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# Air Medical Flights: Angels of Mercy or Angels of Death?

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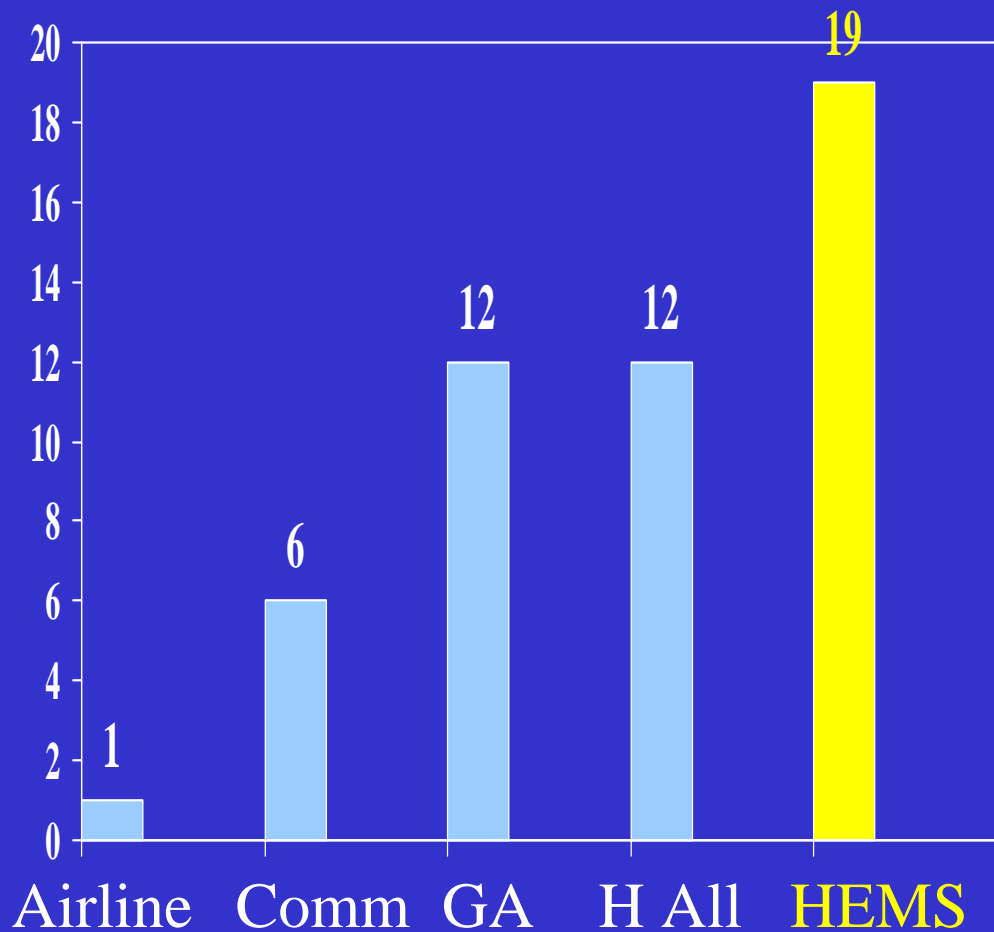
# Occupational Deaths/100,000/yr

## U.S., 1995-2001

All workers	5
Farming	26
Mining	27
Air medical crew	74

# Fatal Crashes/Million Flight Hours, 2001

A Safety Review and Risk Assessment in Air Medical Transport, AMPA, 2002



- Comment: EMS helicopter (HEMS) crashes are more likely to occur at night or in bad weather than crashes of non-EMS helicopters.

