TRB Webinar
Improving Rear Seat Passenger Safety: Challenges and Strategies
– Introduction

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Office of Behavioral Safety Research
National Highway Traffic Safety Administration
Fatality Distribution for Front Seat and Second Row Passenger Vehicle Occupants in 2014 by Restraint Use (FARS)

<table>
<thead>
<tr>
<th></th>
<th>Front Seat</th>
<th>Second Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestrained</td>
<td>43%</td>
<td>53%</td>
</tr>
<tr>
<td>8,231</td>
<td>869</td>
<td></td>
</tr>
<tr>
<td>Restrained</td>
<td>49%</td>
<td>38%</td>
</tr>
<tr>
<td>9,283</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>8%, 1,457</td>
<td>9%, 144</td>
</tr>
</tbody>
</table>

Safer drivers. Safer cars. Safer roads.
Observed Rear Seat Belt Use by State Seat Belt Law (NOPUS)

All Seating Positions Law

Front Seat Only Law

Safer drivers. Safer cars. Safer roads.
Related NHTSA Activities

- Published research on advanced rear seat occupant restraints in March 2016
- December 2015 NCAP Upgrade Announcement
  - Proposed rear seat dummy for NCAP crash tests
- Developing NPRM to amend FMVSS No. 208 to require seat belt reminders for front and rear seating positions
- New research to evaluate the effect of an all seating positions seat belt law
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NHTSA.gov
safercar.gov
References


References


Rear Seat Safety: Variation in protection by occupant, crash and vehicle characteristics

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Perelman School of Medicine
University of Pennsylvania

Chief Clinical Research Officer
The Children’s Hospital of Philadelphia
Research Institute
ADVANCES IN HIGHWAY SAFETY

Motor Vehicle Traffic Fatality Rates by Age Group, 2004–2013


Increased restraint use

Highway safety laws

Advanced restraint systems

Vehicle Crashworthiness
ADVANCES IN HIGHWAY SAFETY

ADVANCES IN THE FRONT SEAT

Airbag systems

Seat belt systems

- Double pretensioner
- Load-limiter

Testing procedures
REAR VS. FRONT SEAT SAFETY
FARS, 1990-2009

- Rear seat less protective relative to the front in newer model year vehicles
- Advances in safety technology have lagged in the rear.

Relative effectiveness of rear vs. right front seat for belted occupants

Sahraei at al. Proc AAAM, 2010
OBJECTIVES

- Describe characteristics of occupants in front and rear rows of MY 2000 and newer vehicles involved in crashes
  - Rear row occupants with serious (AIS 3+) and fatal injuries

- Determine risk of AIS3+ injury for restrained rear row occupants by age group, impact direction and vehicle MY

- Determine the relative risk of fatal injury for restrained rear vs. front row occupants by age group, impact direction and vehicle MY
METHODS

• Sources of Data
  • NASS-CDS, 2007-2012
  • FARS, 2007-2012
  • Passenger Vehicles restricted to MY 2000 and newer and ≤ 10 years old

• Combined FARS and NASS-CDS data
  • FARS cases substituted for all weighted fatality cases in NASS

• Serious injury:
  • AIS 3+
METHODS

• Variable definitions
  • Occupant Age: 0-3; 4-8; 9-12; 13-19; 20-54; 55+
  • Restraint Status: restrained vs. not
  • Impact direction: front, rear, right side, left side, rollover, other/unknown
  • Rear row included 3rd row in 3-row vehicles

• Statistical Analysis
  • Counts of deaths/injuries from FARS or NASS
  • Whole sample estimates of occupants from NASS
  • Logistic regression modeling to estimate RR
  • Analyses accounted for sampling and clustering of data
**AGE DISTRIBUTION IN THE REAR OCCUPANTS AND INJURIES**

- **56% of occupants**
- **81% of injuries**
- **75% of fatalities**

### Occupant Age Group

- **0 to 3**
- **4 to 8**
- **9 to 12**
- **13 to 19**
- **20 to 54**
- **55 and older**
REAR SEAT RESTRAINT USE BY AGE

RR_{SI} unrestrained vs. restrained  7.9 (5.1, 12.3)
RISK OF SERIOUS OR FATAL INJURIES BY AGE AMONG RESTRAINED REAR ROW OCCUPANTS

