Spotlight on Highway Safety

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Unbuckled in Back:
An Overlooked Issue in Occupant Protection

Prepared for
Governors Highway Safety Association
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Contents

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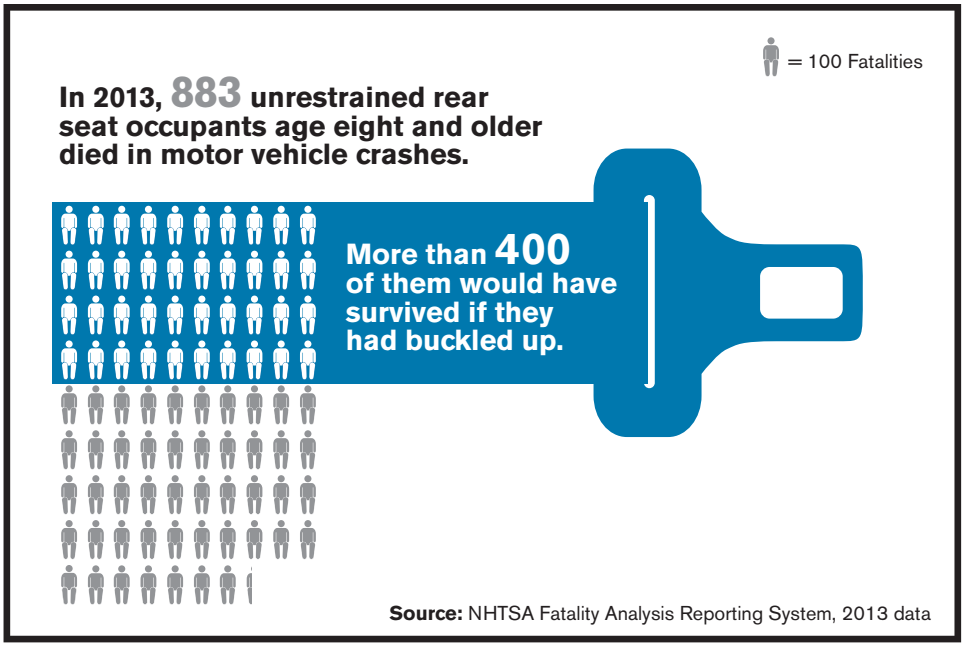


EXECUTIVE SUMMARY

In 2013, 883 unbelted rear seat passenger vehicle occupants age 8 and older died in traffic crashes in the United States. More than 400 of these occupants would have survived if they had worn their seat belts.

Nationwide, rear seat belt use in 2013 was 78%, 9 percentage points lower than front seat belt use. Rear seat belt use was lower than front seat belt use in almost every state and was substantially lower in many states. But most strategies for encouraging and increasing belt use do not target rear seat occupants. Twenty-two states don't require belt use in rear seats. The remaining states don't emphasize rear seat belt use. There are no state or national campaigns explicitly targeting rear seat belt use by adults.

Increasing rear seat belt use is a quick, easy, and inexpensive way to save lives. States should:

- Enact a primary rear seat belt law in the 32 states that do not have one;
- Include rear seating positions as a regular part of seat belt enforcement;
- Include rear seating positions in belt use education and public outreach;
- Include taxis and for-hire vehicles throughout their belt use programs; and
- Increase front seat belt use, because rear seat passengers are far more likely to buckle up when the driver is belted.

Seat belt laws, enforcement, public outreach, and education have a common goal: all occupants should buckle up, all the time, on every trip.

INTRODUCTION

Seat belts save lives. For 50 years this fact has motivated auto manufacturers to improve their belt systems, states to pass and enforce laws requiring belt use, and drivers and passengers to buckle up. The results are impressive. All states except New Hampshire require front seat occupants to be belted. The states publicize and enforce these laws regularly and urge occupants to buckle up. Front seat belt use in passenger vehicles has increased from 11% in 1979-1982 to 87% in 2014 (Kahane, 2015; Pickrell & Choi, 2015). NHTSA estimates that seat belts saved the lives of 12,584 passenger vehicle occupants age 5 and older in 2013 alone (NHTSA, 2015a).

However, belt use laws, enforcement, and public information campaigns often overlook rear seat passengers. Twenty-two states do not require belt use in rear seats. Only 18 states and the District of Columbia have a rear seat belt use law with primary enforcement. Rear seat belt use is not highlighted in traffic safety messages. As a result, rear seat belt use in vehicles observed on the road in 2013 was 78%, 9 percentage points lower than front seat belt use. In fatal crashes – crashes in which a person died, not necessarily a passenger vehicle occupant – rear seat belt use in 2013 was 60% compared to 74% in the front seat.

Rear seats are safer than front seats in most crashes. The public knows this, perhaps because of the many messages that children should sit in rear seats. But front seats have become safer for adults in recent model year cars, due to improved air bags and front seat belt systems, while rear seats have not. An unbelted adult is now only slightly safer in the rear seat (Smith & Cummings, 2006). In any seat, adults are considerably safer when belted.

Taxis and other for-hire vehicles play a small but important part in this story. Five states (Illinois, Maryland, South Carolina, Vermont and Wisconsin) exempt some or all for-hire vehicle passengers from their rear seat belt law. Many people who regularly buckle up in private cars and vans ignore the belts when they ride in taxis or other for-hire vehicles.

The rapid rise of ride services such as Uber and Lyft is producing many trips in which rear seat passengers are not used to riding in the rear seat and may not buckle up.

As of November 2015, Uber and Lyft each operated in over 175 cities and metropolitan areas in North America (*www.uber.com/cities*, *www.lyft.com/cities*). In the first quarter of 2015, Forbes reported that almost half of all paid rides by business travelers in major United States markets used Uber (Bender, 2015). At the beginning of 2015, Lyft was providing 2.5 million rides a month. By the end of the year, the company says it expects it will provide almost 13 million rides a month, or about 90 million rides in 2015 (Kosoff, 2015).