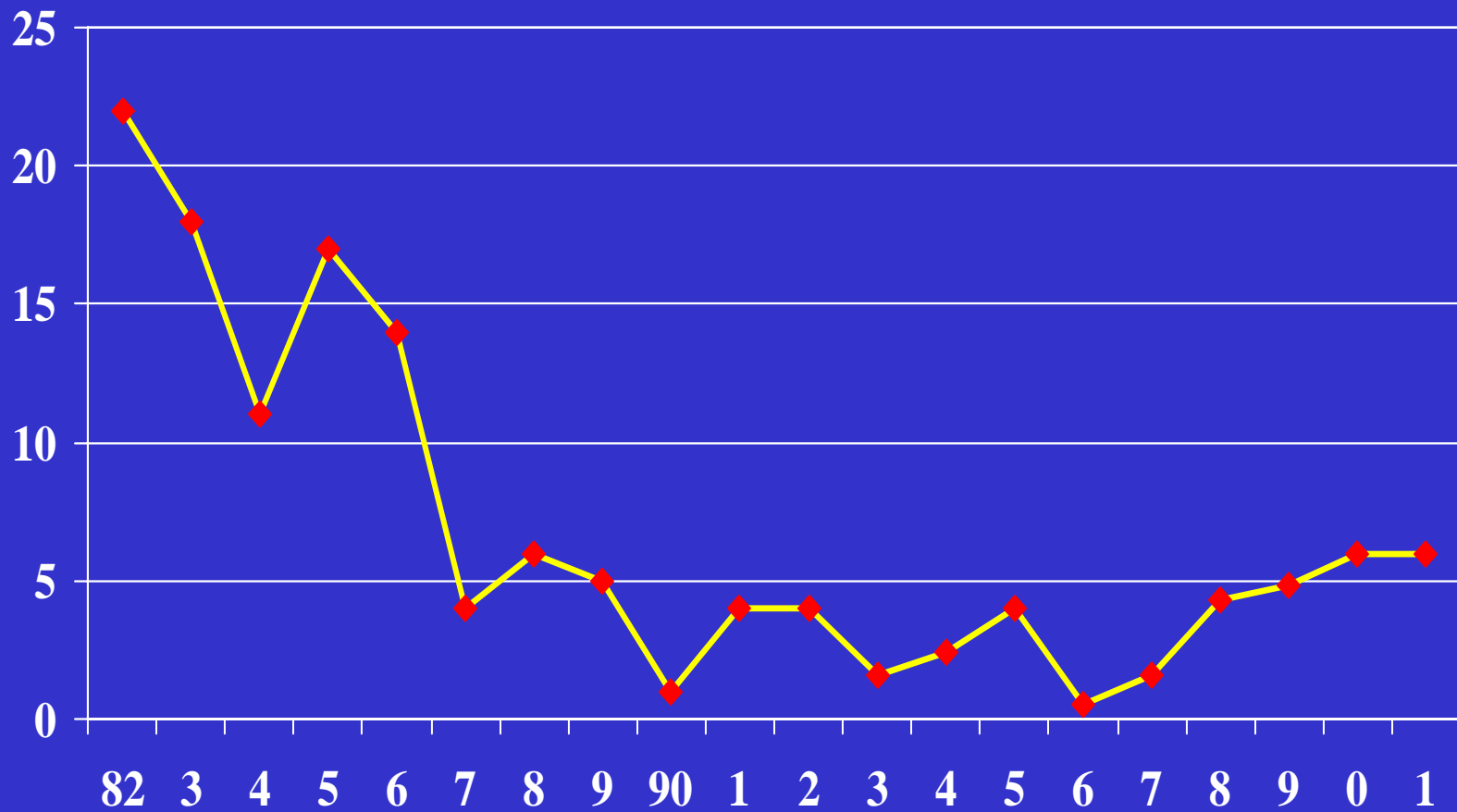
- H All = all helicopters

Based on 19 fatal crashes/ million flight hours

An EMS helicopter (HEMS) pilot or crew member flying 20 hours/week for 20 years would have a 40% chance of a fatal crash.

