Causes and Severity of Motor Vehicle Crashes in Iowa

AMY HAHN

UNIVERSITY OF IOWA

TIFFANY BAILEY

CENTRAL STATE UNIVERSITY

FACULTY MENTOR: JEFFREY DAWSON, SC.D.

Background

- The Injury Registry of the University of Iowa Injury Prevention Research Center (IPRC) with Iowa Department of Transportation
- Crash data from 1.2 million observations for the years 2001 to 2013
- Hundreds of variables grouped in 17 annual datasets pertaining to crash location, environment and roadway, vehicle, driver and passenger characteristics, and contributing factors
- Reduced to 765,894 crashes

Research Question

- Motivation: According to CDC, unintentional motor vehicle accidents are in the top three leading causes of injury deaths for all age groups
- What causes of motor vehicle crashes resulted in the highest cost, both financially and in human life?
  - Relationship between crash cause and severity
  - Relationship between crash cause and repair cost
  - Change in repair cost over time
  - Change in crash severity over time
- Focused on overall crash instead of individual vehicles

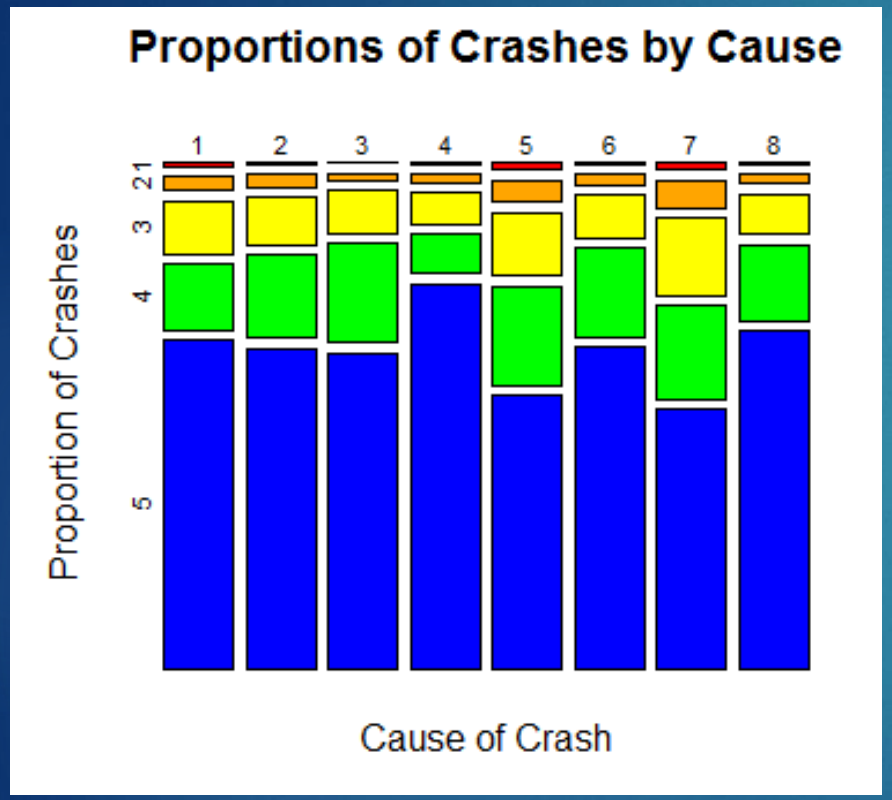
Variables

- Crash Causes
  1. Vehicle/ Equipment Failure (0.54%)
  2. Failure to yield the right of way (19.19%)
  3. Inattentive/Distracted (1.24%)
  4. Obstruction in road/Evasive action (18.99%)
  5. Disregard of Road Signs/Signals (9.15%)
  6. Reckless/Inadequate Driving (33.28%)
  7. Road Departures (7.33%)
  8. Unknown (10.28%)

Variables Cont.

- Severity
  1. Fatal (0.65%)
  2. Major Injury (2.78%)
  3. Minor Injury (9.85%)
  4. Possible Injury (16.83%)
  5. Property Damage Only (69.89%)
- Repair Cost
  - Ranging from $0 to $4 million
- Year
  - 2001 to 2013

Cause vs. Severity



- Proportion of Crashes - Severity (Left side)

1. Fatal (Red)
2. Major Injury (Orange)
3. Minor Injury (Yellow)
4. Possible Injury (Green)
5. Property Damage Only (Blue)

- Cause of Crash (Top)