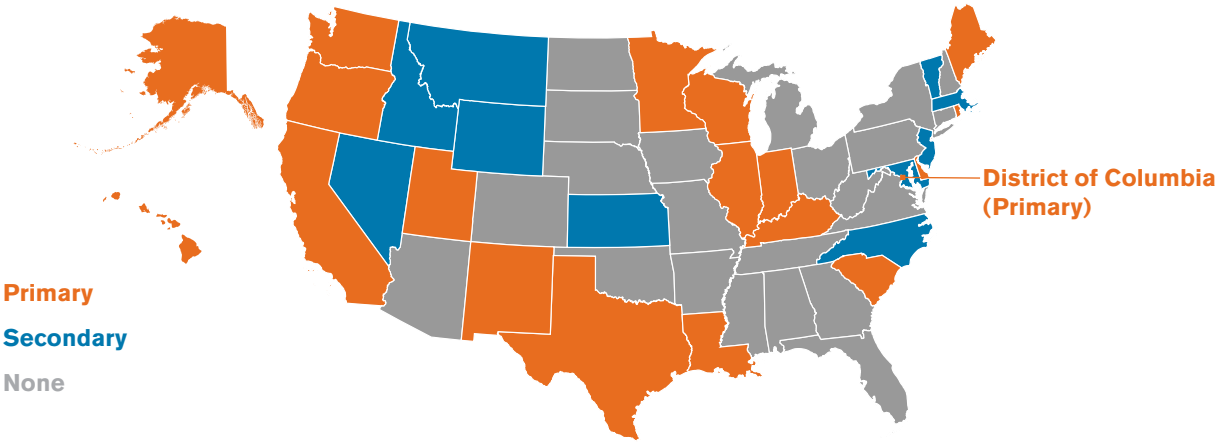
This spotlight summarizes data on rear seat belt use. It reviews the states' rear seat belt laws, enforcement, and publicity using information obtained from all 50 states and the District of Columbia through a survey (GHSA, 2015b). It recommends how the laws, enforcement, and publicity can be improved and estimates the lives that will be saved if rear seat belt use increases.

In this report, a passenger vehicle is a car, light truck, or van. A rear seat is any designated seating position behind the front seat, which includes third rows for vans and SUVs. The report addresses only passenger vehicle occupants age 8 and older.

REAR SEAT BELT USE LAWS

As of November 2015, 28 states and the District of Columbia require adults in the rear seats of passenger vehicles to be properly buckled up. Belt use laws for children and teenagers vary considerably across the states. Enforcement of these laws is primary in 18 states and the District of Columbia: any unbelted occupant may be ticketed at any time. Enforcement is secondary in the remaining 10 states: unbelted occupants may be ticketed only if police have another reason to stop the vehicle. Rear seat belt use is not required for adults in the other 22 states. Figure 1 illustrates these laws.

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



In some jurisdictions, including Maryland, Montana, Rhode Island, Vermont, and the District of Columbia, the driver is responsible for assuring that all adult passengers are buckled up. In others, including Idaho, New Mexico, Oregon, South Carolina, Texas, Washington, and Wyoming, the driver is responsible for the belt use of teenagers under the age of 16, 17, or 18 (NHTSA, 2015b).

All jurisdictions with primary rear seat belt laws have primary front seat belt laws. States with secondary or no rear seat belt use laws have a mix of front seat laws, as shown in Table 1.

Table 1. Rear and front seat belt use laws for adults, 50 states and the District of Columbia, November 2015

	Rear Seat Law Type			
Front Seat Law Type	**Primary**	**Secondary**	**None**	**Total**
Primary	19	4	12	**35**
Secondary	0	6	9	**15**
None	0	0	1	**1**
Total	**19**	**10**	**22**	**51**

Front and rear seat belt use laws are summarized on the GHSA (2015a) and IIHS (2015) websites, both of which are updated regularly. Details of the laws as of 2013 are available in NHTSA (2015b), which is updated about every two years.

Recent rear seat belt use legislation

Utah was the only state to make a substantial change to its rear seat belt law the past two years. In 2015, Utah upgraded its rear seat belt law to a form of primary enforcement: an unbelted occupant must be given a warning on the first violation and may be ticketed on subsequent violations. However, the law is in force only until July 1, 2018, without further legislative action.

In 2014, bills were introduced in Mississippi, New York, and Oklahoma to require belt use in the rear seat, but they did not pass (Teigen et al., 2015). In 2015, bills to upgrade secondary laws to primary failed in Missouri and Montana and a bill was carried over to the next legislative session in Vermont. Bills to introduce a law in states without a law failed or were carried over in Connecticut, Missouri, New York, Oklahoma, and Virginia. A bill to require taxi passengers to be belted was carried over in New York, while a bill that would have downgraded enforcement from primary to secondary failed in Minnesota. Bills to increase the fine for failure to wear a belt passed in Arkansas and Maryland and failed or were carried over in Kansas, Massachusetts, Missouri, Montana, South Dakota, and Tennessee (NCSL, 2015; GHSA, 2015b).

Maryland's secondary law became effective on October 1, 2013. No other state enacted or upgraded a rear seat belt law in 2013.

Taxis

Rear seat belt laws in four states – Illinois, Maryland, Vermont, and Wisconsin – exempt passengers in taxis and various for-hire vehicles. South Carolina does not exempt taxi passengers but does exempt other for-hire vehicle passengers. California and Oregon exempt taxi drivers but not taxi passengers (NHTSA, 2015b, GHSA 2015b).

Two high-profile traffic fatalities in 2015 illustrate that taxis and other for-hire vehicles offer no more protection in a crash than private vehicles. On February 11, the well-known CBS News correspondent Bob Simon, who was riding unbelted in the rear seat of a limousine, died in a crash in Manhattan (Copeland, 2015). On May 23, Nobel Prize winner John F. Nash, Jr. and his wife Alicia, both unbelted in the rear seat, were thrown from their taxi and died in a crash on the New Jersey Turnpike (Hu, 2015).

REAR SEAT BELT USE RATES

Rear seat belt use can be estimated from three sources: observations of vehicles on the road, surveys of passengers, and police crash reports. Each source has limitations. Taken together, they document four conclusions:

- Adult belt use in the rear seat is 10 to 15 percentage points lower than in the front seat;
- Adult belt use in the rear seat is generally higher in states with a primary enforcement rear seat belt law, followed by states with a secondary law, and lower in states with no law.
- Adult belt use in the rear seat is generally higher in states with higher front seat belt use.
- Adult belt use in the rear seat is substantially higher when the driver is belted.

