An Analysis of HEMS Accidents and Accident Rates

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NTSB Report, 1988*

- 59 HEMS accidents
  - 47 patient missions
  - 12 “other”
- Accident rates
  - 12.34/100,000 flight hours
  - *Nearly double other Part 135*
- Fatal Accident rates
  - 5.4/100,000 flight hours
  - *Nearly 3.5 times other Part 135*

* “Safety Study – Commercial Emergency Medical Service Helicopter Operations”
HEMS Accidents Rates / 100,000 Flight Hours
“You can’t manage what you can’t measure”
Our Study: 2002, 2005-2008

- Determine the magnitude of the HEMS “risk”
  - Accident rates
  - Fatal accident rates
  - Death rates
- Compare the risk to
  - Other occupations
  - High risk activities
U.S. HEMS Accidents and Fatal Accidents

NTSB report

Total Accidents Fatal Accidents

*Dedicated and dual-purpose through December 31, 2008*
Accidents and Injuries: 1972-2008

- 264 accidents
  - 256 dedicated HEMS
  - 8 dual-purpose aircraft
  - 98 (of 264) with fatalities
- 797 individuals
  - 264 fatalities
  - 89 serious
  - 104 minor
  - 340 uninjured

through December 31, 2008
Focus: 1998-2008

- 146 HEMS accidents
  - 55% off all HEMS accidents since 1972
  - 141 dedicated HEMS
  - 5 dual purpose
  - 50 (of 146) fatal
    - 47 HEMS
    - 3 dual purpose

through December 31, 2008
Focus: 1998-2008

- 430 individuals
  - 131 fatalities
    - 105 HEMS crewmembers
    - 6 dual purpose crewmembers
    - 16 patients
    - 4 others
  - 49 serious
  - 42 minor
  - 208 uninjured
HEMS: 1998-2008 (146 accidents)

Avg. accidents/yr 1988-1997: 5.0

98-08: 12.4

Fatal Accidents: 4.5

Flying more...?  
...or flying less safe?

Dedicated and Dual-purpose through December 31, 2008
Percentage of Fatal Accidents

*Dedicated and Dual-Purpose aircraft*

Fatal Accidents: 39% 46% 34%
When and Why?

- Night: 49% of the accidents
- Scenes: 49% of the accidents during patient-related missions

1998-2008
When and Why?

- Probable cause...
  - “Human error” – 77%
    - Weather-related
    - Collision with objects
  - Mechanical – 17%
  - Other – 3%
  - Undetermined – 2%
**When and Why? 1998-2008**

- **In flight collision with objects**
  - 33 accidents*(3.3/yr)
  - 3 fatal
- **CFIT**
  - 21 accidents*(2.1/yr)
  - 19 fatal
- **54 of 128 = 42% of all accidents** (*with final reports*)
- **1990-1998 – 8 (Frazer)**
  - < 1/yr
  - 8 of 45 = 18% of all accidents
When and Why?

- Weather-related accidents
  - 19% of all accidents
  - Fatal Accidents
    - 56% of weather-related accidents were fatal (compared to 34% of all accidents having a fatality)
Accident Data vs. Rates

- Raw numbers
- Meaningful comparison
  - Compare like groups
  - Normalized data
  - Accident or incident rate
    - Per 100,000 flight hours
    - Per 100,000 departures
    - Per 100,000 patients transported
    - Etc.
HEMS Accident and Fatal Accidents Rates

Number of accidents and fatal accidents

Normalized Data

*Number of hours flown

Exposure data* for each year
**Methodology**

- **2000-2002**
  - Determine exposure data for 16 of 22 years (1980-2001)
  - Published data, surveys, etc.
  - Web survey
  - Operator survey (5)
  - Manufacturer survey
  - Database analysis (ADAMS, AMT-R)
  - Operator survey (9, 15, 20)
“Exposure” Data Collection:
Operator Survey

- 2002: 5 largest operators
- 2005, 2006: 9 operators with > 10 helicopters
- 2007: 15 operators with > 5 helicopters
- 2008: 20 operators

Limitations
- Lack of available data for earlier years
- Paper trail vs. computer
- “End of fiscal year” data
Data Sampling

- Programs
  - ~80% of all programs
- Helicopters
  - ~90% of all helicopters
Average Flight Hours per Helicopter

Published Data

'02 Calculations/AMJ Surveys (response rate 33-96%)

