Aircraft Impact and Injury Patterns in US Army Aircraft Accidents from 1983 to 2005:

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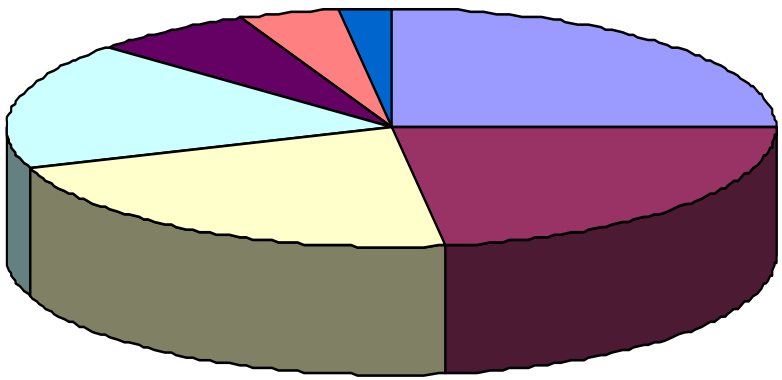
Relationship Between Crash and Injuries

- Government and Industry
  - Transformed Interior Design over last 30 years through large investment of money and effort
  - Crashworthy Features / Dynamic Load Requirements for Seats
- What have we Achieved? How to Prioritize Future?
  - Accident Data: Feedback to Measure effects of crashworthy design
- Public increasingly Aware of Aviation Crash Safety, especially for expanded use of Regional, Air Taxi, and Very Light Jet operations
- Study Objectives
  - Evaluate the unique Crash AND Injury Data that exists
  - Illustrate how data can measure crashworthy cost/benefit
  - Recommend preparation for future safety questions

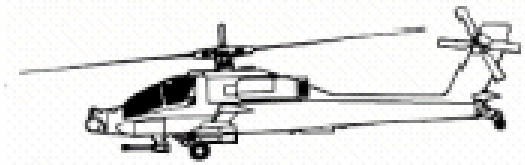
Methods / Data Source

- US Army Combat Readiness Center (USACRC) at Ft Rucker AL. Accident Database
- Non Combat Accidents, 1983 – 2005; 20G and Above
- Accident Evaluation
  - Impact Orientation – Frequency of Fwd/Aft Up/Down Left/Right
  - Proportion of Direction to Total
  - Impact Magnitude: What accelerations were Fatal / Non-Fatal?
- Occupant Injury Evaluation
  - Injury Distributions
  - Injury compared to Acceleration
- Discussion / Conclusions

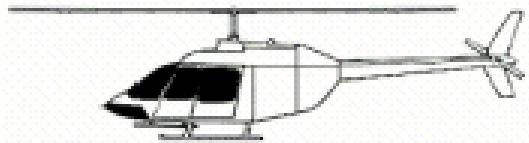
Aircraft Types



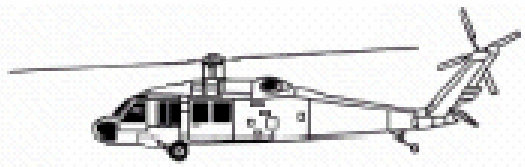
- AH64: 23%
- OH58: 21%
- UH60: 20%
- UH1: 16%
- CH/MH 47: 6%
- AH1: 4%
- other: <2%