Observations of vehicles on the road: NOPUS 2013

The annual National Occupant Protection Use Survey (NOPUS) of the National Highway Traffic Safety Administration (NHTSA) is a nationwide probability-based survey of seat belt use. It has two components. The Moving Traffic survey observes passenger vehicles in traffic and records front seat occupant lap-shoulder belt use. The Controlled Intersection survey observes passenger vehicles stopped at a stop sign or traffic signal and records lap-shoulder belt use for up to two passengers in the rear seat (second row of seats only).

In 2013, the last year for which data from both components are available, the Moving Traffic survey observed 91,850 occupants of 72,907 vehicles at 1,584 sites and the Controlled Intersection survey observed 52,701 occupants in 37,428 vehicles at 1,382 sites (Pickrell and Liu, 2014; 2015).

In the 2013 NOPUS Controlled Intersection survey, belt use was 78% for rear seat occupants age 8 and older, compared to 87% for front seat occupants in the Moving Traffic survey. Rear seat belt use was higher for females than for males (82% compared to 74%), higher for children under age 15 (83%) and adults 70 and over (82%), and higher in states with a rear seat belt use law than in states with no law (83% compared to 74%). The survey does not provide state-level estimates.

Self-reported belt use: Porter Novelli ConsumerStyles 2012

Porter Novelli Public Services conducts regular web-based surveys of the American public. The 2012 ConsumerStyles survey included a question on rear seat belt use. The Centers for Disease Control and Prevention analyzed and reported the results from 3,953 respondents who sometimes rode in the back seat of a passenger vehicle (Bhat et al., 2015).

Overall, 62% of respondents age 12 and older reported that they always wore a seat belt in the rear seat. Reported “always” belt use was higher for females than for males (63% compared to 60%) and lower for those age 25-44 (56%) than for younger or older occupants. It was highest for states with a primary enforcement rear seat belt use law (71%), followed by states with a secondary law (62%), and lowest for states with no law (54%).

Crash reports: FARS 2013

NHTSA's Fatality Analysis Reporting System (FARS) records belt use for all occupants in all seating positions of vehicles involved in fatal crashes. In 2013, belt use was 60% for the 5,403 rear seat occupants age 8 and older with known belt use in passenger vehicles, compared to 74% for front seat occupants of these vehicles (FARS, 2015). Rear seat belt use was highest for states with a primary rear seat belt law (66%), followed by states with a secondary law (58%), and lowest for states with no law (55%).

The FARS data provide several additional rear seat belt use rate breakouts:

- By occupant age: higher for children younger than age 15 (75%) and adults 70 and older (72%), as shown in Table 2, with data from Porter Novelli for comparison;
- By sex: higher for females (65%) than for males (55%);
- By seating row: 60% in the second row and 66% in the third row;
- By seating position: 62% in the outboard positions and 49% in the middle;
- By vehicle type: higher in vans (68%) than in cars (57%), SUVs (59%), and pickups (61%).

Table 2. Rear seat belt use by age

Occupant age	Porter Novelli	FARS
8-15	62%	75%
16-24	56%	51%
25-69	64%	55%
70-111	67%	72%

Porter Novelli, 2012, age 12 and older, "always use belts in rear seat"
FARS: 2013, age 8 and older, all rear seating positions, all belt types

Table 3 summarizes the national belt use estimates from the three sources.

Table 3. Seat belt use, 2012 and 2013

	NOPUS	Porter Novelli	FARS
Rear seat	78%	62%	60%
Front seat	87%	--	74%

NOPUS: 2013; front seat from Moving Traffic survey, all occupants; rear seat from Controlled Intersection survey, second seat only, lap-shoulder belt only, age 8 and older
Porter Novelli, 2012, age 12 and older, "always use belts in rear seat"
FARS: 2013, age 8 and older, all seating positions, all belt types

It's quite clear that belt use is lower in the rear seat than in the front: by 9 percentage points in NOPUS and by 14 percentage points in FARS.

Each of these estimates has limitations.

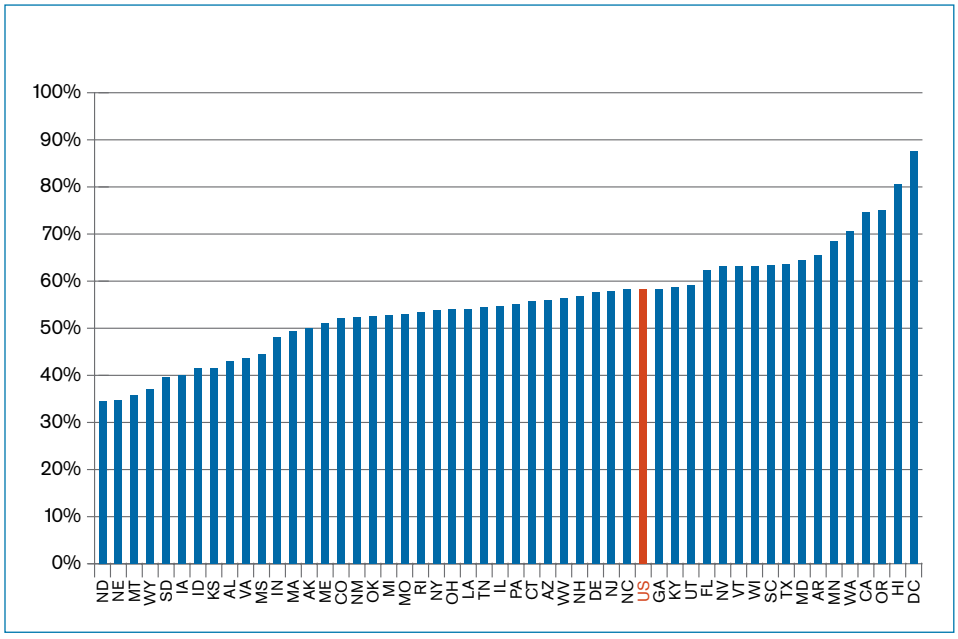
- NOPUS reports the highest use rates, based on observed behavior. NOPUS may underestimate rear seat belt use because it does not observe occupants using only a lap belt (6% of the belted rear seat occupants in FARS were using lap belts only). On the other hand, NOPUS may overestimate rear seat belt use because it probably does not observe most occupants in the middle seating position, where FARS reports lower belt use than in outboard positions.
- The Porter Novelli survey results are self-reported, and self-reports usually overestimate actual belt use (Parada et al., 2001; Zambon et al., 2008). However, the results include only those who said they always wear their belt, not those who sometimes wear belts, which may produce an underestimate.
- FARS reports only occupants of vehicles involved in fatal crashes, who wear belts less frequently than all occupants on the road. However, FARS is the only source that provides state-level belt use data.