# HEMS Crash Rate/100,000 Patient Transports

1972-2001; Source AMPA, 2002



# Air Medical Flights - 46 Crashes

1/1/2002 – 8/21/04

- 17 crashes were fatal
- 42 deaths
  - including 5 patients
- 22 crew seriously injured
  
- 37 helicopters, 9 airplanes
- 1 public use helicopter, 45 commercial aircraft

# Case-fatality rates

- 36% of patients died in the crashes
- 9% of crew members died
  
- 37% of crashes were fatal
- (18% of non-EMS helicopter crashes are fatal)

# Air Medical Flights - 46 Crashes\*

1/1/2002 – 8/21/04

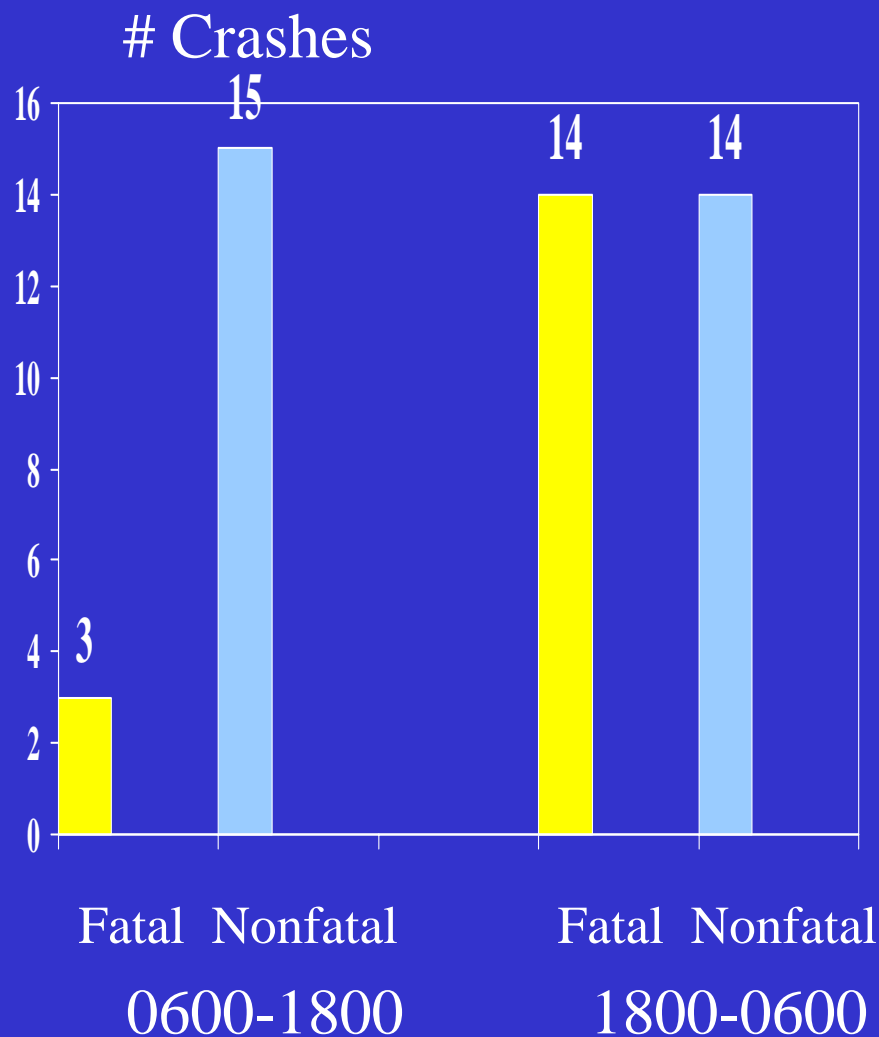
## MISSION:

- 14 (30%) transporting patient
- 15 (33%) going to pick up patient
- 17 positioning, returning to base, etc.

