Translating Teen Driver Research from the Simulator to the Road

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Outline

• Introduction

• Teen ACAT Study (Simulator)
  – Study Overview
  – Simulator Response Measurements

• Teen IVBSS Study (IVBSS)
  – Study Overview

• Conclusions
Introduction

Teen Drivers account for 15% of fatal crashes in the US

Source: NHTSA Fatal Accident Reporting System (FARS)
Introduction

Exposure

Teen drivers account for < 5% of VMT

Source: 2009 National Household Transportation Survey
Introduction

Fatality Rate by Age & VMT

Fatality Rate per Mile Traveled

<table>
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<tr>
<th>Age</th>
<th>Societal Fatality Rate / 1,000,000 PMT</th>
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<tbody>
<tr>
<td>05-09</td>
<td>0.3</td>
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<tr>
<td>10-15</td>
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<tr>
<td>16-20</td>
<td>0.4</td>
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<tr>
<td>21-25</td>
<td>2.5</td>
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<tr>
<td>26-30</td>
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<tr>
<td>31-35</td>
<td>0.5</td>
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<tr>
<td>36-40</td>
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<td>41-45</td>
<td>0.8</td>
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<tr>
<td>46-50</td>
<td>0.6</td>
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<tr>
<td>51-55</td>
<td>0.3</td>
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<td>66-70</td>
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<td>71-75</td>
<td>0.8</td>
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<td>76-80</td>
<td>2.4</td>
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US Data
Teen ACAT Study

Advanced Crash Avoidance Technologies

DRI Driving Simulator
Honda-DRI ACAT Methodology
Crash Imminent Braking (Honda aCMBS)
Methodology

Simulator Reconstruction of NASS-CDS collision events
Methodology

4 Scenario Types x 3 Variations = 12 Cases

Intersecting Path

Rear End

Head On

Pedestrian
Methodology

Key Response Variables

Brake

Steer

Naturalistic Driving Symposium – August 28th, 2012
Results

Response Type

Warning OFF

Warning ON

37% Did Nothing – Teens (47% Did Nothing – Adults)

14% Did Nothing – Teens (16% Did Nothing – Adults)
Results

Response Type

• Teens more likely to respond than adults without a warning
• Teens twice as likely to steer than adults
• Experienced teens are more likely to steer than novices

• ACAT more than doubles the brake and brake + steer response rates for all groups
Results

Brake Response - Delay

- Brake response delay graph showing time (sec) vs. pressure (MPa) for different groups (Adult, Experienced, Novice).
- ACAT Off and ACAT On conditions are compared.

Naturalistic Driving Symposium – August 28th, 2012
Results

Brake Response – Rise Time

- Adult
- Experienced
- Novice

ACAT Off

ACAT On

Naturalistic Driving Symposium – August 28th, 2012
Results

Brake Response – Amplitude

![Graph showing brake response amplitude with different categories: Adult, Experienced, Novice.](Image)

- ACAT Off
- ACAT On

Naturalistic Driving Symposium – August 28th, 2012
Braking Responses

- ACAT improves response delay for adults
- Novice drivers are quicker to push the brake, but depress the pedal slower
  - Novices are the only group to exhibit an improved rise time with the ACAT on
- Experienced teens and adults apply greater brake pressure with the ACAT on
What have we learned?

What we now know:

- Teens only account for ~5% of VMT
  - but 15% of fatalities

- Teens are more likely to steer during a critical event than to brake

- Crash warnings increase the overall response rate to critical event for teens
  - Brake rise time is improved
  - Steering amplitude in decreased
What have we learned?

Limitation & questions in what we know:

– Why are teens getting into ROR crashes?
  • Is it their speed, brake timing, steering input, …?
– To what extent is distraction involved?
  • What kind of distractions are common?
– Driving response data is from a simulator.
  • Simplified environment
  • Response to critical events only
  • Laboratory setting
  • Limited sample size

– What are teens doing in the real-world?
Teen IVBSS Study

Integrate Vehicle Based Safety System:
– Real world study of teen driving with and without Integrated Crash Warnings

Naturalistic Driving Study – 12 Accords
Equipped with Radar, vision and GPS based warnings systems

Teen IVBSS
40 drivers
– Teen (16.5<age<17 years)
– 20 Controls (no intervention)
– 20 Treatment (w/ intervention)

14 weeks of driving per participant
First 3 weeks – Warning inhibited (Baseline)
Next 8 weeks – Warnings enabled (Treatment)
Last 3 weeks – Warning inhibited (Baseline)

Warning Systems
– Takata: Vision based
– Visteon: Radar based

NHTSA IVBSS
108 drivers
– younger (20-30 years)
– middle-aged (40-50 years)
– older (60-70 years)

