tr>
<tr>
<td>Any other physiological or anatomical indicators from National Triage Guidelines</td>
<td>2</td>
</tr>
</tbody>
</table>
Interfacility Transport - Trauma


Includes a control group and includes all patients in a single trauma registry (avoids selection bias)

25% improvement in predicted mortality in HAA group with ISS > 12 in an ideal setting for HAA utilization. GEMS cohort had greater than expected mortality so actual decrease in mortality was 35%


First national level study comparing GEMS to HAA for interfacility outcome using National Trauma Bank data.

HAA was an independent predictor of survival for victims with ISS > 15. Data supports contention that at national level, providers are triaging high-severity patients to HAA.
Helicopter Utilization and Safety
Imagine that several times a year (approximately every 50,000 procedures) there was a cardiac catheterization lab accident in which the medical team (cardiologist, nurse and technician) perished along with their patient.

There would be an immediate outcry to make the procedure safer (technology, practices, safeguards) and reduce risk for the patient and providers. Second, all cath lab procedures would undergo intense scrutiny to assure appropriate utilization. Although such a scenario may seem outrageous, it is essentially the same risks that helicopter EMS (HEMS) crews face on a daily basis.

In fact, HEMS transport is the only medical procedure that holds a much higher morbidity and mortality for the providers than it does for the patient.

Abernathy, Bledsoe and Carrison, 2009
Critical Components of Air Medical Transport Programs

- IFR or VFR program
- Base Location Density
- Simultaneous Ground and Air Response (Auto launch and integration with 911 GEMS programs)
- Cost Efficiency - Variation in annual program costs ranging from $115,777 to $2,436,178
Safety Overview

Helicopter EMS crews have one of the highest risk occupations in the United States.

In 2006, Baker, et al. estimated that a flight crewmember flying 20 hours a week for 20 years had a 37% chance of being in a fatal crash which is 17 times higher than the US average for occupation related death.

FAA analysis shows that CFIT, Inadvertent IMC and lack of operational control, especially at night or in low visibility conditions are the predominate factors.

Fire remains the greatest predictor of post-crash mortality and flight between 7 pm and 6 AM is the biggest risk factor.
Modern HAA Dispatch and Control

Safety Recommendations

- Establish Risk Assessment Tools that involve consultation for higher-risk flights
- All HAA flights under Part 135
- Formal Flight Following and Dispatch
- Install Terrain Awareness and Warning systems
- Night Vision Use during nighttime operations

Risk Assessment Tools

- Flight Decision Making is no longer concentrated on the pilot by using a formal risk assessment process and flight release system
- Static Risk Factors
  - Pilot,
  - Equipment
- Dynamic Risk Factors
  - Weather
  - Time of Day
- Control Factors that can reduce risk
## Risk Assessment Example - Static Items

<table>
<thead>
<tr>
<th>Condition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 months on job</td>
<td>+1</td>
</tr>
<tr>
<td>&lt; 1yr in EMS</td>
<td>+1</td>
</tr>
<tr>
<td>&lt; 200 hrs in type</td>
<td>+1</td>
</tr>
<tr>
<td>&gt; 500 hrs in type</td>
<td>-1</td>
</tr>
<tr>
<td>Last flight &gt; 30 days</td>
<td>+1</td>
</tr>
<tr>
<td>Last Night Flight &gt; 30days</td>
<td>+1</td>
</tr>
<tr>
<td>6 months since checkride</td>
<td>+2</td>
</tr>
<tr>
<td>Not configured for IMC</td>
<td>+1</td>
</tr>
<tr>
<td>MEL Items</td>
<td>+1</td>
</tr>
</tbody>
</table>

### Backup Aircraft
- +1

### New Equipment installed
- +1

### NVG Equipped
- -1

### < 3 NVG flights in last 120 days
- +1

### Medical Crew < 3yrs
- +1

### IFR Program
- -4

### VFR Program
- +1

### External Stress
- +1

### Total Static Score
- 

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North Oaks Trauma Symposium
Friday, November 3, 2017
### Risk Assessment Example - Dynamic Items

<table>
<thead>
<tr>
<th>Condition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling 200 ft of min</td>
<td>+1</td>
</tr>
<tr>
<td>Viz within 1 mile of GOM min</td>
<td>+1</td>
</tr>
<tr>
<td>Pricip with convext activtity</td>
<td>+1</td>
</tr>
<tr>
<td>Convect activity + Front pass</td>
<td>+1</td>
</tr>
<tr>
<td>Deteriorating Wx. Trend</td>
<td>+1</td>
</tr>
<tr>
<td>High Winds/ Gust Spread</td>
<td>+2</td>
</tr>
<tr>
<td>Moderate Turbulence</td>
<td>+2</td>
</tr>
<tr>
<td>Narrow Temp/ Dew point (3°F)</td>
<td>+1</td>
</tr>
<tr>
<td>Fog/ Snow/ Ice forecast</td>
<td>+2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather reporting at Destination</td>
<td>-1</td>
</tr>
<tr>
<td>Mountainous or hostile terrain</td>
<td>+1</td>
</tr>
<tr>
<td>Class B or C Airspace</td>
<td>+1</td>
</tr>
<tr>
<td>Ground Ref High</td>
<td>-1</td>
</tr>
<tr>
<td>Ground Ref Low</td>
<td>+1</td>
</tr>
<tr>
<td>Night Flight</td>
<td>-4</td>
</tr>
<tr>
<td>80 % of Fuel required</td>
<td>+1</td>
</tr>
<tr>
<td>Flight refused by other program</td>
<td>+4</td>
</tr>
</tbody>
</table>