\*excludes flights for fuel, training, maintenance

# Fatality by Time of Day

46 Air Medical Crashes, 1/1/2002- 8/21/04



- 17% of day crashes were fatal
- 50% of night crashes were fatal

# Nighttime Crashes

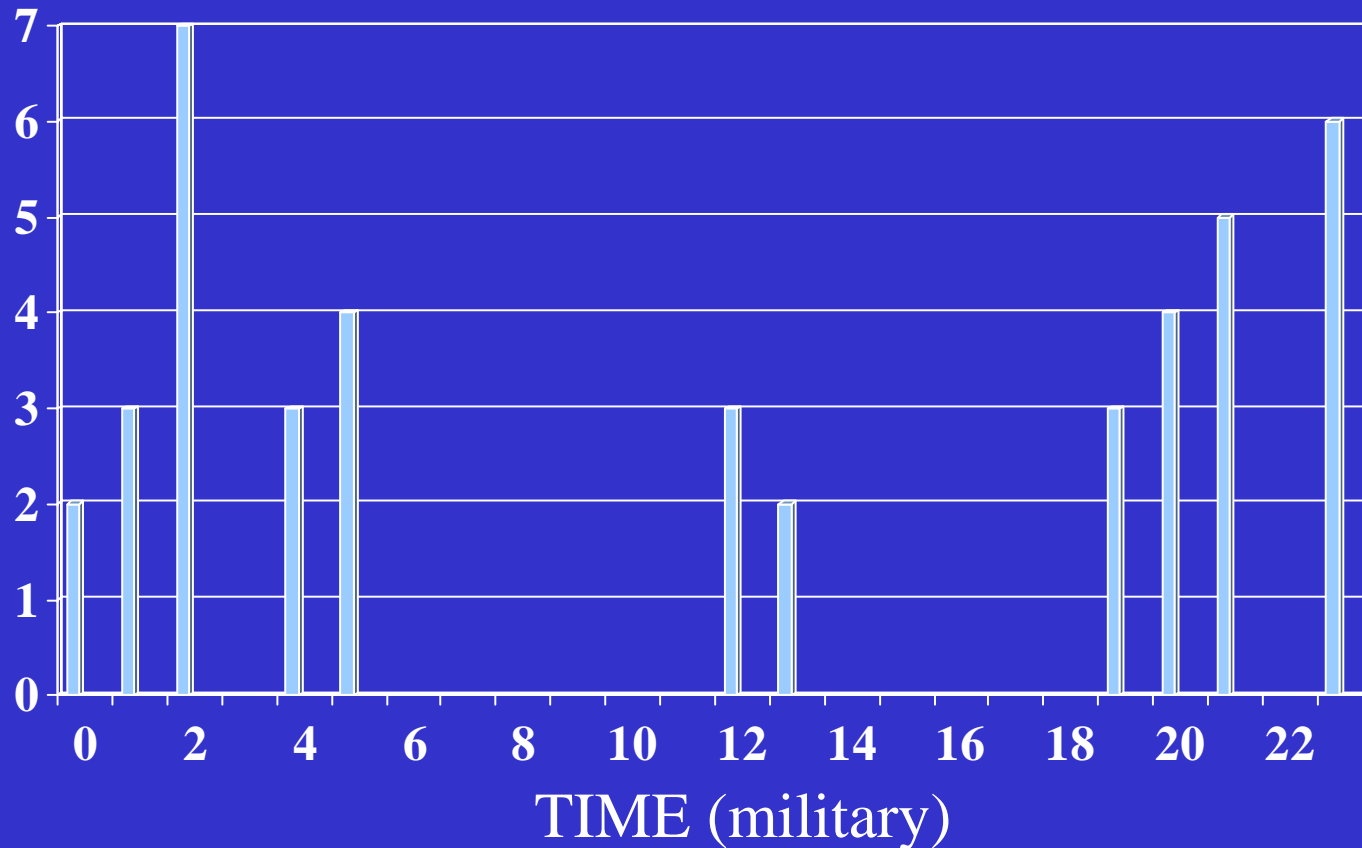
46 Air Medical Crashes, 1/1/2002- 8/21/04