- AIS 3+ injury
- Fatal injury

<table>
<thead>
<tr>
<th>Occupant age group</th>
<th>AIS 3+ injury</th>
<th>Fatal injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>4 to 8</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>9 to 12</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>13 to 19</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>20 to 54</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>55 and older</td>
<td>3.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
DIFFERENCE IN RISK OF FATAL INJURY FOR REAR VS. FRONT ROW PASSENGERS BY OCCUPANT AGE

<table>
<thead>
<tr>
<th>Occupant age</th>
<th>Risk Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 3</td>
<td>RR 0.27 (0.12-0.58)</td>
</tr>
<tr>
<td>4 to 8</td>
<td>RR 0.55 (0.30-0.98)</td>
</tr>
<tr>
<td>9 to 12</td>
<td>RR 1.83 (1.18-2.84)</td>
</tr>
<tr>
<td>13 to 19</td>
<td>RR 1.41 (0.94-2.13)</td>
</tr>
<tr>
<td>20 to 54</td>
<td></td>
</tr>
<tr>
<td>55 and older</td>
<td></td>
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</tbody>
</table>
Risk of Serious and Fatal Injury for Restrained Rear Row Occupants by Vehicle Model Year
DIFFERENCE IN RISK OF FATAL INJURY FOR REAR VS. FRONT ROW PASSENGERS BY VEHICLE MY

Model years

- 2000 to 2002: RR 0.79 (0.61-1.02)
- 2002 to 2006: RR 1.10 (0.83-1.45)
- 2007 and newer: RR 1.46 (1.11-1.92)
SUMMARY OBSERVATIONS

- Children under age 13 account for over half of rear seat occupants
  - Adults account for only 1 in 5 rear seat occupants

- More rear seat occupants ride unrestrained, which substantially increases risk of serious and fatal injury

- Restrained children 8 years and younger continue to be well-protected in the rear
  - Evidence of increased relative risk of death in the rear for 9-12 year olds requires further study
SUMMARY OBSERVATIONS

- Restrained passengers 55 years and older
  - highest risk of serious and fatal injuries
  - increased relative risk of death in the rear compared with front passengers

- Increased relative risk of death for 2007 and newer vehicles likely due to front rows getting safer, not increased crash pulse severity in the rear

- Challenge is to improve safety for older adults while maintaining the current safety for younger occupants
ADVANCED RESTRAINT TECHNOLOGY

- **Seat belt pretensioners**
  - Remove belt slack prior to impact

- **Seat belt load limiters**
  - Release excess belt webbing after threshold force is reached

- **Curtain air bags**
  - Deploy from roof rail along entire length of vehicle

- **Inflatable seat belts**
  - Distribute belt forces, reduce head rotation and neck flexion
CURRENT RATING SYSTEMS

NHTSA Tests

• **Full Frontal**
  • No rear seat ATD

• **Side Impact**
  • Small adult female in left rear

IIHS Tests

• **Frontal Offset**
  • No rear seat ATD

• **Side Impact**
  • Small adult female in left rear

• **Small Overlap Frontal**
  • No rear seat ATD
Acknowledgements

• Insurance Institute for Highway Safety
  • Jessica Jermakian, DSc
  • Anne McCartt, PhD

• University of Pennsylvania Center for Clinical Epidemiology and Biostatistics
  • Michael Kallan, MS

• Center for Injury Research and Prevention at The Children’s Hospital of Philadelphia
  • Kristy Arbogast, PhD
  • Mark Zonfrillo, MD, MSCE
  • Rachel Myers, MS
What factors are associated with adult use of seat belts in the rear seat?

Laurie F. Beck, MPH

Transportation Safety Team
Division of Unintentional Injury Prevention
National Center for Injury Prevention and Control
Centers for Disease Control and Prevention

TRB Webinar: Improving Rear Seat Passenger Safety: Challenges and Strategies
October 27, 2016
CDC and Transportation Safety

- **CDC mission:**
  Protect public health and safety through control and prevention of disease, injury, and disability

- Motor vehicle crashes are a leading cause of death in the U.S. and a CDC “Winnable Battle”
Transportation Safety Team priorities:
- Restraint use
- Impaired driving
- American Indian and Alaska Native tribes
- Older adults

Working together, we can help keep people safe on the road—every day.
What do we know about seat belt use in the U.S.?