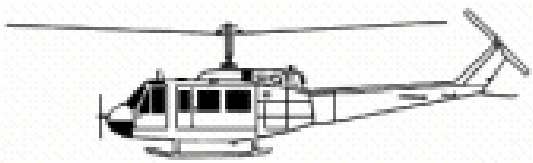
AH64 Apache



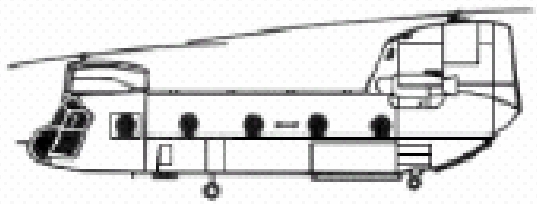
OH58 Kiowa



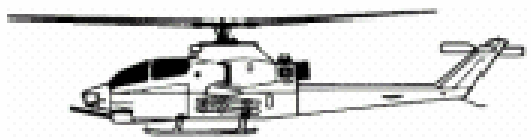
UH60 Blackhawk



UH1 Huey

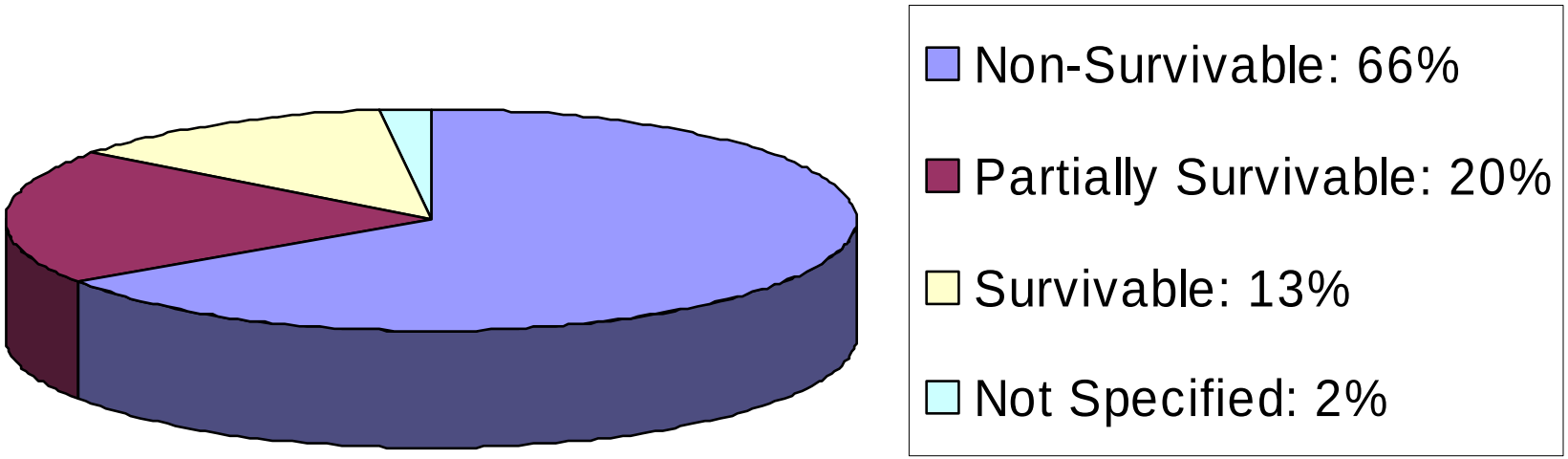


CH/MH 47 Chinook



AH1 Cobra

Aircraft Severity



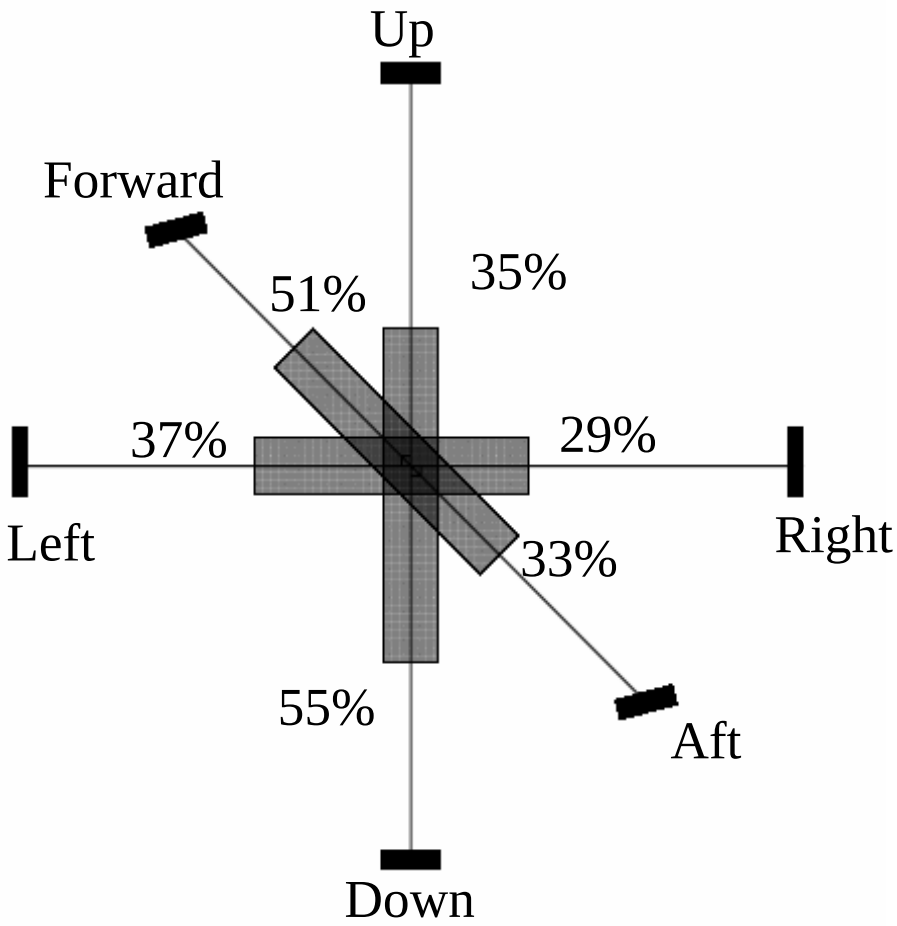
Occupants

- 606 Occupants, 98% Male, 1.6% Female, 0.4% Unspec.

  Fatal 67% Non-Fatal 33%

- 2,236 Injury Listings Evaluated (Fatal: 1,635; Non-Fatal: 601)

Accident Orientation



Frequency of Accident Listings per Impact Vector (reported by investigator)

- All Directions Significant
- General for Rotorcraft

  If: Specific Aircraft or Mission Evaluated….