- 61% of the crashes were at night
- 82% of fatal crashes were at night
  
- 38% of HEMS flights are at night
  - Based on published data for 1982-2001

# # Deaths by Time of Day

46 Air Medical Crashes, 1/1/2002- 8/21/04

# deaths



# Three Phases of Injury Control

- **PRE-EVENT** – prevent the event from occurring
- **EVENT** – reduce injury during an event
- **POST-EVENT** – minimize death and other sequelae of the event

## The Haddon Matrix – Examples re Air Medical Crashes

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	Experience Alcohol Fatigue	Instruments Autopilot	Structures Weather	ATC Management pressure
<b>CRASH</b>	Restraint, helmet, & Nomex use	Restraint dsgn. EA seats Cabin mods.	Trees Buildings	Aircraft design regs.
<b>POST- CRASH</b>	Physical condition	Crashworthy fuel system	EMS access	Medical system

# Battle Mountain NV 8/21/04

- Transporting infant from hospital to medical center
- **Dark** VMC @2358 h, cloud cover
- **Struck mountain** @8,644 feet MSL
- Pilot, 2 medical crew, infant and mother killed

# Battle Mountain

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	<b>X</b>	<b>X</b>	<b>X</b>	
<b>CRASH</b>				
<b>POST- CRASH</b>				

Cleveland



# Cleveland OH 1/18/02

- Crashed on departure to pick up patient
- 10 ft wall next to helipad, **16 floor building nearby**
  - **windsocks** gave different readings
- **Tailwind plus sudden gust** of wind on takeoff carried them into building
  - Reported winds 25k gusting to 30k
  - **Manual warned against TO/landing with winds >17k**
- Dropped 13 floors
- Pilot and nurse killed, medic badly **burned**

# Cleveland

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	X		XX	
<b>CRASH</b>		X		X
<b>POST- CRASH</b>		X		X

# Miami FL 8/31/02

- **Buildings** surrounded departure path from hospital helistop
  - Climbout between office bldg and parking garage
- Copilot: “*every takeoff is a maximum performance takeoff*”
  - **Management**: “I know it is really tight in there, but *deal with it* because we need the work.”
- Struck parking garage, hard landing in street
- 1 serious and 3 minor injuries

# Miami

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>			<b>X</b>	<b>X</b>
<b>CRASH</b>		<b>?</b>		
<b>POST- CRASH</b>				

“**Competition** is the dragon in disguise for faulty decision making, cutting safety corners, eliminating safety infrastructure, training and education, and general apathy toward developing a safety culture.”

Michelle North, AMPA 2002

# Pressures on Pilots

EMS Line Pilot Survey, 2001

- Undue pressure from
  - Management, dispatch, flight crews themselves
- Pressure to
  - Speed response or lift-off times
  - Launch/continue in marginal weather
  - Fly when fatigued or ill

# Salt Lake City 1/10/03

- Tried to reach MVC site, returning to SLC at 2050h due to wx, **dense fog**
- Another EMS pilot had given up due to wx
  - **Black box:** *“Air Med got sent out for this same damn thing and turned back due to low visibility -- then the dispatcher called US to go out!”*
- Pilot then reported inadvertent IMC, declared an emergency -- and crashed.
- Pilot and medic killed, nurse seriously injured
- Helicopter pilot for 17 years, EMS pilot for >5

# Salt Lake City

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>			<b>X</b>	<b>X</b>
<b>CRASH</b>		<b>X</b>		<b>X</b>
<b>POST- CRASH</b>				

# Susanville CA 3/21/02

- Flying above glassy lake, **disoriented** by reflected clouds
- Gradually flew lower until collided with lake
- 2.5 miles from shore
- Captain killed (**went thru canopy**)
- Nurse and medic seriously injured
- **How were they rescued?**