Belt use in taxis

Survey data from New York City support the view that belt use is low in the rear seats of taxis and other for-hire vehicles. In 2012 and 2013, passengers were invited to take a survey while they were riding in a taxi. Only 38% reported they were using the taxi's seatbelts while taking the survey (NYTLC, 2014). In comparison, NOPUS reported that overall front seat belt use in New York was 90% in 2012 and 91% in 2013 (Chen, 2014).

Belt use by state

Figure 2. Rear seat belt use rates, FARS 2012 and 2013 combined



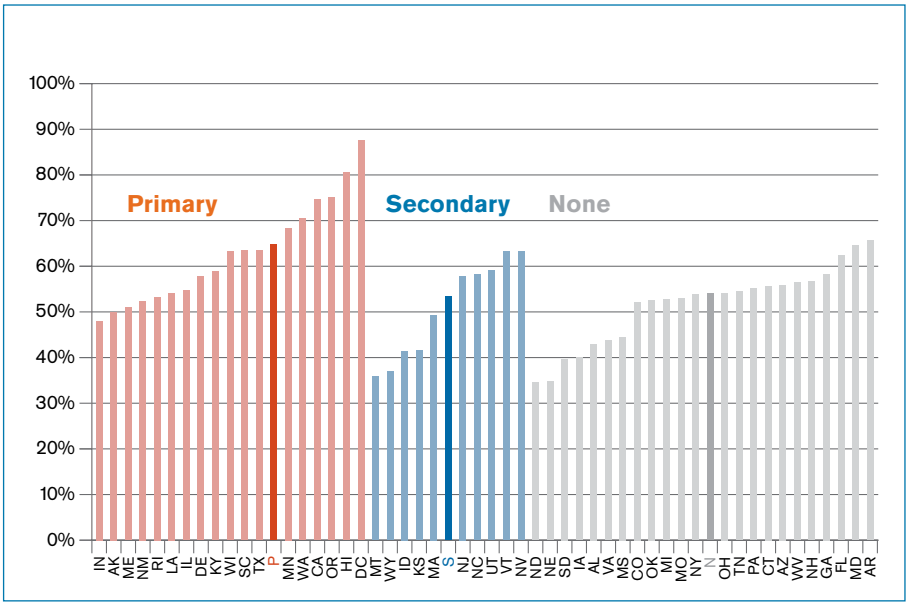
Source: FARS (2015), age 8 and older

Figure 2 shows seat belt use rates from FARS for all rear-seat occupants of passenger vehicles involved in fatal crashes. The years 2012 and 2013 are combined to provide more stable estimates for states with few rear seat occupants of vehicles involved in fatal crashes. Table 6 on page 18 provides the data.

Rear seat belt use in fatal crashes ranged from 35% in North Dakota to 81% in Hawaii and 87% in the District of Columbia, two jurisdictions with few fatal crashes. Fourteen states had use rates of 50% or lower while four states and the District of Columbia had rates of 70% or higher. The use rate was 58% for the nation as a whole, noted by the red bar. Two-thirds of the states had use rates below 58% because three large states – California, Florida, and Texas – all had use rates above 58%.

Table 6 also shows that rear seat belt use by passengers in fatal crashes is lower than front seat belt use in almost every state and is substantially lower in many states.

Figure 3. Seat belt use rates of passengers in fatal crashes, by rear seat belt law type, FARS 2012 and 2013 combined



Source: FARS (2015), age 8 and older

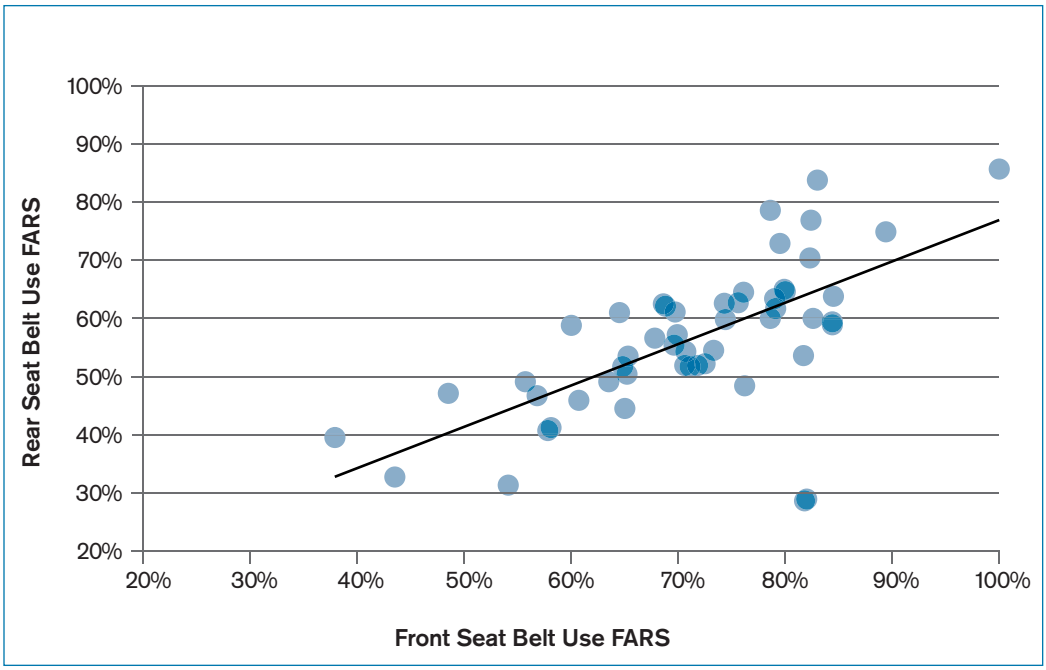
Figure 3 shows the same use rates arranged by rear belt law type in 2013. The jurisdictions in the initial group, from Indiana to the District of Columbia, had primary rear seat belt laws; those in the middle group, from Montana to Nevada, had secondary laws; and those in the final group, from North Dakota to Arkansas, had no law. The dark bars, denoted by P, S and N, show the combined use rates for primary (65%), secondary (53%), and no law (54%) states.

