



Passenger use of and attitudes toward rear seat belts

Jessica S. Jermakian, * Rebecca A. Weast

Insurance Institute for Highway Safety, United States

ARTICLE INFO

Article history:

Received 15 May 2017

Received in revised form 9 September 2017

Accepted 5 December 2017

Available online 28 December 2017

Keywords:

Rear seat

Belt use

Belt use laws

Survey

ABSTRACT

Objectives: This study sought to identify attitudes toward belt use in the rear seat and to gain insight into the experiences of rear-seat passengers. **Method:** A telephone survey conducted between June and August 2016 targeted adult passengers who had recently ridden in the rear and who did not always wear their seat belt when doing so. Respondents were questioned regarding their reasons for not buckling up and possible conditions under which they would be more likely to buckle up during rear-seat travel. **Results:** Of 1163 recent rear-seat passengers, 72% reported always using their seat belt in the rear. Full-time belt use was lower among passengers who primarily travel in the rear of hired vehicles compared with personal vehicles. The most common explanation for not buckling up was that the back seat is safer than the front. Four out of five agreed they do not buckle up because of type of trip; two-thirds forget or do not see the need; and two-thirds agreed with reasons related to design, comfort, or usability issues. Nearly 40% agreed that they sometimes do not buckle up in the rear because there is no law requiring it. **Conclusion:** Many reasons for not using belts in the rear are similar to reasons in the front, such as forgetfulness, inconvenience, or discomfort. One difference is that many rear-seat passengers perceive using the belt is unnecessary because the back seat is safer than the front. More than half of part-time belt users and nonusers reported interventions such as rear seat belt reminders, stronger belt-use laws, and more comfortable belts would make them more likely to use their seat belt in the rear seat. **Practical applications:** This study identifies barriers to rear seat belt use that point to the need for a multi-faceted approach to increase belt use.

© 2018 National Safety Council and Elsevier Ltd. All rights reserved.

1. Introduction

Seat belt use in the rear seat has improved over time but remains consistently lower than belt use in the front seat. A national observational survey on seat belt use among occupants 8 years and older found that while rear seat belt use increased between 2004 and 2015 (from 47% to 75%), the gap between front- and rear-seat belt use has remained; rear-seat restraint use has averaged about 11 percentage points lower than front-seat use over the past decade (Pickrell, Li, & Kc, 2016; Pickrell & Ye, 2010). In a 2008 nationally representative telephone survey, 86% to 88% of respondents reported they always use their belt in the front seat, while only 58% always use their belt in the rear seat (Boyle & Lampkin, 2008).

The gap in restraint use translates into a larger proportion of unbelted fatally injured occupants in the rear compared with the front; 56% of fatally injured rear-seat occupants were unbelted in 2015, compared with 49% of fatally injured front-seat occupants (National Highway Traffic Safety Administration, 2017). In a study of fatal crashes, unrestrained rear-seat passengers were nearly 3 times as likely to be

fatally injured compared with belted ones (Mayrose et al., 2005). In a study of nationally representative data on towaway crashes during 2007–2012, unrestrained occupants in the rear were nearly 8 times as likely to suffer a serious injury compared with restrained occupants (Durbin et al., 2015).

In addition to posing a risk to themselves, unrestrained rear-seat passengers increase the risk of fatal injury to other occupants in the vehicle. In a study of fatal crashes occurring during 2001–2009, drivers were 2.37 times as likely to be fatally injured in crashes in which the left rear passenger was unrestrained compared with crashes in which the passenger was restrained (Bose, Arregui-Dalmases, Sanchez-Molina, Velazquez-Ameijide, & Crandall, 2013). The risk of fatality increased with each additional unrestrained rear-seat occupant. An earlier study using 1995 to 2001 fatal crash data reported the odds of death for a driver in front of an unrestrained passenger in a frontal crash were 2.27 higher than the odds of death when the rear-seat passenger was restrained (Mayrose et al., 2005). Research on fatalities in Japan also shows an increased risk of death to front-seat occupants from unrestrained rear-seat occupants (Ichikawa, Nakahara, & Wakai, 2002). In another study looking at occupants in all rows exposed to an unrestrained occupant, the restrained occupant was nearly 5 times as likely to be fatally injured when positioned between an unrestrained occupant and the principal direction of force of the crash (MacLennan, McGwin Jr., Metzger, Moran, & Rue III, 2004).