- Nationally, seat belt use relatively high
  - 2014, front row, observational = 87%
  - 2013, self-reported = 87%

- Some groups have much lower use rates than others, e.g.:
  - Males
  - Young adults
  - Drinking drivers
  - Overweight/obese occupants
  - Rear seat occupants
Unrestrained passenger vehicle occupant deaths (%), by seating position, US, 2014

Source: National Highway Traffic Safety Administration, Report No. DOT HS 812 262
Why buckle in the back?

- To reduce the risk of death by half
- To reduce the risk of injury or death to drivers and other passengers
Study Purpose: What makes them click?

- Improve understanding of predictors of seat belt use among adult passengers in the rear seat
Study Methods: Data Sources

- **HealthStyles, 2012**
  - Self-report survey, health-related attitudes & behaviors
  - Nationally representative
  - Adults (18+ years)
  - Sample size n=3953

- **Insurance Institute for Highway Safety (IIHS)**
  - Identify states by type of seat belt laws in 2012
HealthStyles 2012 Data

- How often do you wear seat belts when you ride in the back seat of a car, truck, van, or SUV (sport utility vehicle)?
  - Always
  - Nearly always
  - Sometimes
  - Seldom
  - Never
  - Never ride in the back seat
HealthStyles 2012 Data

- Demographic and geographic variables
  - Gender
  - Age group
  - Race/ethnicity
  - Marital status
  - Household income
  - Census region
  - Metropolitan status
Type of Rear Seat Enforcement, Adults, 2012
Source: Insurance Institute for Highway Safety
Data Analysis

- Prevalence of rear seat belt use (always wears) by demographic, geographic, and state law variables

- Multivariable regression to calculate adjusted prevalence ratios for rear seat belt use (always wears)
Results: Seat belt use among adults in the rear seat, 2012

Prevalence (%)

- < Always Wears
- Always Wears
Rear seat belt use among adults, prevalence and adjusted prevalence ratios, 2012

<table>
<thead>
<tr>
<th>Rear Seat Enforcement</th>
<th>Weighted %</th>
<th>aPR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>71</td>
<td>1.23 (1.16, 1.30)</td>
</tr>
<tr>
<td>Secondary</td>
<td>62</td>
<td>1.11 (1.02, 1.20)</td>
</tr>
<tr>
<td>None</td>
<td>54</td>
<td>1.00</td>
</tr>
</tbody>
</table>
## Rear seat belt use among adults, prevalence and adjusted prevalence ratios, 2012

<table>
<thead>
<tr>
<th>Metropolitan status</th>
<th>Weighted %</th>
<th>aPR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-metropolitan</td>
<td>57</td>
<td>1.00</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>63</td>
<td>1.11 (1.03, 1.19)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>52</td>
<td>0.96 (0.87, 1.06)</td>
</tr>
<tr>
<td>Midwest</td>
<td>58</td>
<td>1.00</td>
</tr>
<tr>
<td>South</td>
<td>60</td>
<td>1.05 (0.98, 1.13)</td>
</tr>
<tr>
<td>West</td>
<td>75</td>
<td>1.25 (1.16, 1.33)</td>
</tr>
</tbody>
</table>
### Rear seat belt use among adults, prevalence and adjusted prevalence ratios, 2012

<table>
<thead>
<tr>
<th>Gender</th>
<th>Weighted %</th>
<th>aPR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>60</td>
<td>1.00</td>
</tr>
<tr>
<td>Female</td>
<td>63</td>
<td>1.04 (1.00, 1.09)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>62</td>
<td>1.09 (1.00, 1.18)</td>
</tr>
<tr>
<td>25-44</td>
<td>56</td>
<td>1.00</td>
</tr>
<tr>
<td>45-64</td>
<td>64</td>
<td>1.14 (1.08, 1.21)</td>
</tr>
<tr>
<td>65+</td>
<td>67</td>
<td>1.16 (1.09, 1.24)</td>
</tr>
</tbody>
</table>
Rear seat belt use among adults, prevalence and adjusted prevalence ratios, 2012