The five jurisdictions with use rates of 70% and above had primary laws. Of the 14 states with use rates below 50%, only Indiana had a primary law. Use rates vary considerably within states with each law type. The data support two conclusions: a primary law helps states achieve higher use rates, but a primary law by itself does not guarantee high belt use.

Belt use in front and rear seats

FARS data show how a state's rear seat belt use is related to its front seat belt use. Figure 4 plots each state's front and rear belt use rate for occupants age 8 and older in passenger vehicles involved in fatal crashes in 2013, with one data point for each state and the District of Columbia.

Figure 4. Rear and front seat belt use by state, FARS 2013



Source: FARS (2015), age 8 and older

Figure 4 shows that, in general, states with higher front seat belt use have higher adult rear seat belt use: as the data points move to the right, with higher front seat use, they also move up, swith higher rear seat use. To make this relationship more precise, the figure also shows the trend line determined by these data – the straight line that best fits the data. The trend line shows that an increase in front seat belt use of 10 percentage points is associated on average with a 6.8 percentage point increase in rear seat belt use.

Passengers of belted drivers are substantially more likely to be belted than passengers of unbelted drivers. Raneses and Pressley (2015) used FARS data from 2010 and 2011 to study the belt use of rear seat passengers aged 18 and older in vehicles involved in fatal crashes. In vehicles with belted drivers, 60% of rear seat adult passengers were belted compared to only 18% in vehicles with unbelted drivers.

CONSEQUENCES: LIVES LOST AND POTENTIAL LIVES SAVED

Unrestrained fatalities in the rear seat

In 2013, 883 unrestrained rear seat occupants died in crashes: 473 in cars, 244 in SUVs, 68 in vans, and 98 in pickups. Two of these fatalities were in taxis.

Potential lives saved with increased rear seat belt use

NHTSA estimates that lap-shoulder belts are 44% effective in preventing fatalities in outboard rear seat positions in passenger cars and 73% effective in light trucks and vans (Kahane, 2015). Padmanaban and Mortazavi (2006) found that there is no significant difference between the effectiveness of center lap belts and outboard lap-shoulder belts. Applying the Kahane effectiveness estimates to all rear seating positions, if all 883 fatally-injured occupants had been belted, 315 of the car and SUV occupants and 121 of the van and pickup occupants would have survived; 436 in all.

While 100% belt use may not be a reasonable short-term goal, raising rear seat belt use to the current front seat belt use rates should be very feasible. Using the NOPUS observed rates, if belt use for rear seat occupants overall had been at the front seat rate of 87% rather than the rear seat rate of 78%, approximately 179 more passengers would have survived. Using the FARS rates in fatal crashes, if belt use for rear seat occupants in potentially fatal crashes had been at the front seat rate of 74% rather than the rear seat rate of 60%, approximately 153 more passengers would have survived. The Appendix gives the detailed calculations.

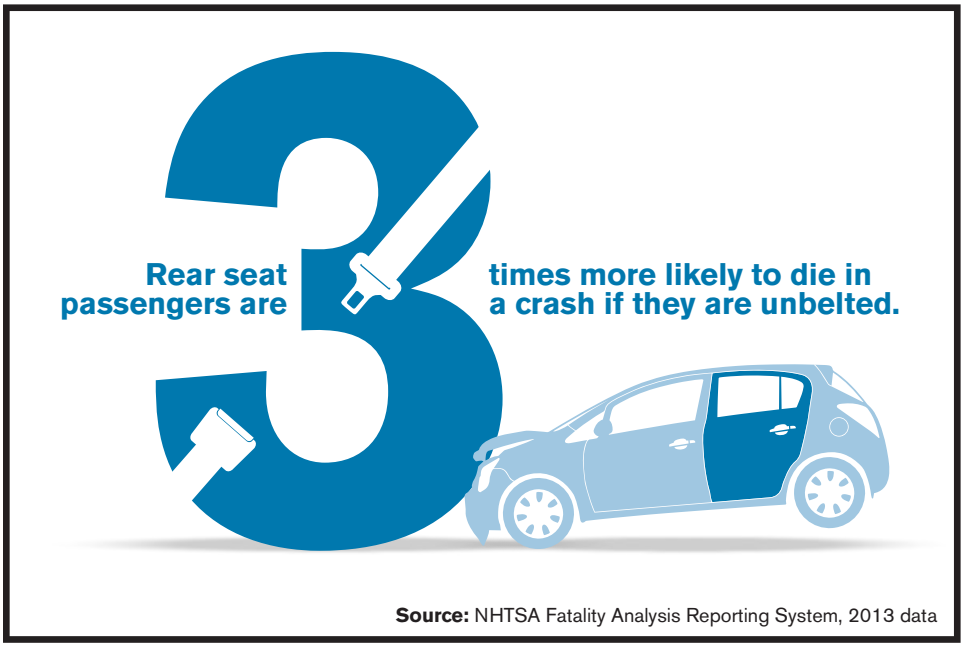
Potential injuries prevented with increased rear seat belt use

Table 4. Passenger vehicle rear seat occupants age 8 and older in fatal crashes, 2013

	Restrained		Unrestrained	
Injury severity	**Count**	**Percent**	**Count**	**Percent***
K – fatal	422	13%	883	41%
A – serious	498	15%	554	26%
B – minor	672	21%	387	18%
C – possible	490	15%	179	8%
O – no injury	1,131	35%	158	7%
Total	**3,213**	**100 %**	**2,161**	**100%**

Source: FARS (2015)
* Total does not equal 100% due to rounding

There are no national data on serious injuries suffered by rear seat occupants. But a closer look at fatal crashes provides some insight into the effect of rear seat belts on injuries. In 2013 there were 5,374 rear seat occupants age 8 and older with known injury severity and restraint use in vehicles involved in fatal crashes. Of these, 3,213 were belted and 2,161 were not. Table 4 gives the injury level of these occupants in the standard KABCO codes, where K is fatal and O is no injury. Only 13% of the restrained occupants died, compared to 41% of unrestrained occupants;



occupants were three times more likely to die if they were unbelted. In contrast, occupants were three times more likely to escape with no injury or only possible injury if they were belted: 50% of the restrained occupants compared to 16% of unrestrained occupants.