  Then: Orientation and Injury Patterns are Expected to be Directional

Ratio: Component / Total Impact

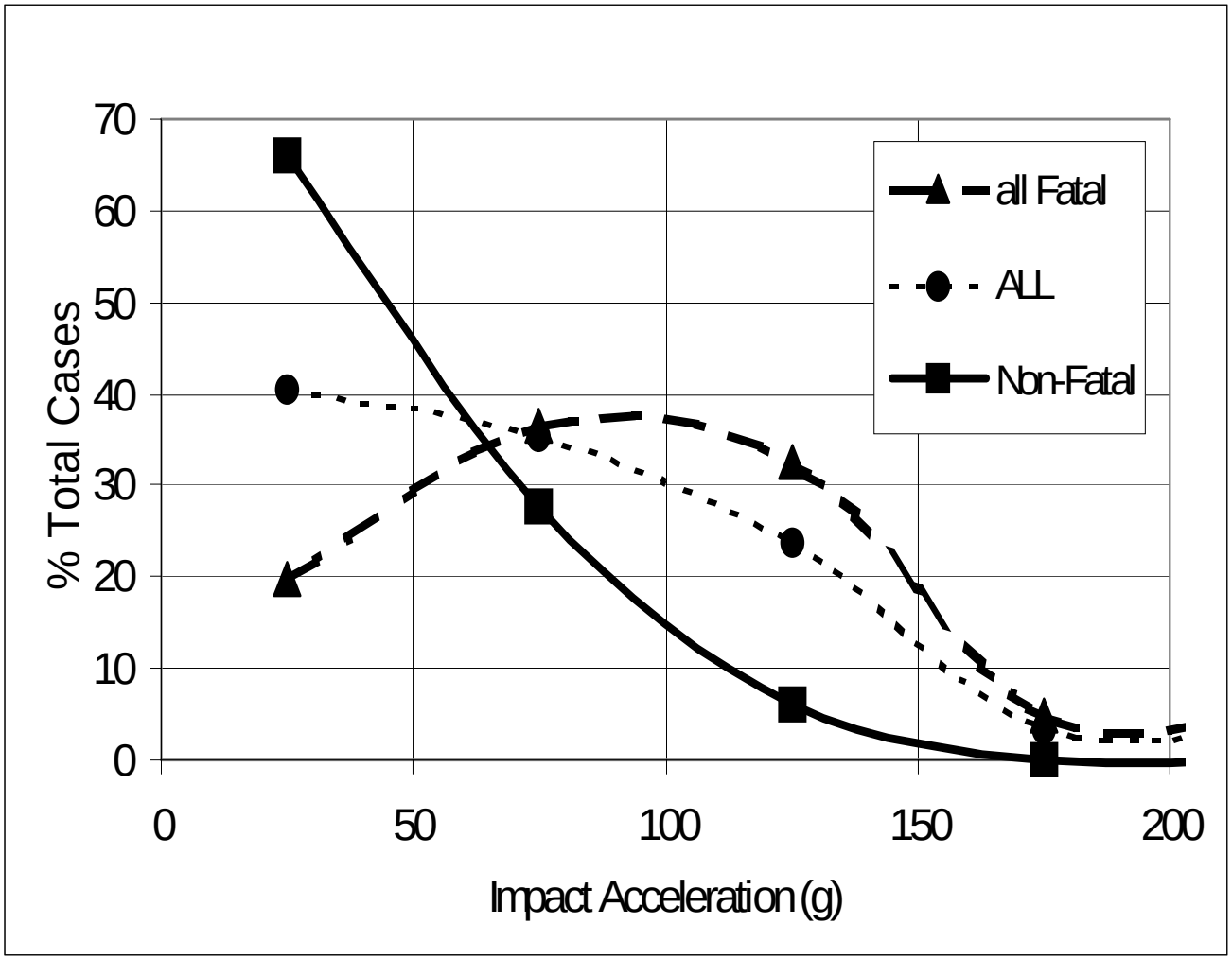
Vertical: **Often a Majority of Total**

Longitudinal: **Evenly Split Across Severity Range**

Lateral: **Small Portion of Total (except in minor acc.)**

Percentile	Left	Right	Fwd	Aft	Up	Dwn
Bottom Third (Ratio = 0 to 0.33)	56%	71%	40%	33%	23%	30%
Middle Third (Ratio=0.34 to 0.67)	23%	16%	26%	25%	8%	9%
Top Third (Ratio = 0.68 to 100)	21%	14%	34%	42%	69%	61%