* Corresponding author at: Insurance Institute for Highway Safety, 1005 N Glebe Rd, Suite 800, Arlington, VA 22201, United States.

E-mail address: jjermakian@ihs.org (J.S. Jermakian).

Previous studies have found belt use is associated with occupant age and sex, vehicle age, time of day, geographic location, and whether the belt-use law has primary or secondary enforcement (Beck & Shults, 2009; Strine et al., 2010; Tison, Williams, & Chaudhary, 2010). Most of this work, however, has focused on either general belt use or use by front-seat occupants; minimal work has specifically examined restraint use by rear-seat passengers. Bhat, Beck, Bergen, and Kresnow (2015) used the ConsumerStyles web-based survey data to look at predictors of rear seat belt use and found belt use varied by demographic factors such as age, race/ethnicity, household income, geographic factors such as census region and metropolitan status, and belt-law enforcement type. Notably, the predictors of rear seat belt use are similar to those of front seat belt use, with the exception of occupant's sex and age. In the rear seat, male occupants were as likely as females to be belted, and adults age 18 to 24 years reported higher belt use than those 25 to 44 years.

Telephone surveys indicate the most common reasons for not using seat belts are driving short distances, forgetting or being in a rush, or finding the belt uncomfortable (Boyle & Lampkin, 2008; Kidd & McCartt, 2014). For those who never use seat belts, the most common reasons include discomfort, the perception that the belt is not needed, and a dislike of being told what to do (Kidd & McCartt, 2014). The adults surveyed in past studies were asked about their belt-use habits in general, not specific to the rear-seat environment. The current study aims to extend this work by identifying factors and attitudes that specifically influence belt use by rear-seat passengers.

2. Methods

2.1. Sample design

The current study targeted adults 18 years old and over who had ridden as a passenger in the rear seat within the preceding six months and who did not always use their seat belt when doing so. Opinion America Group (Cedar Knolls, NJ) carried out the survey, utilizing random samples of both landlines and cellphones with the aim of sampling evenly from each group. Surveys were completed between June and August 2016.

Opinion America began with an initial random sample of 10,807 working U.S. phone numbers (5250 landlines and 5557 cellphones). Of those, 4133 people were reached. That number includes 1499 who refused to participate, 219 who did not qualify or otherwise did not complete the survey, and 2415 who completed the survey, for a 58.4% cooperation rate. A total of 1163 of the 2415 survey respondents had ridden in the rear seat of a passenger vehicle in the prior six months, and 316 met the additional inclusion criterion of not using a seat belt on every trip when riding in the rear seat. Those 316 participants completed the full survey. Those participants who did not meet inclusion criteria for the full survey were skipped to the final demographic items of the survey, and finished their participation in less than 5 min on average. The full survey took about 11 min to complete.

2.2. Survey instrument

Participants answered screening questions to identify their rear-seat passenger and belt-use habits. Those participants who met inclusion criteria then answered 41 questions probing the details of their reasons for not consistently wearing a seat belt when traveling in the rear seat, and possible conditions under which they would be more likely to wear a seat belt during future rear-seat travel. Several questions prompted follow-up questions to ascertain more specific information about preferences and behavior.

Following these questions, participants were asked 11 questions about their state's seat belt laws, to which kinds of passengers they apply, and whether the state practices primary enforcement. The survey concluded with six demographic questions.