# Susanville

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	X	X	X	
<b>CRASH</b>		X		X
<b>POST- CRASH</b>	X	X	X	X

# Nipton, CA 9/7/02

- At 0401 h, maneuvering near MVC site to pick up injured
- Trying to locate reasonable landing site
- **Main rotor blade separated** – ‘probable cause’
- Pilot had 62 mg/dL **ethanol**
- Pilot and two crew killed

# Nipton

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	?	X	X	?
<b>CRASH</b>				
<b>POST- CRASH</b>				

# Lexington KY 8/30/02

- Learjet taking passenger for medical treatment
- Upon landing, thrust reverser and brakes failed
- Drag chute not deployed
- Plane went beyond runway end
  - hit wooden structure with ILS antennae and lights
- Post-crash fire
- Patient was killed; 4 seriously injured

# Lexington

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	<b>X</b>	<b>X</b>		<b>?</b>
<b>CRASH</b>	<b>X</b>		<b>X</b>	
<b>POST- CRASH</b>		<b>X</b>		<b>X</b>

# Weather and HEMS Crashes

A Safety Review and Risk Assessment in Air Medical Transport, AMPA, 2002

- A factor in one-fourth of all crashes
- Fatalities in:
  - 76% of weather-related crashes
  - 37% of non-weather crashes

# Clyde TX 2/20/03

- Going to pick up patient for transfer
- Paramedic suggested abandoning mission based on weather map
- Weather deteriorated, paramedic repeatedly asked pilot to abort flight
- Pilot descended too fast through clouds, broke out at 50 ft
- Pilot unable to slow descent, crashed in road
- Paramedic injured

# Clyde

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	<b>XX</b>		<b>X</b>	
<b>CRASH</b>				
<b>POST- CRASH</b>				

# Recommendations

Air Medical Safety Advisory Council, 2000

AMPA, 2002

High effectiveness, high feasibility

- Improve night flying training
- Improve mountain flying training
- Install terrain avoidance warning system
- Install radar altimeters
- Improve weather briefings

# Recommendations

Air Medical Safety Advisory Council, 2000

AMPA, 2002

High effectiveness, moderate feasibility

- IFR proficiency checks
- Improved understanding of weather briefings
- Improved overall training
- Moving map displays of wx and terrain
- Standardized cockpits
- National criteria for marking towers & wires

# Recommendations

Air Medical Safety Advisory Council, 2000

AMPA, 2002

High effectiveness, low feasibility

- Heads-up displays
- Night vision devices
- Change corporate mindset
- Improve safety culture

# “Most Effective” Recommendations of AMSAC

AMPA, 2002

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	11222	112233	12	33
<b>CRASH</b>				
<b>POST- CRASH</b>				

Feasibility: 1=high, 2=moderate, 3=low

# Likely factors in the above 8 flights

<b>FACTOR PHASE</b>	<b>HUMAN</b>	<b>AIRCRAFT and EQUIPMENT</b>	<b>PHYSICAL ENVIRON- MENT</b>	<b>SOCIAL/ CULTURAL ADMIN ENV.</b>
<b>PRE- CRASH</b>	XXXXXX XX	XXXX	XXXXXX XXX	XXXX
<b>CRASH</b>	X	XXXX	X	XXX
<b>POST- CRASH</b>	X	XXX	X	XXX

# The Bottom Line

- About 16 deaths per year
- About 130,000 patient transfers per year
- Can this ratio be improved?
  - Fewer flights
    - Stiffer criteria, minimums
    - More reliance on ground transport, esp. at night
  - Require autopilot
  - Improve crashworthiness
  - Reduce competition and time pressure
  - Improve safety culture

# HEMS Crash Rate/100,000 Patient Transports

1972-2000; Source AMPA, 2002; plus estimate for 2002-04