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Weighted %</th>
<th>aPR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>63</td>
<td>1.00</td>
</tr>
<tr>
<td>Not Married</td>
<td>60</td>
<td>0.98 (0.93, 1.03)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Weighted %</th>
<th>aPR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>63</td>
<td>1.00</td>
</tr>
<tr>
<td>Black</td>
<td>56</td>
<td>0.95 (0.87, 1.03)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>63</td>
<td>0.97 (0.91, 1.03)</td>
</tr>
<tr>
<td>Other</td>
<td>52</td>
<td>0.80 (0.71, 0.89)</td>
</tr>
</tbody>
</table>
### Rear seat belt use among adults, prevalence and adjusted prevalence ratios, 2012

<table>
<thead>
<tr>
<th>Category</th>
<th>Weighted %</th>
<th>aPR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;=High School</td>
<td>60</td>
<td>1.00</td>
</tr>
<tr>
<td>Some College</td>
<td>64</td>
<td>1.03 (0.97, 1.08)</td>
</tr>
<tr>
<td>&gt;=College Grad</td>
<td>61</td>
<td>0.99 (0.92, 1.05)</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$25k</td>
<td>58</td>
<td>1.00</td>
</tr>
<tr>
<td>$25k to &lt;$50k</td>
<td>62</td>
<td>1.01 (0.94, 1.10)</td>
</tr>
<tr>
<td>$50k to &lt;$75k</td>
<td>59</td>
<td>0.95 (0.89, 1.08)</td>
</tr>
<tr>
<td>$75k+</td>
<td>65</td>
<td>0.99 (0.92, 1.05)</td>
</tr>
</tbody>
</table>
Implications for Increasing Belt Use in Rear Seat

- Potential target populations identified for intervention:
  - 25-44 year olds
  - Rural residents
  - Residents of Northeast, Midwest, Southern regions
  - Residents of states not covered by rear seat enforcement

- Opportunity exists to improve seat belt use for all adults in rear seats
Acknowledgements

- Geeta Bhat, PCORI (formerly CDC/Injury Center)
- Gwen Bergen, CDC/Injury Center
- Marcie-jo Kresnow, CDC/Injury Center

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Every Person. Every Seat. Every Trip.
www.cdc.gov/MotorVehicleSafety

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770-488-4327 or LDF8@cdc.gov
Belts in Back –
How to Raise Rear Seat Belt Use

Jim Hedlund
Highway Safety North
TRB Webinar
October 27, 2016
Unbuckled in Back: An Overlooked Issue in Occupant Protection

Sponsored by the Governors Highway Safety Association

Project oversight by
  Jonathan Adkins, Executive Director, and
  Kara Macek, Communications Director

Available at
Overview

• Adult belt use lower in rear seats than in front
  – Data
  – Consequences

• Reasons
  – Laws and enforcement
  – Programs and messaging
  – Beliefs

• Special case: taxis and limos

• Solutions
  [if I tell you the solutions, you won’t listen to the next 10 minutes]
Adult seat belt use rates 2014

Passenger vehicle occupants age 8 and older
Porter Novelli survey “always use”
Adult rear seat belt use rates 2012-2014

Rear seat belt use in fatal crashes, FARS 2012-2014
Consequences of lower belt use

- 838 unbelted rear seat adult fatalities in 2014 (FARS)
- Rear seat belt effectiveness: 44% cars, 78% LTVs (NHTSA)
- If all 838 had been belted: about 414 would have survived
- If use rate had been 75% (the FARS front seat rate): about 155 would have survived
## Reason: Laws

<table>
<thead>
<tr>
<th>Adult Law</th>
<th>Front Seat</th>
<th>Rear Seat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>35</td>
<td>19</td>
</tr>
<tr>
<td>Secondary</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>No law</td>
<td>1</td>
<td>22</td>
</tr>
</tbody>
</table>

Primary: any unbelted occupant may be ticketed at any time
Secondary: unbelted occupants may be ticketed only if police stop the vehicle for another reason

Last state to enact or upgrade a rear seat law: MD secondary law 2013
Laws

Figure 1. Rear seat belt use laws for adults, November 2015.