2.3. Data analysis

Data for all respondents, including those who did not meet inclusion criteria for the full survey, were weighted to reflect the age and gender distribution of the U.S. population according to 2010 census data. Since the full survey focused on recent rear seat passengers, the final study sample has different age and gender distributions than the U.S. population. All descriptive analyses were calculated as weighted percentages with 95% confidence intervals (95% CI). Survey respondents who reported riding in the rear seat were categorized as full-time belt users, part-time belt users, or nonusers based on whether they reported seat belt use in the rear seat all the time (full-time users), most or some of the time (part-time belt users), or rarely or never (nonusers). Respondents were categorized as hired vehicle passengers if they reported most or all of their rear-seat passenger trips were in a hired vehicle such as a taxi, Uber, or Lyft (ride-hailing services). Otherwise, they were categorized as personal vehicle passengers. Chi-square tests were used to evaluate differences in responses among respondent categories.

3. Results

A total of 2415 respondents were screened for whether they ride as a passenger in a vehicle and, if so, whether they have been a rear-seat passenger in the past six months. The 1163 respondents who reported riding recently as a rear passenger were asked about their belt-use habits in more detail. Table 1 summarizes characteristics of rear-seat passengers. Ninety-one (91.4) percent said they always used their seat belt in the front seat, but only 72.1% said they always used their seat belt in the back seat (data not shown). Twenty-eight (27.9) percent of recent rear-seat passengers reported they use their belt in the back seat most of the time, some of the time, or rarely or never; 16.2% were part-time users and 11.7% were nonusers (data not shown).

Participants who reported that they always use their seat belt when riding in the rear seat differed from those who didn't in a few notable ways (Table 2). Significantly fewer men than women reported always buckling up when riding in the back seat, prime-age adults – between the ages of 35 and 54 – were significantly less likely to report always buckling up than both younger (ages 18–34) and older adult drivers (ages 55+). Participants who had at least some college education reported always using their seat belt at a higher frequency than those who had achieved education levels less than college. Finally, passengers who reported riding in a hired vehicle – either a taxi or ride-hailing

Table 1

Distribution of age, sex, education level, and whether most trips are in a hired vehicle or personal vehicle among respondents who have ridden in the rear seat in the past 6 months. Distribution provided as weighted percentages and 95% confidence intervals with unweighted n.

	All rear seat passengers Weighted percent (95% CI) (n = 1163)
Age (years)	
18 to 34	31.9 (29.2–34.6)
35 to 54	33.3 (30.6–36.0)
55 to 69	24.7 (22.2–27.2)
70 and older	9.5 (7.8–11.2)
Sex	
Male	41.0 (38.2–43.8)
Female	59.0 (56.2–61.8)
Education level	
Some high school	1.1 (0.5–1.7)
High school graduate	16.5 (14.4–18.6)
Some college	30.6 (28.0–33.2)
College graduate	28.3 (25.7–30.9)
Graduate school	21.7 (19.3–24.1)
Most trips are in a...	
Hired vehicle	12.1 (10.2–14.0)
Personal vehicle	87.9 (86.0–89.8)

Table 2

Percent of rear-seat passengers who report always using their seat belt in the rear seat stratified by age, sex, education level, and whether most trips are in a hired vehicle or personal vehicle. P-value from χ^2 statistic.

	Unweighted n	Report always wearing seat belt in the rear seat Weighted percent (95% CI)	p-Value
Age (years)			
18 to 34	168	73.6 (66.9–80.3)	$p = 0.002^*$
35 to 54	235	66.8 (60.8–72.8)	
55 and older	419	76.5 (72.4–80.6)	
Sex			
Male	352	67.7 (62.8–72.6)	$p = 0.003$
Female	495	75.4 (71.6–79.2)	
Education level			
Less than college	161	65.4 (58.1–72.7)	$p = 0.010$
Some college or higher	686	73.7 (70.4–77.0)	
Most trips are in a...			
Hired vehicle	94	57.1 (47.1–67.1)	$p < 0.001$
Personal vehicle	753	74.8 (71.7–77.9)	

* Comparison of 35 to 54 years and other age ranges combined

service – reported always buckling up, with significantly less frequency than those who rode in personal or private vehicles.