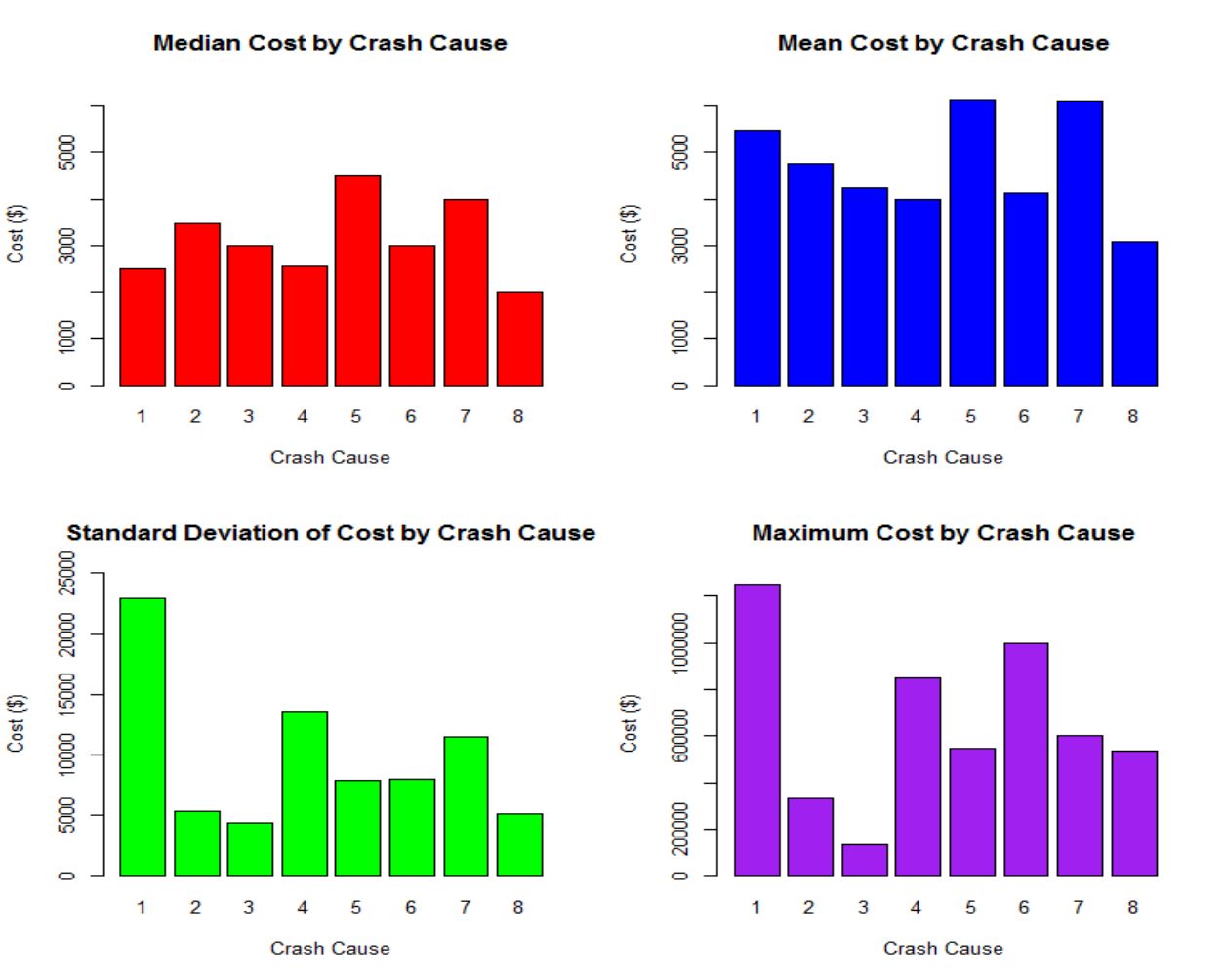
1. Vehicle/ Equipment Failure
2. Failure to yield the right of way
3. Inattentive/Distracted
4. Obstruction in road/Evasive action
5. Disregard of Road Signs/Signals
6. Reckless/Inadequate Driving
7. Road Departures
8. Unknown

Cause vs. Severity

- Nominal vs. Ordinal Data
- Kruskal-Wallis Rank Sum Test: p-value < 2.2e-16
- Followed up with Ordinal Logistic Regression
- General effect on crash severity based on coefficient values

Crash Cause	**Odds Ratio**	**Outcome**
• Disregard of Road Signs • Road Departure	0.61 0.52	High influence in fatal crashes
• Failure to yield • Inattentive/Distracted • Reckless/Inadequate Driving • Vehicle/Equipment Failure	0.96 0.96 0.99 1.00	Mid influence in fatal crashes
• Obstruction in Road/Evasive Action • Unknown	2.00 1.15	Low influence in fatal crashes