Primary
Secondary
None

District of Columbia (Primary)
Belt use by law type: primary, secondary, none

Rear seat belt use in fatal crashes, FARS 2012-2014
Reason: Messaging and programs

• Most law states have “belt use required in all seats” messages

But …

• No state or national campaigns explicitly target rear seat belt use by adults
Reason: Beliefs – “I’m safe in the back seat”

• True for older vehicles, but little difference in newer ones
• Perhaps due to “kids safer in back” campaigns

• The real message point: rear seat adults are 3 times more likely to die in a crash if they are unbelted (FARS)
Reason: Beliefs – “I’m safe in the back seat”

<table>
<thead>
<tr>
<th>Injury</th>
<th>Belted</th>
<th>Unbelted</th>
</tr>
</thead>
<tbody>
<tr>
<td>O - None</td>
<td>36.3 %</td>
<td>6.0 %</td>
</tr>
<tr>
<td>C - Possible</td>
<td>14.4 %</td>
<td>7.7 %</td>
</tr>
<tr>
<td>B – Minor</td>
<td>21.8 %</td>
<td>19.4 %</td>
</tr>
<tr>
<td>A - Serious</td>
<td>14.1 %</td>
<td>27.1 %</td>
</tr>
<tr>
<td>K - Fatal</td>
<td>13.3 %</td>
<td>39.8 %</td>
</tr>
</tbody>
</table>

Rear seat passenger vehicle occupants age 8 and older in fatal crashes, 2014
Here’s a picture

Rear seat passenger vehicle occupants age 8 and older in fatal crashes, 2014
Taxis and limousines

- Some states exempt taxis and limos from rear belt laws
- Self-reported belt use in New York City taxis, 2012-13: 38%
- John Nash and Bob Simon fatalities—unbelted in rear seat
- Some NYC emergency rooms now have a term for the frequent injuries they see when unbelted rear seat passengers strike a taxi’s partition:
  "partition face"  (NY Times)
Solution #1: Laws

Figure 1. Rear seat belt use laws for adults, November 2015.

- Primary
- Secondary
- None
Solution #2: Enforcement

• Enforce rear seat belt laws with the same vigor as front seat laws
Solution #3: Education

- Include rear seat positions in belt use education
- Consider campaigns directed to rear seat occupants
Solution #4: Taxis and limos

- Include taxis and limos in belt use laws, enforcement, and education
Solution #5: Front seat belt use

• Higher front seat use produces higher rear seat use

Rear and front seat belt use, FARS 2013

\[ R^2 = 0.4061 \]

\[ y = 0.6837x + 0.0734 \]
Conclusion

Increasing rear seat belt use is a quick, easy, and cheap way to save lives and reduce injuries
Questions and comments

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Factors Associated with Restraint Use in Rear-Seated Occupants

Joyce C. Pressley, PhD, MPH
Chang Liu, MPH

October 27, 2016

Columbia University
Departments of Epidemiology and Health Policy and Management
Data Sources

Restraint Status and Outcomes

– FARS
  • Census of all fatal crashes
– NASS/GES
  • Sample fatal and nonfatal crashes
– NY State CODES
  • 2010-2013

Primary and secondary rear seat law enforcement

– GHSA
– IIHS
– Supplementation where needed from individual state highway departments

Statistics

– Logistic regression
– Adjusted for violations of assumptions of independence for multiple passengers in same vehicle
  • Multivariable, multilevel models use Glimmix
Law Transitions Examined for Rear Seated Adults in Ten States

- The Fatality Analysis Reporting System (2000-2013) (FARS) was used to examine motor vehicle occupant crash data in adults aged 18 and older for 10 states:
  - Alaska
  - Delaware
  - Illinois
  - Kentucky
  - Maine
  - Minnesota
  - Rhode Island
  - South Carolina*
  - Washington
  - Wisconsin*
- Passage of a primary law is not always temporarily associated with the expected declines in mortality
- Two example states are shown for illustrative purposes
South Carolina: Trends in Front and Rear Seat Restraint Use with the Front to Rear Belt Use Gap

Passage 6/9/05
Effective 12/9/05

1 Front and rear belt use is from FARS
South Carolina: Front Seat and Rear Seat Mortality Rates (per 100,000) Before and After Passage of a Primary Rear Seat Law

Front

Rear

States with Preexisting Primary Laws (n=7)
States with No Primary Laws (n=33)
All States (n=50)
South Carolina
Wisconsin: Trends in Front and Rear Seat Restraint Use with the Front to Rear Belt Use Gap (FARS)
Wisconsin: Front Seat and Rear Seat Mortality Rates

**Front seat fatalities per 100,000**

- States with Preexisting Primary Laws (n=7)
- States with No Primary Laws (n=33)
- All States (n=50)
- Wisconsin