The conclusion is evident: higher rear seat belt use rates will reduce crash fatalities and injuries substantially. NHTSA estimates that lap-shoulder belts reduce front seat occupant injuries by 50% (Pickrell & Choi, 2015). Belts likely are similarly effective in the rear seat.

Additional anecdotal evidence on the potential of rear seat belts to reduce injuries comes from accounts of the Bob Simon and John and Alicia Nash crashes. After Simon's death, *USA TODAY* interviewed Dr. Lewis Goldfrank, chairman of emergency medicine at Bellevue Hospital and NYU Langone Medical Center. He said the hospital treated at least two patients a week with injuries sustained when they were slammed, unbuckled, into the safety partitions of taxis (Copeland, 2015). After the Nash deaths, the *New York Times* interviewed Michael O'Loughlin, campaign director for Cab Riders United, an advocacy group that has called for mandatory seatbelt use in taxis and for-hire cars. He said that injuries caused when unbuckled rear seat taxi passengers strike the taxi's partitions have become so common at some emergency rooms that the doctors and nurses have a name for it: "partition face" (Hu, 2015).

Effects of unbelted rear seat occupants on front seat occupants

In a crash, unbelted rear seat occupants become projectiles that can injure or kill other occupants. In FARS data from 2001 to 2009, a belted driver was more than twice as likely to be fatally injured in a frontal crash when seated in front of an unbelted rear seat occupant than when seated in front of a belted occupant (Bose et al., 2013).

REAR SEAT BELT USE LAW ENFORCEMENT AND PROGRAMS

All primary rear seat belt law jurisdictions – 18 states and the District of Columbia – enforce these laws and all but one include rear seat occupants in their *Click It or Ticket* campaigns. Typically, the states publicize that belt use is required for all occupants and that an officer may stop a vehicle and issue a ticket if any unbelted occupant is observed. For example, the District of Columbia's belt law publicicity makes these points:

- "DC law allows police to stop a vehicle solely because its driver and/or passengers are not properly buckled up."
- "It's a $50 fine and 2 points for not having your seat belt buckled at all times – for drivers and all passengers, front and back seats."
- "Drivers are responsible for seat belt compliance for all passengers."

Similarly, Hawaii's *Click It or Ticket* poster emphasizes belt use year round, day and night, adults and children, in all seating positions (Figure 5).

Figure 5. Hawaii *Click It or Ticket* poster

Some states noted that rear seat occupants are specifically included in some enforcement activities:

- Checkpoints: Delaware
- Mobilizations: Delaware and Illinois
- Nighttime enforcement: New Mexico

Among the secondary enforcement law states, Idaho, Montana, Nevada, New Jersey, and North Carolina include rear seat belt use as part of their regular law enforcement activities. Maryland includes rear seat belt enforcement in officer training and educational materials. Kansas, Massachusetts, and Wyoming encourage officers to enforce the law.

North Carolina reported 12,723 citations for rear seat belt law violations in 2014.

Half the states without rear seat belt use laws include rear seat belt use as part of their overall seat belt education and public outreach campaigns. Georgia promotes rear seat belt use in its graduated driver licensing information, as all occupants under the age of 18 are required to be buckled. New Hampshire's "Room to Live" seat belt education program is presented in high schools and at community safety events approximately 30 times each year. It emphasizes the importance of belt use for every occupant on every trip. New York routinely conducts "Battle of the Belts" competitions in schools to raise awareness of the importance of seat belt use by every passenger regardless of where the passenger is seated. The New York highway safety office uses grant funding through GHSA's partnership with the Ford Driving Skills for Life program to help fund the cost of these competitions.

There are no state or national campaigns explicitly targeting rear seat belt use by adults.

STRATEGIES TO INCREASE USE

As part of their overall occupant protection program, states should consider five complementary strategies to increase rear seat belt use by adults.

Enact a primary rear seat belt law in states that do not have one

Both FARS data from vehicles involved in fatal crashes and Porter Novelli data from a self-reported belt use survey show that belt use is highest in primary law states, followed by secondary law states, and lowest in states with no rear seat belt law. Table 5 summarizes the results.

Table 5. Passenger vehicle rear seat belt use for adults by belt law type

Rear seat belt law type	FARS	Porter Novelli
Primary law – 18 states and DC	66 %	71 %
Secondary law – 10 states	58 %	62 %
No law – 22 states	55 %	54 %

Porter Novelli, 2012, age 12 and older, "always use belts in rear seat"
FARS: 2013, age 8 and older, all rear seating positions, all belt types

The Controlled Intersection survey observed higher belt use in states with a law than in states without one.

The benefits of a well-publicized and enforced primary belt use law for all seating positions have been documented extensively. Goodwin et al. (2013) summarize the evidence. For example, a systematic review of 13 high-quality studies found that primary laws increase belt use by about 14 percentage points and reduce occupant fatalities by about 8% compared to secondary laws. Another study found that passenger vehicle driver death rates dropped by 7% when states upgraded from secondary to primary enforcement.

McGehee et al. (2014) provide a detailed policy analysis of a potential rear seat belt use law in Iowa. They concluded that Iowans widely support enacting a primary enforcement rear seat law. Four out of five respondents to a survey said they would use seat belts more often when sitting in the rear seat if there were a law. The study estimated that rear seat fatalities would decrease about 48%, from 13 to 7 fatalities annually, if a rear seat belt law were implemented in Iowa.

Include rear seating positions as a regular part of belt law enforcement

All states with rear seat belt laws enforce these laws to some degree. States should ensure that regular and well-publicized rear seat belt enforcement is an integral part of all seat belt enforcement activities.

All states except New Hampshire have front seat belt use laws for adults older than 18 and enforce these laws both in regular traffic enforcement operations and in special campaigns such as *Click It or Ticket*. Goodwin et al. (2013) summarize the impact on belt use of high-visibility belt law enforcement in general and of *Click It or Ticket* campaigns in particular.

Include rear seating positions in belt use education

States with rear seat belt laws usually emphasize that their laws require belt use for all occupants in all seating positions. These states could consider enforcement messaging specifically directed to adults in the rear seat and consider targeting the groups with lower rear seat belt use: young adults and males. All states could couple rear seat belt use messaging with their child occupant protection information and education, noting that parents and other adult passengers are role models for young children.