Similar tables are provided for part-time users (Table 3) and nonusers (Table 4). Significantly more participants who primarily travel in hired vehicles reported buckling up most or some of the time (i.e., part-time use; Table 3). Significantly more men, adults ages 35 to 54 years, those with less than some college education and participants who primarily ride in hired vehicles reported rarely or never wearing their belt in the rear seat (i.e., nonuse; Table 4).

Part-time belt users and nonusers were asked more detailed questions about the reasons for their nonuse. Data for part-time users and nonusers were combined for the remaining analyses. Eighty percent (80.1%, $n = 255$) of part-time belt users and nonusers reported that they are less likely to use their seat belt in the back seat compared with the front. That subset was asked for explanations in an open-ended question allowing for multiple responses. Twenty-five (25.4) percent said they believe the rear seat is safer than the front so using the belt is not necessary. The next most popular response was that they do not use their seat belt out of habit, they forget, or simply never or rarely wear it (12.9%). Twelve (11.6) percent of respondents indicated the belt is uncomfortable or doesn't fit, while 10.2% indicated the belt is difficult to use or they can't find the belt or buckle. Nine (9.4) percent said they do not use their seat belt in the rear because the law doesn't require it.

Table 3

Percent of rear-seat passengers who report part-time seat belt use in the rear seat stratified by age, sex, education level, and whether most trips are in a hired vehicle or personal vehicle. P-value from χ^2 statistic.

	Unweighted n	Report part-time seat belt use in the rear seat Weighted percent (95% CI)	p-Value
Age (years)			
18 to 34	37	16.1 (4.3–27.9)	$p = 0.06^*$
35 to 54	64	18.8 (9.2–28.4)	
55 and older	75	13.3 (5.6–21.0)	
Sex			
Male	87	17.4 (9.4–25.4)	$p = 0.33$
Female	98	15.3 (8.2–22.4)	
Education level			
Less than college	41	18.9 (6.9–30.9)	$p = 0.22$
Some college or higher	144	15.6 (9.7–21.5)	
Most trips are in a...			
Hired vehicle	36	23.6 (9.7–37.5)	$p = 0.003$
Personal vehicle	149	14.9 (9.2–20.6)	

* Comparison of 35 to 54 years and other age ranges combined

Table 4

Percent of rear-seat passengers who report rarely or never using a seat belt (i.e., nonuse) when riding in the rear seat, stratified by age, sex, education level, and whether most trips are in a hired vehicle or a personal vehicle. P-value from χ^2 statistic.

	Unweighted n	Report rarely or never using a seat belt in the rear seat Weighted percent (95% CI)	p-Value
Age (years)			
18 to 34	24	10.3 (0.0–22.5)	$p = 0.030^*$
35 to 54	52	14.5 (4.9–24.1)	
55 and older	55	10.2 (2.2–18.2)	
Sex			
Male	72	14.9 (6.7–23.1)	$p = 0.002$
Female	59	9.3 (1.9–16.7)	
Education level			
Less than college	34	15.7 (3.5–27.9)	$p = 0.031$
Some college or higher	97	10.7 (4.5–16.9)	
Most trips are in a...			
Hired vehicle	34	19.3 (6.0–32.6)	$p < 0.001$
Personal vehicle	97	10.3 (4.3–16.3)	

* Comparison of 35 to 54 years and other age ranges combined.

As noted above, riding in the rear seat of a hired vehicle is associated with significantly lower rates of buckling up. Fifty percent (49.8%, $n = 149$) of part-time belt users and nonusers reported they are less likely to use their seat belt in the back seat of a taxi or other hired vehicle than in a personal vehicle. When asked for their reasons in an open-ended question allowing for multiple responses, 16.8% reported they do not use their seat belt out of habit, they forget, or it is inconvenient. Another 16.6% said they don't know why they don't use the seat belt. Fifteen (14.3) percent of respondents indicated they are only going short distances or at low speeds, while 9.8% said the belt is difficult to use or they can't find the belt or buckle. Six (6.4) percent reported the driver is a professional and they trust him/her, while 6.5% said they "feel safe" in the rear seat of a hired vehicle.