**Rear seat fatalities per 100,000**

- States with Preexisting Primary Laws (n=7)
- States with No Primary Laws (n=33)
- All States (n=50)
- Wisconsin

- Passage 6/30/09
- Effective 6/30/09
Percent Higher Front Seat Belt Use than Rear Seatbelt Use at The Time of Passage of Primary Rear Seat Belt Law-- FARS Data on Fatal Crashes

Baseline

<table>
<thead>
<tr>
<th>State (Year)</th>
<th>Front: 64.1% ± 6.1 %</th>
<th>Rear: 46.4% ± 8.7 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington (2002)</td>
<td></td>
<td>+26.8%</td>
</tr>
<tr>
<td>Illinois (2002)</td>
<td></td>
<td>+21.1%</td>
</tr>
<tr>
<td>Delaware (2003)</td>
<td></td>
<td>+23.6%</td>
</tr>
<tr>
<td>South Carolina (2005)</td>
<td></td>
<td>+18.1%</td>
</tr>
<tr>
<td>Alaska (2006)</td>
<td></td>
<td>+14.8%</td>
</tr>
<tr>
<td>Maine (2007)</td>
<td></td>
<td>+2.2%</td>
</tr>
<tr>
<td>Kentucky (2007)</td>
<td></td>
<td>+15.5%</td>
</tr>
<tr>
<td>Wisconsin (2009)</td>
<td></td>
<td>+8.3%</td>
</tr>
<tr>
<td>Minnesota (2009)</td>
<td></td>
<td>+28.7%</td>
</tr>
</tbody>
</table>

% Restrained

*Preexisting states: California, Hawaii, Indiana, Louisiana, New Mexico, Oregon, Texas

**No law: 33 states had no primary rear seat law covering adults

***Rhode Island is not shown due to small numbers of death each year
### Rear Seatbelt Use and the Rear-Front Seat Belt Gap in States Transitioning to a Primary Rear Belt Law (FARS)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Rear (% Belted)</td>
<td></td>
<td>Rear (% Belted)</td>
<td></td>
<td>Rear (% Belted)</td>
<td></td>
<td>Rear (% Belted)</td>
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<td>Rear (% Belted)</td>
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<td>Rear (% Belted)</td>
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<tr>
<td></td>
<td>Rear-Front Gap (%)</td>
<td></td>
<td>Rear-Front Gap (%)</td>
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<td>Rear-Front Gap (%)</td>
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<td>Rear-Front Gap (%)</td>
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<td>Rear-Front Gap (%)</td>
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<td>Rear-Front Gap (%)</td>
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</tr>
<tr>
<td>Preexisting Law*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Alaska (2006)</td>
<td>56.3</td>
<td>-14.8</td>
<td>56.3</td>
<td>42.0</td>
<td>-23.6</td>
<td>-23.6</td>
<td>-14.8</td>
<td>-23.6</td>
<td>-14.8</td>
<td>-23.6</td>
<td>-23.6</td>
<td>-14.8</td>
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<tr>
<td>Delaware (2003)</td>
<td>42.0</td>
<td>-23.6</td>
<td>42.0</td>
<td>53.8</td>
<td>-23.6</td>
<td>-23.6</td>
<td>-14.8</td>
<td>-23.6</td>
<td>-14.8</td>
<td>-23.6</td>
<td>-23.6</td>
<td>-14.8</td>
</tr>
<tr>
<td>Illinois (2002)</td>
<td>40.4</td>
<td>-21.1</td>
<td>40.4</td>
<td>48.7</td>
<td>-24.4</td>
<td>-24.4</td>
<td>-14.8</td>
<td>-24.4</td>
<td>-14.8</td>
<td>-24.4</td>
<td>-24.4</td>
<td>-14.8</td>
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<tr>
<td>Kentucky (2007)</td>
<td>40.6</td>
<td>-15.5</td>
<td>40.6</td>
<td>51.7</td>
<td>-10.3</td>
<td>-10.3</td>
<td>-5.5</td>
<td>-10.3</td>
<td>-5.5</td>
<td>-10.3</td>
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<td>-5.5</td>
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<tr>
<td>Maine (2007)</td>
<td>61.1</td>
<td>-2.2</td>
<td>61.1</td>
<td>57.3</td>
<td>-10.8</td>
<td>-10.8</td>
<td>-4.2</td>
<td>-10.8</td>
<td>-4.2</td>
<td>-10.8</td>
<td>-10.8</td>
<td>-4.2</td>
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<td>Minnesota (2009)</td>
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<td>43.4</td>
<td>67.8</td>
<td>-12.3</td>
<td>-12.3</td>
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<td>-12.3</td>
<td>-3.5</td>
<td>-12.3</td>
<td>-12.3</td>
<td>-3.5</td>
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<td>42.4</td>
<td>65.6</td>
<td>-16.0</td>
<td>-16.0</td>
<td>-3.6</td>
<td>-16.0</td>
<td>-3.6</td>
<td>-16.0</td>
<td>-16.0</td>
<td>-3.6</td>
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<tr>
<td>Wisconsin (2009)</td>
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<td>55.2</td>
<td>56.6</td>
<td>-11.9</td>
<td>-11.9</td>
<td>-1.4</td>
<td>-11.9</td>
<td>-1.4</td>
<td>-11.9</td>
<td>-11.9</td>
<td>-1.4</td>
</tr>
</tbody>
</table>