Median, Mean, and Standard Deviation of Cost



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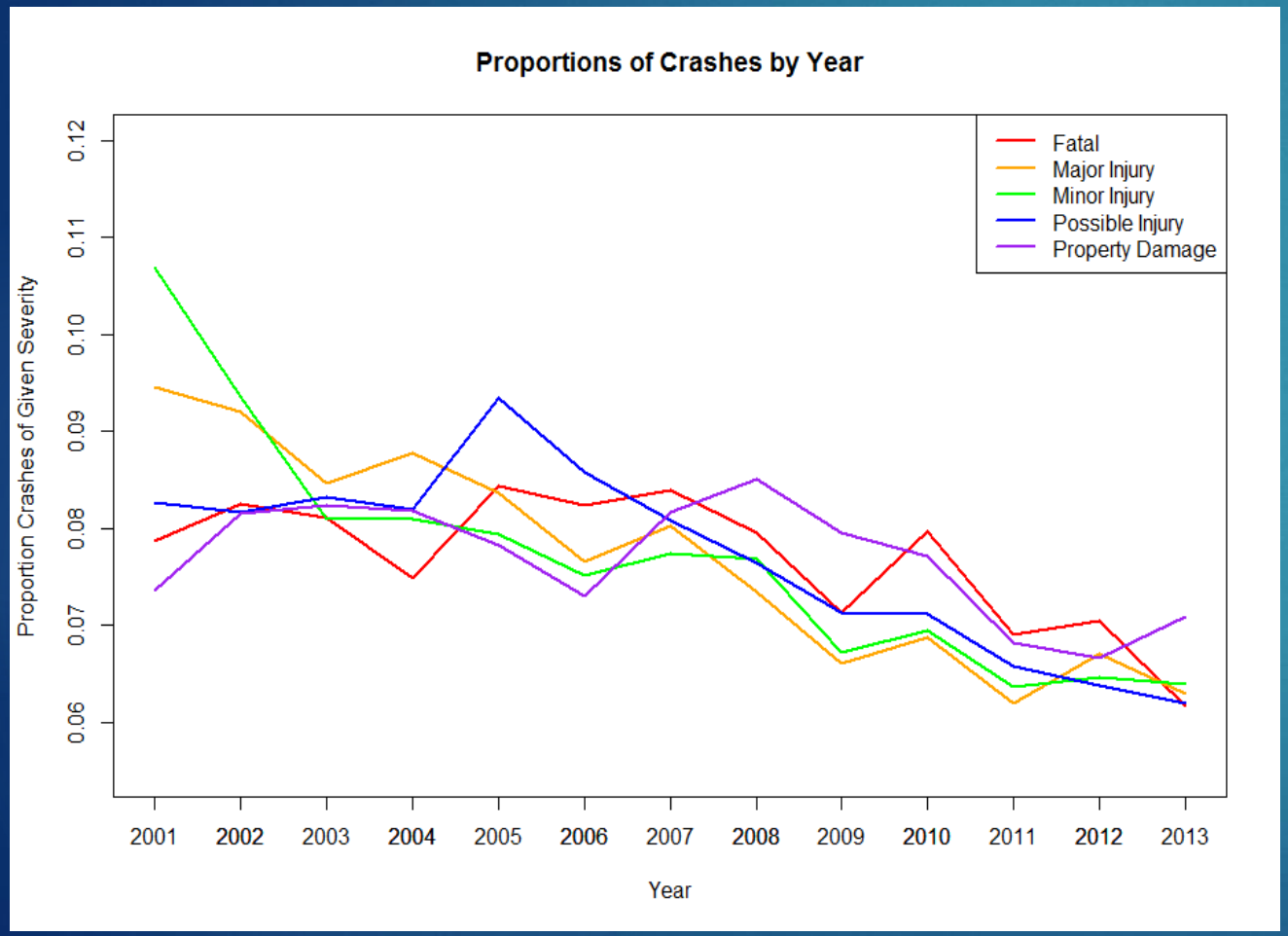
*outliers removed from Maximum Cost

Severity vs. Year



- Proportions given a specific level of severity

Severity vs. Year

- Change in severity over time
  - Coefficient Value = 0.021
  - Per decade: odds of less severe crash increases by 24%
- Compared Year to Year
  - Years with more fatal tendencies
    - 2003-2005
    - 2009-2012

Cost vs. Year

- Spearman's Rank Correlation Coefficient: 0.116
- National Automobile Dealership Association (NADA) reports average increase in new and used car sale prices
  - After correction for price increase, general increase in median cost

Conclusion

- Disregard of Road Signs/Signals (group 5) and Road Departures (group 7) had the highest cost both financially and in human life.
- Crash Severity decreased over time.
- Financial cost slightly increased over time.
- Our findings could be used in:
  - educational campaigns by driving schools
  - insurance companies
  - government agencies
- Further investigations
  - Cases of Outliers
  - Years that tended toward fatal accidents

Acknowledgements

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  - Michelle Reyes - University of Iowa Public Center
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- Questions?

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