In addition to open-ended questions, part-time belt users and nonusers were asked to agree or disagree with a series of statements

Table 5

Percentage of part-time belt users and nonusers who agree with statements describing reasons for sometimes not wearing the seat belt in the back seat. Total rows summarize all respondents who agreed to one or more of the statements immediately preceding the total.

Percentage of respondents who agree with the statement "Sometimes I do not wear my seatbelt in the back seat because..."	Part-time belt users and nonusers Weighted percent (95% CI) ($n = 316$)
I am only going a short distance	67.7 (62.5–72.9)
I'm being driven in a taxi	39.1 (33.7–44.5)
I'm being driven in an Uber, Lyft or other passenger vehicle rideshare	28.4 (23.4–33.4)
I'm being driven in a vanpool	20.5 (16.0–25.0)
Total: belt is not needed because of the type of trip	79.6 (75.2–84.0)
I forgot to put it on	51.5 (46.0–57.0)
The probability of being in a crash is low	24.0 (19.3–28.7)
Total: forget or don't see the need	68.2 (63.1–73.3)
The seat belt is uncomfortable	43.8 (38.3–49.3)
The seat belt doesn't fit me	15.0 (11.1–18.9)
I can't find the buckle	33.8 (28.6–39.0)
I can't find the belt	29.4 (24.4–34.4)
I can't figure out which buckle goes with my seat belt	28.0 (23.0–33.0)
The seat belt is too hard to buckle	23.4 (18.7–28.1)
Total: design, comfort or usability issues	68.0 (62.9–73.1)
Law doesn't require it	37.5 (32.2–42.8)
The people I am with are not wearing their belts	23.9 (19.2–28.6)
There are too many people in the back seat	33.3 (28.1–38.5)
I don't want my clothes to get wrinkled	11.8 (8.2–15.4)

about why they do not wear their seat belt in the rear seat (Table 5). Of part-time belt users and nonusers, 79.6% agreed with statements that they do not use the seat belt because of the type of trip (e.g., short distances or in a hired vehicle). Sixty-eight (68.2) percent agreed with statements indicating they forget or do not see the need to buckle up, and 68.0% agreed with reasons related to design, comfort, or usability issues. Nearly 40% (37.5%) agreed that they sometimes do not use their seat belt in the rear seat because there is no law requiring it.

Part-time belt users and nonusers were asked whether laws, belt design changes, and other interventions would make them more or less likely to use the seat belt (Table 6). Sixty percent said a rear-seat belt law would make them more likely to buckle up, while 72.6% said they would be more likely to buckle up if the driver could get pulled over because they were unbuckled. Fifty-nine (58.6) percent of part-time users and nonusers said they would be more likely to buckle up if shoulder belts were more comfortable, and 61.9% said an audible belt reminder would make them more likely to use their belt. Half (50.4%) would be more likely to buckle up if the buckle were easier to find.

Respondents who reported they would be more likely to use their seat belt if it was more comfortable were asked in an open-ended question what they would like to see improved. The most common response was shoulder and lap belts that were made of softer or more padded material (33.2% and 32.7% for shoulder and lap belt, respectively). Other common responses were shoulder belts that were adjustable (18.3%) or positioned away from the neck (25.2%), and lap and shoulder belts that were not as tight and/or did not lock (16.4% and 27.0% for lap and shoulder belt, respectively). When uncomfortable or annoyed due to the seat belt, 52.6% reported they sometimes or always take their seat belt off, while 30.1% said they always leave it on despite the discomfort. When these responses were examined in relation to height, weight, body mass index (BMI), and age, no notable relationships were observed; participants reported a variety of comfort and usability issues, regardless of age or body size.