Include taxis and for-hire vehicles in belt use laws, enforcement, and education

The limited available information suggests that rear seat belt use is lower in for-hire vehicles – taxis, limousines, and ride services such as Uber and Lyft – than in personal vehicles. States should consider ways to include occupants of these vehicles throughout their belt use programs.

Increase front seat belt use

In general, states with higher front seat belt use have higher adult rear seat belt use. Passengers are far more likely to buckle up when the driver is belted.

Conclusions

An unbelted adult is only slightly safer in the rear seat compared to the front seat and is far safer when belted. But rear seat occupants do not buckle up as frequently as front seat occupants. To achieve the overall goal that all occupants buckle up, all the time, on every trip, state belt use laws, enforcement, and public information campaigns should give rear seat occupants as much attention as front seat occupants.

Table 6. Rear and front seat belt use, passenger vehicle occupants age 8 and older in fatal crashes, 2012 and 2013 FARS

	2013	2013	2013	2012-13 Combined	
State	Rear Law Type	Rear % Belted	Front % Belted	Rear Total	Rear % Belted
Alabama	N	49%	63%	258	43%
Alaska	P	60%	79%	24	50%
Arizona	N	63%	74%	388	56%
Arkansas	N	63%	69%	160	66%
California	P	75%	89%	1,248	75%
Colorado	N	52%	65%	186	52%
Connecticut	N	52%	73%	79	56%
Delaware	P	77%	82%	26	58%
District of Columbia	P	86%	100%	8	88%
Florida	N	62%	79%	815	62%
Georgia	N	55%	70%	384	58%
Hawaii	P	79%	79%	31	81%
Idaho	S	47%	48%	70	41%
Illinois	P	52%	72%	353	55%
Indiana	P	48%	76%	177	48%
Iowa	N	29%	82%	95	40%
Kansas	S	49%	56%	130	42%
Kentucky	P	61%	64%	204	59%
Louisiana	P	57%	68%	194	54%
Maine	P	55%	73%	49	51%
Maryland	N	54%	82%	121	64%
Massachusetts	S	62%	69%	69	49%
Michigan	N	59%	84%	222	53%
Minnesota	P	64%	84%	114	68%
Mississippi	N	46%	61%	236	44%
Missouri	N	59%	60%	268	53%
Montana	S	33%	43%	95	36%
Nebraska	N	39%	38%	69	35%
Nevada	S	73%	79%	114	63%
New Hampshire	N	47%	57%	30	57%
New Jersey	S	65%	80%	233	58%
New Mexico	P	54%	65%	166	52%
New York	N	59%	84%	359	54%
North Carolina	S	63%	79%	479	58%
North Dakota	N	31%	54%	52	35%
Ohio	N	57%	70%	342	54%
Oklahoma	N	50%	65%	247	53%
Oregon	P	84%	83%	92	75%
Pennsylvania	N	52%	71%	341	55%
Rhode Island	P	29%	82%	15	53%
South Carolina	P	64%	76%	273	63%
South Dakota	N	41%	58%	58	40%
Tennessee	N	54%	71%	288	55%
Texas	P	65%	80%	1,370	64%
Utah	S	52%	71%	66	59%
Vermont	S	60%	83%	19	63%
Virginia	N	45%	65%	229	44%
Washington	P	70%	82%	139	71%
West Virginia	N	61%	70%	78	56%
Wisconsin	P	63%	76%	163	63%
Wyoming	S	41%	58%	46	37%
United States		**60%**	**74%**	**11,272**	**58%**

Law type: P = primary, S = secondary, N = no law
Maryland implemented a secondary law on Oct. 1, 2013. Utah upgraded to primary on May 12, 2015.
Belt used includes all restraint types; occupants with unknown restraint use excluded
Source: FARS (2015)

REFERENCES

Bender, A. (2015). Uber's astounding rise: overtaking taxis in key markets. *Forbes.* www.forbes.com/sites/andrewbender/2015/04/10/ubers-astounding-rise-overtaking-taxis-in-key-markets/

Bhat, G., Beck, L., Bergen, G., & Kresnow, M. J. (2015). Predictors of rear seat belt use among US adults, 2012. *Journal of Safety Research* 5, 103-106.

Bose, D., Arregui-Dalmases, C., Sanchez-Molina, D., Velazquez-Ameijide, J., & Crandall, J. (2013). Increased risk of driver fatality due to unrestrained rear-seat passengers in severe frontal crashes. *Accident Analysis & Prevention* 53, 100-104.

Copeland, L. (2015, February 15). Bob Simon was not violating seat belt law in fatal crash. *USAToday.* www.usatoday.com/story/news/2015/02/13/no-seat-belt-violation-in-simon-crash/23354289/

Chen, Y. Y. (2014). *Seat Belt Use in 2013–Use Rates in the States and Territories.* (Report No. DOT HS 812 030). Washington, DC: National Highway Traffic Safety Administration.

FARS (2015). FARS Query System. www-fars.nhtsa.dot.gov//QueryTool/. Accessed 2/13/15.

GHSA (2015a). *Seat Belt Laws.* Washington, DC: Governors Highway Safety Association. www.ghsa.org/html/stateinfo/laws/seatbelt_laws.html. Accessed 9/24/15.

GHSA (2015b). *Survey of State Highway Safety Offices.* Washington, DC: Governors Highway Safety Association.

Goodwin, A., Kirley, B., Sandt, L., Hall, W., Thomas, L., O'Brien, N., & Summerlin, D. (2013). *Countermeasures that Work: A Highway Safety Countermeasures Guide for State Highway Safety Offices.* 7th edition. (Report No. DOT HS 811 727). Washington, DC: National Highway Traffic Safety Administration.

Hu, W. (2015, May 26). Deaths of math genius John F. Nash Jr. and wife show need to use seatbelts in back, experts say. *New York Times.* www.nytimes.com/2015/05/26/nyregion/deaths-of-math-genius-john-f-nash-jr-and-his-wife-show-need-to-use-seatbelts-in-back-experts-say.html?_r=0

IIHS (2015). *Safety Belt Laws.* Arlington, VA: Insurance Institute for Highway Safety. www.iihs.org/iihs/topics/laws/safetybeltuse. Accessed 9/24/15.