6 weeks of driving per participant
First 12 days – Warning inhibited (Baseline)
Next 27 days – IVBSS warnings enabled (Treatment)

Warning Systems
– Takata: Vision based
– Visteon: Radar based
Teen IVBSS Status:

- 40+ drivers to complete by October
  - 20 Treatment & 20 Control

- Warning rates appear higher than the adult data set
  - Too early to draw ANY conclusions

- 6 drivers have had minor to moderate crashes
  - 5 parking lot mishaps
    - Lots of vehicle damage, but little risk of injury
  - 1 rear end crash with minor injury in the other car

### Warning Rates per 100 miles

| Driver # | Treatment/Control | Gender | FCW Dis | FCW En | IVBSS | CSW Dis | CSW En | IVBSS | LDWCaut Dis | LDWCaut En | IVBSS | LDWIm Dis | LDWIm En | IVBSS | LCM Dis | LCM En | IVBSS |
|----------|-------------------|--------|---------|--------|-------|---------|--------|-------|-------------|------------|-------|-----------|----------|-------|---------|--------|-------|-------|
| 1        | T                 | M      | 1.23    | 1.52   | **0.19** | 0.47    | 0.71   | **0.30** | 3.96         | 3.94       | **5.56** | 1.04      | 0.71     | **1.01** | 0.75    | 0.56   | **0.61** |
| 2        | T                 | M      | 0.00    | 0.21   | **0.19** | 1.96    | 1.86   | **0.30** | 3.08         | 2.07       | **5.56** | 1.96      | 0.83     | **1.01** | 0.84    | 2.90   | **0.61** |
| 3        | T                 | F      | 0.16    | 0.47   | **0.19** | 0.08    | 0.32   | **0.30** | 3.32         | 1.10       | **5.56** | 0.24      | 0.63     | **1.01** | 0.08    | 0.32   | **0.61** |
| 4        | T                 | F      | 0.80    | 1.05   | **0.19** | 0.48    | 1.24   | **0.30** | 2.71         | 1.91       | **5.56** | 0.64      | 0.48     | **1.01** | 1.12    | 1.05   | **0.61** |
| 5        | T                 | M      | 1.38    | 1.13   | **0.19** | 0.35    | 0.28   | **0.30** | 21.40        | 7.94       | **5.56** | 1.73      | 0.57     | **1.01** | 0.00    | 0.00   | **0.61** |
| 6        | T                 | F      | 0.30    | 0.97   | **0.19** | 0.60    | 2.74   | **0.30** | 27.57        | 8.87       | **5.56** | 2.41      | 1.29     | **1.01** | 0.15    | 1.61   | **0.61** |
| 7        | C                 | M      | 0.43    | N/A    |         | 0.43    | N/A    |         | 3.76         | N/A        | 0.11     | N/A       | 0.00     | N/A     | 1.37    | N/A    | N/A     |
| 8        | C                 | M      | 0.00    | N/A    |         | 0.34    | N/A    |         | 17.12        | N/A        | 2.61     | N/A       | 0.23     | N/A     | 0.01    | N/A    | N/A     |
| 9        | C                 | F      | 0.27    | N/A    |         | 1.14    | N/A    |         | 4.22         | N/A        | 0.40     | N/A       | 2.01     | N/A     | 0.19    | N/A    | N/A     |
| 10       | C                 | F      | 0.19    | N/A    |         | 0.09    | N/A    |         | 7.74         | N/A        | 1.12     | N/A       | 0.19     | N/A     | 1.37    | N/A    | N/A     |
| 11       | C                 | M      | 0.88    | N/A    |         | 1.39    | N/A    |         | 13.42        | N/A        | 2.11     | N/A       | 1.17     | N/A     | 0.01    | N/A    | N/A     |
Teen IVBSS Study

Teen IVBSS Examples:
  – FCW (Forward Crash Warning)
Teen IVBSS Study

Teen IVBSS Examples:
– Rear end crash
Teen IVBSS Limitations:

- Sample is limited to Ann Arbor area teens

- Only novice drivers
  - < 17 years old

- They know they are being studied
  - Systems are explained to them at time of release

- Systems are warning systems only

- Systems are not near OEM production level
  - High rates of false warnings for FCW & CSW
Conclusion

Simulator Results

• Teens and Adults responses are not consistent
  – Teens are more likely to respond
    • That response is more likely to be steering
  – Teen response time is quicker than adults
    • Response intensity is lower than adults

• Crash warnings improved response rates
  – Improvements were less for teens than adults

On-road Results

• Crash/Near Crash events are not clear cut
• Environment influences driver response
• Stay Tuned
Acknowledgements

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Thank You!