Thirty-six (36.4) percent of the respondents reside in states with rear-seat belt use laws that covered adult passengers at the time of study. A table of the state laws during the study period can be found in the Appendix A. Part-time users and nonusers were asked for details about their state's belt-use laws, including whether a law exists, who is covered under the law, and whether the law allows primary or secondary enforcement (Table 7). Ninety-two (91.5) percent said their state has a belt-use law of some type (data not shown). Among the respondents who said their state has a belt-use law, 40.9% believed the law covers adults in the rear seat (data not shown), but only 22.0% correctly stated that the law covers adults in the rear seat (that is, only about half of respondents who said the law covers adults in the rear seat were

Table 7

Part-time belt users and nonusers knowledge of who is covered under belt-use laws in their state and whether the belt use law in their state has primary or secondary enforcement for adults in the rear seat.

	Weighted percent (95% CI)
Among respondents who said state has a belt use law ... (n = 289)	
Correctly identified that state belt-use law	32.5 (27.1–37.9)
Does not cover adults in the rear seat	
Correctly identified that state belt-use law	22.0 (17.2–26.8)
Covers adults in the rear seat	
Among respondents who also cited law as a reason for not using the belt... (n = 111)	
Correctly identified that state belt-use law	61.5 (52.5–70.6)
Does not cover adults in the rear seat	
Correctly identified that state belt-use law	9.2 (3.8–14.6)
Covers adults in the rear seat	
Among respondents who said state has a belt-use law that covers adults in the rear seat... (n = 114)	
Correctly identified the belt-use law	13.1 (6.9–19.3)
Has primary enforcement	
Correctly identified the belt-use law	2.6 (0.0–5.5)
Has secondary enforcement	

correct). Forty-one (41.3) percent said the law does not cover adults in the rear seat (data not shown), and 32.5% correctly indicated that their state's law does not cover adults in the rear seat. A larger proportion of respondents who cited the law as a reason for not using the seat belt in the rear correctly said that their state law does not cover adults in the rear seat (61.5%). Among those who believe their state belt-use law covers adults in the rear seat, 36.9% reported that they do not know whether the driver can be pulled over if a rear passenger is not belted (data not shown). Thirteen (13.1) percent of respondents correctly identified their state's rear-seat belt law as primary enforcement, and 2.6% correctly identified their law as secondary enforcement.

4. Discussion

This study provides a snapshot of adult rear-seat passengers who do not regularly use their seat belt when riding in the rear seat, a population that, to-date, has received little attention. Several reasons such passengers give for not buckling up were identified; these can be loosely grouped into four categories: ambivalence, misperception of safety benefits, design and usability, and the law. While respondents note that issues of fit, comfort, and convenience, as well as legal requirements, contribute to their behavior, the most common responses reflected participants' ambivalence and misperception about the consequences of not buckling up.

In the current study, more than a quarter of adults who recently had ridden in the rear seat of a passenger vehicle reported not regularly buckling up when doing so. A larger proportion of respondents (72%) reported always buckling up in the rear seat than reported by Bhat et al. (2015; 62%) in a study based on a 2012 web-based survey. In the current study, there was a 19 percentage point difference between participants who always buckle up in the front seat and those who always buckle up in the rear seat, which is a markedly smaller difference than the difference of 30 percentage points noted in the Boyle and Lampkin (2008) telephone survey of belt use. Observational studies show rear-seat belt use has increased in recent years but, on average, has been 11 percentage points lower than front-seat use during the past 10 years (Pickrell & Li, 2016; Pickrell & Ye, 2010).

Similar to other studies of general or front-seat belt-use practices, demographic factors such as age, sex, and education level were associated with reporting less than full-time belt use (Beck & Shults, 2009; Boyle & Lampkin, 2008; Strine et al., 2010; Tison et al., 2010). However, previous surveys of general belt-use practices found the youngest adults (18 to 25 years) tend to have lower rates of belt use, while the current study shows those least likely to always buckle up are 35- to 54-year-old rear-seat passengers. This finding is consistent with an earlier

Table 6

Percentage of part-time belt users and nonusers who say the following interventions would make them more likely to wear the seat belt in the rear seat.