*Preexisting states: California, Hawaii, Indiana, Louisiana, New Mexico, Oregon, Texas

**No law: 33 states have no primary rear seat law covering adults

***Rhode Island is not shown due to small numbers
## Rear Seatbelt Use and the Rear-Front Seat Belt Gap in States Transitioning to a Primary Rear Belt Law (FARS)

<table>
<thead>
<tr>
<th>State (Effective Year)</th>
<th>Current (2014)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rear (% Belted)</td>
<td>% Rear Lags Front Belt Use</td>
<td>% Difference in Restraint Use Post Law</td>
</tr>
<tr>
<td>Preexisting Law*</td>
<td>52.7</td>
<td>-23.5</td>
<td>-</td>
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<tr>
<td>Alaska (2006)</td>
<td>55.0</td>
<td>-19.5 W</td>
<td>-1.3</td>
</tr>
<tr>
<td>Delaware (2003)</td>
<td>53.8</td>
<td>-23.6 S</td>
<td>11.8</td>
</tr>
<tr>
<td>Kentucky (2007)</td>
<td>51.7</td>
<td>-10.3 N</td>
<td>11.1</td>
</tr>
<tr>
<td>Maine (2007)</td>
<td>57.3</td>
<td>-10.8 W</td>
<td>-3.8</td>
</tr>
<tr>
<td>Minnesota (2009)</td>
<td>67.8</td>
<td>-12.3 N</td>
<td>24.4</td>
</tr>
<tr>
<td>South Carolina (2005)</td>
<td>55.6</td>
<td>-15.0 N</td>
<td>18.9</td>
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<tr>
<td>Washington (2002)</td>
<td>65.6</td>
<td>-16.0 N</td>
<td>23.2</td>
</tr>
<tr>
<td>Wisconsin (2009)</td>
<td>56.6</td>
<td>-11.9 W</td>
<td>1.4</td>
</tr>
<tr>
<td>No Law**</td>
<td>39.5</td>
<td>-24.6</td>
<td>-</td>
</tr>
</tbody>
</table>

*Preexisting states: California, Hawaii, Indiana, Louisiana, New Mexico, Oregon, Texas
**No law: 33 states have no primary rear seat law covering adults  
***Rhode Island is not shown due to small numbers
Despite the state by state variability just observed--
In multivariable\(^1\), multi-level models across the age span, coverage by a primary rear-seat restraint law was associated with an increased odds of being restrained:

- Primary (2.29, 1.48-3.54)
- But not secondary law coverage (1.59, 0.85-2.86)
  - Secondary laws were limited by small sample size

\(^1\) controlled for passenger age and gender; driver age, gender, driver restraint status, impairment and crash time of day
Multilevel Models\textsuperscript{1} for Teen (13-19) and Young Adult (20-24) Rearseat Seatbelt Use by Primary and Secondary Law Coverage (FARS)

1 Controlling for age and gender of passenger, driver age, driver gender, belt status, driver impairment and crash time of day
Multilevel Models\textsuperscript{1} for Adult (25-64) and Elderly (65 and older) Rear Seat Seatbelt Use by Primary and Secondary Law Coverage (FARS)