**Total Static Score**
### Risk Assessment Example - Control Measures

<table>
<thead>
<tr>
<th>Control Measure</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay for Better Conditions</td>
<td>-1</td>
</tr>
<tr>
<td>Route to avoid haz terrain</td>
<td>-1</td>
</tr>
<tr>
<td>Use pre-designated LZ</td>
<td>-1</td>
</tr>
<tr>
<td>Plan Alternate Fuel</td>
<td>-1</td>
</tr>
<tr>
<td>Familiar with Area</td>
<td>-1</td>
</tr>
</tbody>
</table>

### Example Go / No-Go Matrix

<table>
<thead>
<tr>
<th>Risk category</th>
<th>Category</th>
<th>EOC Action</th>
<th>Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Green</td>
<td>Pilot Approval</td>
<td>0-14</td>
</tr>
<tr>
<td>Elevated</td>
<td>Yellow</td>
<td>Operation Approval</td>
<td>15-18</td>
</tr>
<tr>
<td>Unacceptable</td>
<td>Red</td>
<td>Cancel/Refuse</td>
<td>&gt;18</td>
</tr>
</tbody>
</table>
Air Med Overview

- Program launched in 1981, providing response to Louisiana’s rural areas and offshore industry.
- Today, provides emergency and interfacility responses in Louisiana and SE Texas, flying more first response missions than any other air medical service in the US.
- Operates a fleet of modern, multi-engine, IFR capable aircraft
  - Average fleet age 12 years
  - Improved efficiency and Safety
  - Color Wx. Radar, Terrain Warning
  - > Mission Range and Speed compared to older EMS aircraft
  - Greater useable payload for teams and specialty care
Air Med Overview

- Contracted rates with all major third-party payors
  - Minimal out of pocket expense to patients

- Simultaneous dispatch via integrated Ground and Air dispatch system from multiple bases spaced strategically throughout the coverage area
  - Ability to dispatch multiple aircraft if needed

- Response can be generated by EMS, Law Enforcement, Fire or initiated internally by dispatch when significant indicators of need are reported
  - Rollover
  - Multi-patient
  - Limited access such as Basin Bridge, Spillway

- High level of integration between air and ground response provides a coordinated response and ensures continuity of care
Rotor Wing Coverage Area (50 mile radius shown)

Air Med 6- Hammond

Air Med 21- Silsbee TX

Fixed

chris.mixon@acadian.com

AM6 is now located in Hammond; not sure if a new graphic is available I made the graphic, I can recreate as needed. I'll move that dot.

North Oaks Trauma Symposium
Friday, November 3, 2017
American Trauma Society
Level 1 and II trauma centers with 75 statute mile radius
Aircraft

EC-135

- Full IFR instrumentation
- Three-axis autopilot reduces pilot workloads
- Night-vision allows the ability to navigate through dark expanses
- Satellite tracking in Operational Control Center
- Traffic collision avoidance system (TCAS)
Aircraft

EC-135

- Helicopter terrain warning avoidance systems (TAWS)
- Honeywell's state-of-the-art WU 660 weather and obstacle radar
- Advanced communications
  - Interoperability with Louisiana Radio Network
- Satellite Communications
- Digital voice-to-text communications capability
Aircraft

Lear 45
- Certified flight level 51,000 ft
- Cruise speed: 535 mph
- Maximum speed: 570 mph
- Maximum range: 2,049 miles

King Air B-200
- Certified flight level 35,000 ft
- Maximum speed: 270 mph
- Maximum range: 1,200 miles
Crew

Dual Provider:

Critical Care Flight Paramedic

Flight RN/ RN Paramedic

IFR Certified Pilot

Specialty Care Team (NICU / PICU)

Emergency Medicine Physicians
Night landing Zones

- Annual NLZ Coordinator training provided to local first responders

- Direct communication between the Air Med crew and the NLZ Coordinator via radio ensures a landing zone free of hazards or obstructions

- Crew members are equipped with Night Vision goggles, providing an extra layer of safety while landing in unimproved areas
Gulf of Mexico

- Hundreds of offshore platforms located in remote areas surrounded by vast open water necessitate helicopter response in an emergency.

- Four bases along the Gulf coast provide 24/7 coverage to offshore personnel, with the ability to call on a long-range SAR helicopter for more challenging missions where hoisting capability may be required.

- Offshore Fuel Reserves allow greater mission capabilities.
Air Med Operations Center

- Coordinates emergency response between AirMed and multiple agencies

- Provides flight following for the AirMed fleet; in contact with each active helicopter every 15 minutes of flight

- Working with emergency call-takers, triage through over 1,000 calls per day to provide helicopter response to the most critical patients

- Auto-launch
  - Reduces response time and out of hospital time
  - Increased patient benefit due to access (only 40% capture)

- AMOC - 911 integration results in highly efficient use of helicopter and ground resources

- Medical Direction and protocols are
Questions?