Would the following situation make you more likely, less likely or just as likely to wear your seat belt in the back seat... (n = 316)	More likely Weighted percent (95% CI)
If I knew there was a law that I had to wear my seat belt	60.0 (54.6–65.4)
If the driver could get pulled over because I'm not wearing my seat belt	72.6 (67.7–77.5)
If the shoulder belt was more comfortable	58.6 (53.2–64.0)
If the lap belt was more comfortable	52.2 (46.7–57.7)
If the buckle was easier to find	49.3 (43.8–54.8)
If the belt was easier to find	45.1 (39.6–50.6)
If the seat belt was easier to buckle	44.8 (39.3–50.3)
If it was easier to figure out which buckle goes with my belt	44.9 (39.4–50.4)
If the back seat was more comfortable	46.1 (40.6–51.6)
If there was an audible belt reminder	61.9 (56.5–67.3)
If there was a visual belt reminder	50.4 (44.9–55.9)
If someone in the car reminded me	75.0 (70.2–79.8)

survey of rear-seat occupants in which adults ages 25 to 44 years had the lowest belt-use rates, while the youngest adults had higher use rates (Bhat et al., 2015). However, the current study found males were less likely to report always using the seat belt in the back seat, which is contrary to the findings of Bhat et al.

People who reported that most of their trips as a rear-seat passenger were in a hired vehicle such as a taxi or other ride-hailing service were more likely to report not always using their seat belt than passengers in personal vehicles. In this survey, 57% of passengers in hired vehicles reported always using their seat belt in the rear, which is substantially higher than the 38% of survey respondents who reported using seat belts in New York City's taxi cabs (New York City Taxi and Limousine Commission, 2014) but still lower than the 74% of passengers of personal vehicles who report always using their seat belt. Respondents in the current study commonly noted that they forget, find buckling up inconvenient, or simply do not know why they fail to use their seat belt. While belt-use laws influence belt-use rates (Beck & Shults, 2009; Boyle & Lampkin, 2008; Pickrell et al., 2016; Strine et al., 2010; Tison et al., 2010), many states exempt taxis from such laws, leaving taxi passengers free from this influence. Passengers in hired vehicles also might perceive their trips as fundamentally different than trips in personal vehicles.

Similar to other belt-use surveys (Boyle & Lampkin, 2008; Kidd & McCartt, 2014), part-time belt users and nonusers commonly reported not using their seat belt for certain trip types, such as going short distances, and those reasons may be confounded with riding in a hired vehicle. However, a study of belt use using naturalistic driving data suggests that drivers in personal vehicles make different restraint decisions depending on characteristics of the trip. This suggests that this reasoning is not exclusive to passengers in hired vehicles (Reagan, McClafferty, Berlin, & Hankey, 2013). Specifically, occasional belt users were less likely to buckle up on lower-speed roads and, to some extent, on trips of shorter distances, providing confirmation of the self-report data in the current study.

Many part-time belt users and nonusers reported that belt-use laws (60%) and primary enforcement (73%) would encourage them to buckle up in the rear seat. However, respondents were generally not well informed about whether their state's belt-use law covers adults in the rear seat and the type of enforcement allowed. Half of respondents believed that their state's laws require adults to use a seat belt when riding in the rear seat, but only about half of that group was correct. Respondents who cited the law as a reason for not buckling up were more knowledgeable, with 7 out of 10 correctly identifying who is covered by their state's law. There is consistent evidence that belt-use laws influence belt-use rates in the front seat (Beck & Shults, 2009; Shults, Elder, Sleet, Thompson, & Nichols, 2004), resulting in an associated reduction in death rates (Farmer & Williams, 2005). While most studies have focused on the influence of laws on front-seat belt use, there is some evidence that laws will influence rear-seat belt use. Based on the national observational survey of front- and rear-seat belt use in 2015, belt use in rear seats was higher in states with laws requiring belt use in all seating positions (83%) than in states requiring belt use only in the front seat (61%; Pickrell et al., 2016), and self-report data show that when rear-seat occupants know that a seat-belt-use law covers the rear seat, they are more likely to report always using their belt (Boyle & Lampkin, 2008).