Impact Magnitude

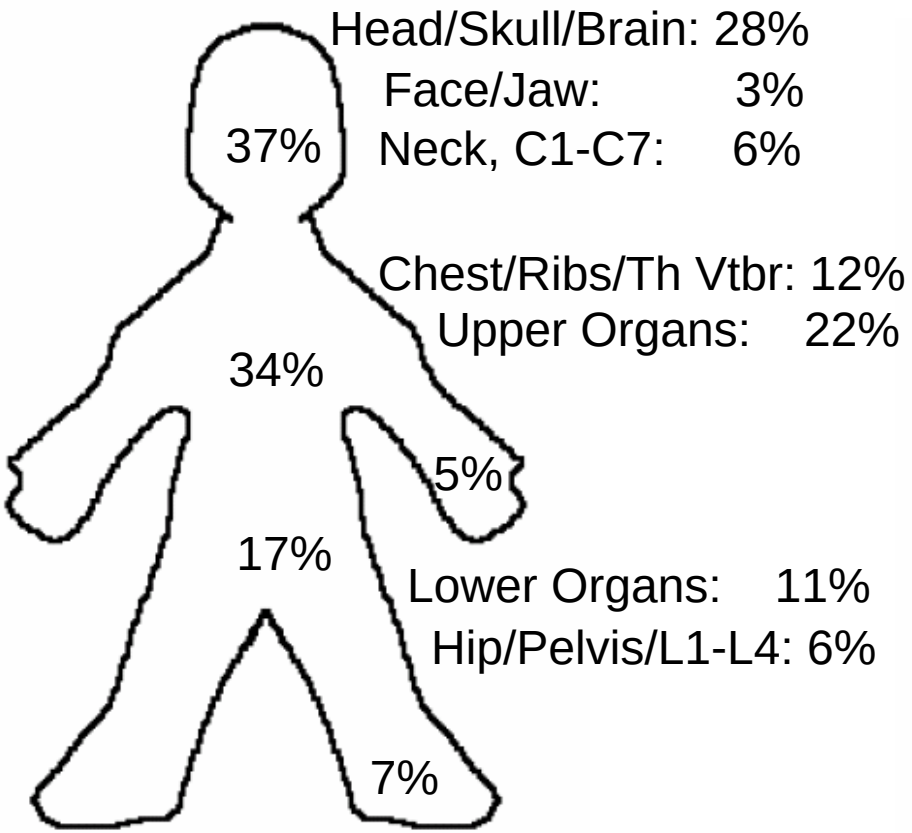


Fatal Case Listings Most Common at ~ 100g

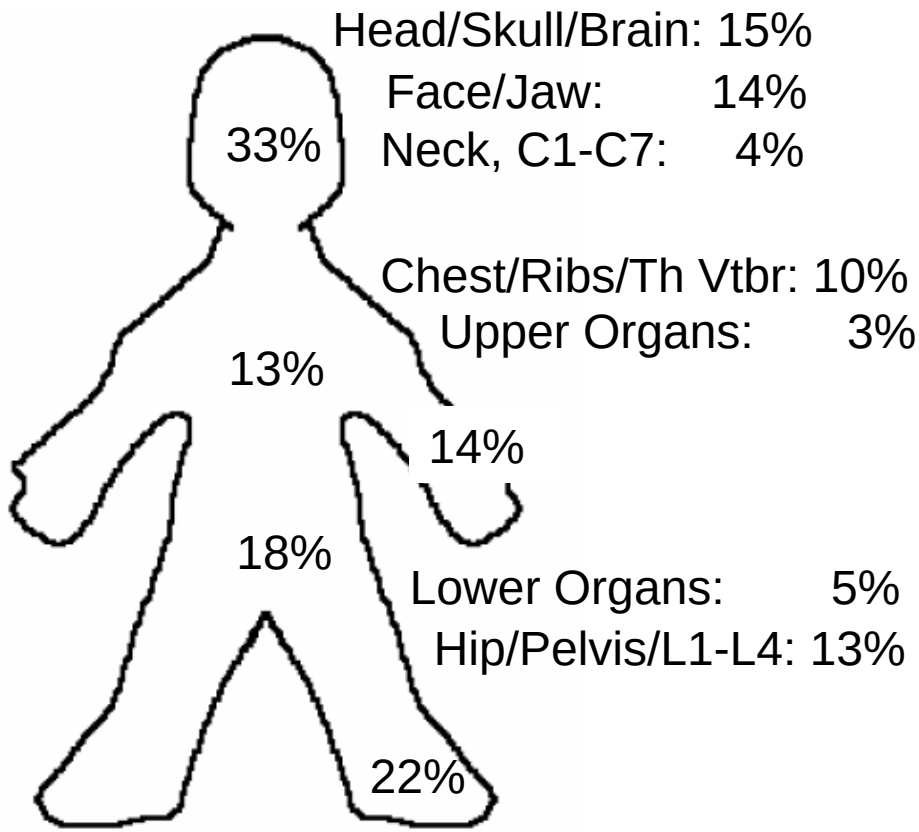
Fatal and Non-Fatal Cross at ~ 65g

95% of Non-Fatal Occur at < 125g

Injury Listings

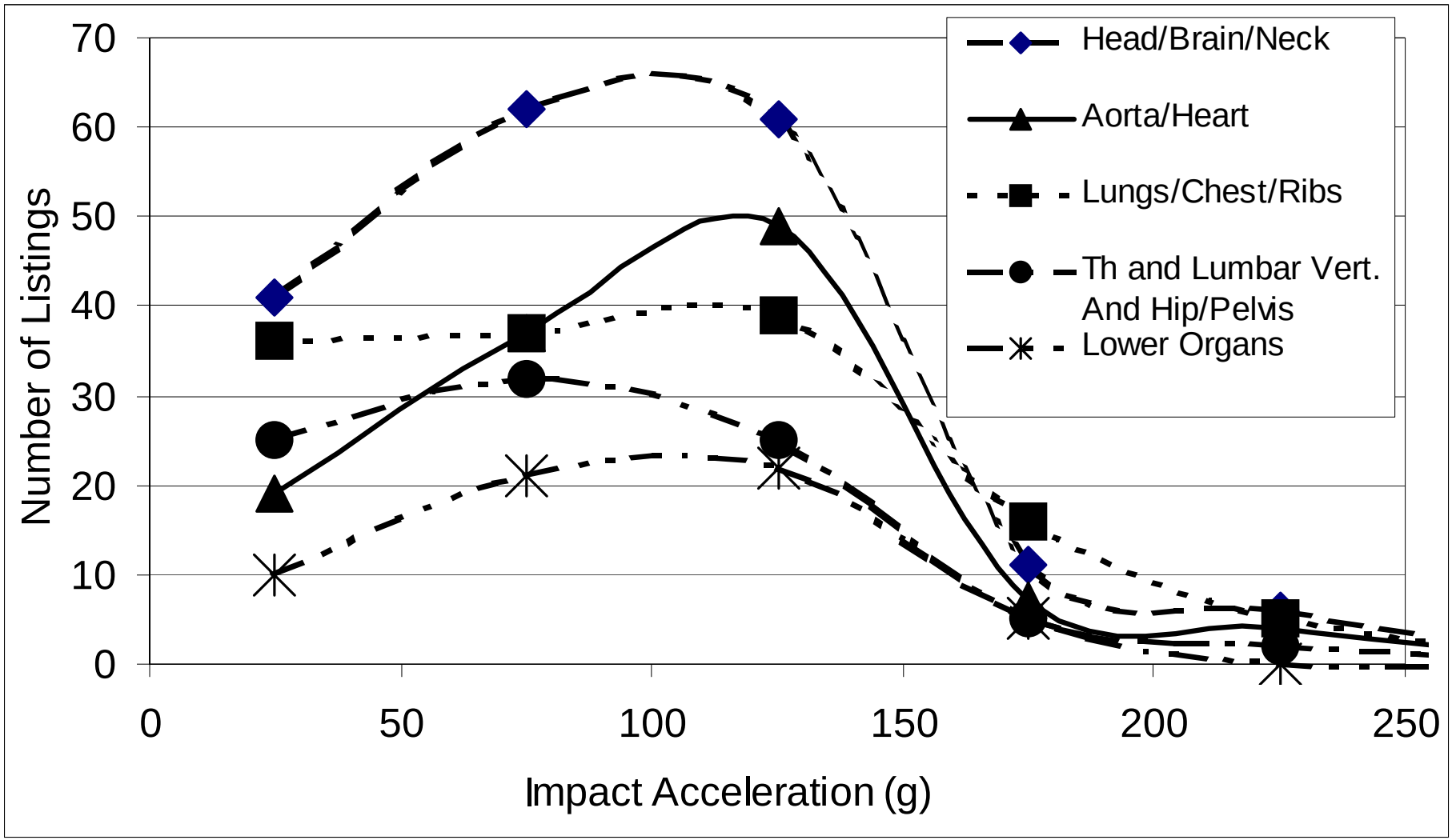


Fatal



Non-Fatal

Relate Impact to Injury



Conclusions

- Investment of Crashworthy Technology
  - These Methods can Measure Cost / Benefit
- Civil Aircraft Accident Data
  - No organized collection of Survival Factors Data
  - Database Needed (GA and Rotorcraft in particular)
- Rotorcraft
  - All impact directions need to be considered
  - Better understanding of mission can narrow focus
- Injury
  - Head is most common, but at low to moderate severity, chest injuries are under-represented

Thank you for your time and attention

and,

Thanks to the organizations who have supported my research…

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