Kahane, C. J. (2015). *Lives saved by vehicle safety technologies and associated Federal Motor Vehicle Safety Standards, 1960 to 2012 – Passenger cars and LTVs – With reviews of 26 FMVSS and the effectiveness of their associated safety technologies in reducing fatalities, injuries, and crashes.* (Report No. DOT HS 812 069). Washington, DC: National Highway Traffic Safety Administration.

Kosoff, M. (2015). Shockingly, Lyft isn't getting demolished by Uber. *Business Insider.* www.businessinsider.com/lyft-internal-growth-numbers-revealed-2015-3.

McGehee, D. V., Reyes, M. L., Marshall, D., Skinner, E., Lundell, J., & Peek-Asa, C. (2014). *A Comparative Policy Analysis of Seat Belt Laws* (Report No. RB37-013). Iowa City, IA: University of Iowa. www.iowadot.gov/research/reports/Year/2014/fullreports/UIowa_SeatBeltPolicyAnalysis_FinalReport.pdf. Accessed 10/28/15.

NCSL (2015). *State Traffic Safety Legislation Database*. Denver, CO: National Conference of State Legislatures. www.ncsl.org/research/transportation/state-traffic-safety-legislation-database.aspx. Accessed 9/19/15.

NHTSA (2015a). *Lives Saved in 2013 by Restraint Use and Minimum Drinking Age Laws*. (Report No. DOT HS 812 137). Washington, DC: US Department of Transportation.

NHTSA (2015b). *Summary of Vehicle Occupant Protection and Motorcycle Laws, Twelfth Edition Current as of November 15, 2013*. (Report No. DO THS 812 129). Washington, DC: National Highway Traffic Safety Administration.

NYTLC (2014). *2014 Taxicab Fact Book*. New York, NY: Taxi & Limousine Commission. www.nyc.gov/html/tlc/downloads/pdf/2014_taxicab_fact_book.pdf

Padmanaban, J., & Mortazavi, L. (2006). Kid in the middle: a discussion of effectiveness of center rear-seat restraint systems. In *Annual Proceedings/Association for the Advancement of Automotive Medicine* (Vol. 50, p. 221). Association for the Advancement of Automotive Medicine.

Parada, M. A., Cohn, L. D., Gonzalez, E., Byrd, T., & Cortes, M. (2001). The validity of self-reported seatbelt use: Hispanic and non-Hispanic drivers in El Paso. *Accident Analysis & Prevention* 33, p. 139-143.

Pickrell, T. M., & Choi, E.-H. (2015). *Seat belt Use in 2014—Overall results*. (Report No. DOT HS 812 113). Washington, DC: National Highway Traffic Safety Administration.

Pickrell, T. M., & Liu, C. (2014). *Seat Belt Use in 2013 – Overall Results*, (Report No. DOT HS 811 875). Washington, DC: National Highway Traffic Safety Administration.

Pickrell, T.M., & Liu, C. (2015). *Occupant restraint use in 2013: results from the NOPUS controlled intersection study*. (Report No. DOT HS 812 080). Washington, DC: National Highway Traffic Safety Administration.

Raneses, E., & Pressley, J. C. (2015). Factors associated with mortality in rear-seated adult passengers involved in fatal motor vehicle crashes on US roadways. *Injury Epidemiology, 2*(1), 5-5.

Smith, K. M., & Cummings, P. (2006). Passenger seating position and the risk of passenger death in traffic crashes: a matched cohort study. *Injury Prevention* 12(2), 83-86.

Teigen, A., Shinkle, D., & Essex, A. (2015). *Traffic Safety Trends: State Legislative Action in 2014*. Denver, CO: National Conference of State Legislatures. www.ncsl.org/documents/transportation/2014Trafficsafetytrends.pdf. Accessed 10/5/15.

Zambon, F., Fedeli, U., Marchesan, M., Schievano, E., Ferro, A., & Spolaore, P. (2008). Seat belt use among rear passengers: validity of self-reported versus observational measures. *BMC public health* 8(1), p. 233.

APPENDIX: POTENTIAL LIVES SAVED

With 100% belt use

NHTSA estimates that lap-shoulder belts are 44% effective in preventing fatalities in outboard rear seat positions in passenger cars and 73% effective in light trucks and vans (Kahane, 2015). Padmanaban and Mortazavi (2006) found that there is no significant difference between the effectiveness of center lap belts and outboard lap-shoulder belts. Using the Kahane effectiveness estimates for all rear seating positions, if all these fatally-injured passengers had been belted, 315 of the car and SUV passengers (44% of 717) and 121 of the van and pickup passengers (72% of 166) would have survived; 436 in all.

With belt use at front seat levels from NOPUS

Suppose that the 883 unbelted rear seat fatalities in 2013 were among the 22% of rear seat passengers on the road who were unbelted in the NOPUS data. If rear seat use had been 87% instead of 78%, the unbelted rate would have decreased by 9 percentage points, from 22% to 13%, or by 9/22. So 9/22 of 883 unbelted passengers would have been belted. The lives saved estimates are:

> Cars and SUV passengers: 9/22 * 717 = 293.3 would have been belted; 44% of these, or 129.05 would have survived.
>
> Light trucks and van passengers: 9/22 * 166 = 67.9 would have been belted; 73% of these, or 49.57 would have survived.
>
> Together, there would have been 129.05 + 49.57 = 178.62 fewer fatalities.

With belt use at front seat levels from FARS

For a more conservative estimate, suppose that the 883 unbelted rear seat fatalities had worn their belts at the same rate as the front seat occupants in these fatal crashes: 74%, rather than 60%. That means that the unbelted rate would have decreased by 14 percentage points, from 40% to 26%, or by 14/40. The lives saved estimates under this assumption are:

> Cars and SUV passengers: 14/40 * 717 = 250.95 would have been belted; 44% of these, or 110.42 would have survived.
>
> Light trucks and van passengers: 14/40 * 166 = 58.10 would have been belted; 73% of these, or 42.41 would have survived.
>
> Together, there would have been 110.42 + 42.41 = 152.83 fewer fatalities.

To summarize: 100% belt use in the rear seat would have saved approximately 436 lives in 2013. Rear seat belt use at front seat belt use rates observed in either NOPUS or FARS would have saved approximately 165 lives.