1 Controlling for age and gender of passenger, driver age and gender, driver restraint status, impairment and crash time of day
Percent Passengers Restrained

Percent of Rear-Seated Passengers Belted for Primary, Secondary, and No Rear Seat Law Coverage by Passenger Age (FARS 2010-2011)

Pressley et al. Journal of Trauma, 2016
Percent of Rear-Seated Passengers Belted for Primary, Secondary, and No Rear Seat Law Coverage by Passenger Age (FARS 2010-2011)

Pressley et al. Journal of Trauma, 2016
Same Side Impact Point is Associated with the Highest Adjusted Odds Ratio of Mortality for Rear Seated (FARS)

Raneses and Pressley, Injury Epidemiology 2015
Disparities in Belt Wearing by Seating Position (FARS 2010-2013)
Percent Child Passengers Unrestrained by Passenger Age and Driver Drug and Alcohol Status (FARS)

- negative for both drugs and alcohol
- positive for drugs only
- positive for alcohol only
- positive for both drugs and alcohol
- untested, day
- untested, night

Huang, Liu and Pressley, Pediatrics 2016
Linked NYC DMV Crash and Hospital Admissions (CODES Data) for Pediatric Passengers in Private (n=23,615) vs Taxi’s (n=1,631)

In DMV crash data linked to hospital records:

• Belt use was higher in privately-owned compared to taxi’s
• In taxi cabs, fewer than 6% of children younger than 8 years old were restrained in an infant, child or seat
• For the total population, rear-seated unrestrained passengers were 1.7 times more likely to be injured
• Passengers in taxis were 1.8 times more likely to be injured compared to those in private vehicles
• Passengers in taxi cabs were more than twice as likely to have facial and/or traumatic brain injury

Percentage of NYC Rear Seated Pediatric Passengers Using a Seatbelt or in a Child Restraint System by Age Category
Private Passenger Vehicles vs. Taxi Cabs, NYS CODES 2011-2013

Restraint use in pediatric population in federally designated Indian lands vs. Non-Indian lands, FARS 2000-2014
Driver Drug and Alcohol Status by Pediatric Passenger Restraint Status -- Fatal Collisions on Federal Designated Indian lands Compared to Adjacent State
FARS 2000-2014

Oh, Liu and Pressley, 2016
Differences are not Explained by Pickup Trucks on Indian Lands

Oh, Liu and Pressley, 2016
Conclusions

Primary laws are associated with higher belt status use

- Having a primary vs. no law or a secondary law is associated with higher belt wearing across all teen, young adult, adults including elderly adult age groups examined
  - However, temporal trends in rear seat restraint use and outcomes vary across states transitioning to a primary law
  - At the individual state level, passage of a primary rear seat belt law was not always sufficient to produce increased belt wearing and lower population level mortality
  - GDL produces increased rear seat belt wearing, but this change is not sustained
- Special geographic jurisdictions (IL) have low rear seat belt use, placing their populations at increased risk
- Drug use, including cannabis, in drivers of pediatric populations is associated with increased child endangerment
- Strong association with driver belt status and rear seat restraint use may represent an opportunity for enforcement
Future Directions: Emerging Issues With Rear Seat Safety Implications

- There are several emerging social and legal changes that have potential to impact road safety including rear seat safety.
- These changes are outpacing our surveillance systems—our current data collection efforts do not allow for tracking these rapidly growing trends.
- Standards need to encourage and guide our state level DMVs on data changes needed to track these “here to stay” trends.
- Examples of issues associated with the rapid growth of ride sharing and electronically hailed vehicles for hire:
  - Taxi’s and vehicles for hire are generally exempt from rear seatbelt laws—including for infants, children, teens and adults in NYC.
  - Multipurpose vehicles that crossover from use as a private vs. vehicle for hire (Ubers/Lyft/Ride hailing services).
  - Current data systems based on vehicle registrations do not accurately capture when a vehicle was in “for hire” mode or in private use.
  - Driver training and licensing is required for known vehicles for hire, but not for cross over vehicles.
Future Directions: Emerging Issues With Rear Seat Safety Implications

Changing drug laws, particularly legalization of cannabis, for medicinal and recreational purposes

- Lower proper seating for children of drivers who are positive
- Lower restraint use in rear-seated children driven by positive drivers
- Scientific obstacles to road side testing and lacks of standards for “under the influence”