'08 Operator Survey (sampling ~90%)
HEMS Total Flight Hours

Estimated Total Flight Hours, 1972-2007: 4,700,000
AVIATION SAFETY

Improved Data Collection Needed for Effective Oversight of Air Ambulance Industry
“FAA estimated that air ambulances amassed about 900,000 flight hours annually from 1999 to 2003 and that the number of flight hours increased to 1.6 million in 2004. However, as noted, the reliability of these estimates is questionable, given various shortcomings . . .”
1999-2003

- 900,000 flight hours (FAA/GAO)
  - 443 helicopters (OSI-HEMS)
  - $2,031$ hrs per helicopter
- Operator survey (OSI-HEMS)
  - Capturing $>90\%$ of the helicopters
  - $587$ hrs per helicopter
  - Estimate 260,000 total flight hours
2004

- 1,600,000 flight hours (FAA/GAO)
  - 513 helicopters (OSI-HEMS)
  - ≈ 3,119 hrs per helicopter
- Operator survey
  - Capturing >90% of the helicopters
  - 571 hrs per helicopter
  - Estimate 293,000 total flight hours
### Average Patients Flown per Helicopter

<table>
<thead>
<tr>
<th>Year</th>
<th>Published Data</th>
<th>Calculations/AMJ Surveys (response rate 33-96%)</th>
<th>Operator Survey</th>
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Estimated Total Patients Flown, 1972-2007: 4,300,000
Accident Rates

Flight Hours per Year

Accidents per Year

Patients Flown per Year

Fatal Accidents per Year
HEMS Accidents Rates
/ 100,000 Flight Hours

Dedicated HEMS
through December 31, 2008
HEMS Fatal Accident Rates
/ 100,000 Flight Hours

Dedicated HEMS through December 31, 2008
A Comparison of HEMS to Other Types of Aviation in the U.S.
Fatal Accidents Rates / 100,000 Flight Hours

HEMS
Helicopter
General Aviation
135 Nonscheduled
135 Scheduled
121 Nonscheduled
121 Scheduled
A Comparison
Of Individual Risk
Determining Risk

Number of crew injuries or fatalities per year

*Number of crew members engaged in HEMS transport
High-Risk Occupations, 2007

- Fishers and related fishing workers: 111.8
- Logging workers: 86.4
- Aircraft pilots and flight engineers: 66.7
- Structural iron and steel workers: 45.5
- Farmers and ranchers: 38.4
- Roofers: 29.4
- Electrical power-line installers/repairers: 29.1
- Coal mining: 28.4
- Driver/sales workers and truck drivers: 26.2
- Refuse and recyclable material collectors: 22.8
- Police and sheriff’s patrol officers: 21.4

Source: Bureau of Labor Statistics
Census of Fatal Occupational Injuries, 2007
Population at Risk

- Average number of crew members / RW (18)
- For 2008: ~12,000
- Average crew members
  - Full-time vs. Part-time
    - Assumes equal exposure for all
- Average flight program
HEMS Crew* Fatalities

*With no information on population at risk, dual purpose fatalities are not included in calculations

Thru December 31, 2008
Results, 1980-2008

- 264 total fatalities
  - 34 patients
  - 10 dual-purpose crew members
  - 7 others
  213 dedicated HEMS crewmember deaths

- Population at risk over 29 years
  - Range: estimated 700 – 12,000
  - A very small sampling
HEMS Crew Fatalities / 100,000 Personnel

Range: 0-806/100,000
29-yr average: 212/100,000
10-yr average: 113/100,000
High-Risk Occupations, 2007

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<th>2008 Fatality Rate (per 100,000 employees)</th>
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<td>HEMS Crew (Dedicated)</td>
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<td>Structural iron and steel workers</td>
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HEMS: The Risk to the Patient

- 29-year study
- ~ 4,500,000 patients flown by HEMS
- 34 patients have died in HEMS accidents
- Death rate: 0.76/100,000 patients flown
Institute of Medicine, 1999

- Estimates of two major studies
- 44,000-98,000 deaths each year due to adverse events
- Death rate: 131-292/100,000 pts per year
In conclusion...

- Crunched the numbers
- Validated the magnitude of the risk
  - Aircraft
  - Personnel
  - Patient
  - Community
- We have the ability to save lives—and take them
- We have the ability to make a difference—each and everyone of us
Thank you