The most common reasons for failing to buckle up given by participants in the current survey are forgetfulness, being out of the habit, or the perception it is unnecessary. Previous work shows overlap in the reasons people give for not buckling up in the front seat and the rear seat (Boyle & Lampkin, 2008; Kidd & McCartt, 2014), and so strategies that have increased belt use in the front — extending strong belt-use laws to adults in the rear seat or enforcement campaigns that specifically target the rear seat (Beck & Shults, 2009; Shults et al., 2004) — may also encourage rear belt use. For front-seat occupants, stronger belt-use laws and targeted enforcement have effectively increased seat belt usage at the state level in several cases. For example, North Carolina first implemented *Click It or Ticket*, an effort coupling public advertising and education with

targeted enforcement, in 1993, increasing belt usage (Reinfurt, 2004). Belt use for both drivers and passengers in Nevada rose significantly between 2003 and 2005, following a targeted media-based education program and enforcement campaign (Vasudevan, Nambisan, Singh, & Pearl, 2009), and a *Click It or Ticket* campaign in Hawaii increased observed belt usage by an average of 6.9% (Kim, Yamashita, & Transportation Research, 2003). In 2002, 10 states implemented strong *Click It or Ticket* programs and increased belt usage by 8.3% over the four-week campaign (Solomon, Ulmer, & Preusser, 2002). In a more recent evaluation of the national *Click It or Ticket* program in 2013, awareness of the campaign slogan, buckle-up messaging, and high-visibility enforcement increased following the campaign (Nichols, Chaffe, Solomon, & Tison, 2016). High-visibility enforcement of rear-seat belt use laws in states that have them would raise awareness of those laws.

Stronger belt-use laws and targeted enforcement also may influence passengers' beliefs about the relative safety of the rear seat, when compared with the front. One-quarter of respondents report they are less likely to use their belt in the back because the back seat is safer, so a seat belt is not necessary. Research contradicts this belief, showing that safety advances in the front seat in newer model year vehicles has made the rear seat comparatively less safe for restrained passengers (Bilston, Du, & Brown, 2010; Durbin et al., 2015; Sahraei, Digges, & Marzougui, 2010). Restrained rear-seat occupants in 2007 and newer vehicles have a 45% higher risk of sustaining fatal injuries compared with restrained front-seat passengers (Durbin et al., 2015). In addition, the risk of serious injury is substantially higher for unbelted versus belted occupants in the rear seat (Durbin et al., 2015).

Two-thirds of part-time belt users or nonusers reported they sometimes do not use the seat belt because of design, comfort, or usability issues, which may point to some engineering countermeasures to increase belt use. In another belt-use survey, about a third of drivers said their non-use of belts is related to the belt being uncomfortable, suggesting the design and comfort issues may not be unique to the rear seat (Boyle & Lampkin, 2008). The most common changes respondents would like to see are seat belts made of softer or more padded material and shoulder belts that are adjustable or moved away from the neck. Some vehicles have adjustable d-ring locations in rear-seat positions, but whether passengers use them is unknown. In a 2007 survey, two-thirds of drivers who had adjustable shoulder belts in the front seat reported they had adjusted them to achieve a more comfortable fit (Boyle & Lampkin, 2008). Still, about a third of part-time belt users and nonusers said making belt comfort improvements would not make them more likely to buckle up, suggesting that while comfort and fit issues were cited, they are not the most important reasons for many.

Half of part-time belt users and nonusers reported they would be more likely to buckle up if there was a visual seat belt reminder, and 60% reported an audible reminder would help. Vehicle manufacturers have not widely adopted rear-seat belt reminder systems despite evidence that enhanced seat belt reminders have been effective in increasing belt use in the front seat (Freedman, Levi, Zador, Lopdell, & Bergeron, 2007). NHTSA is expected to initiate rulemaking to require rear-seat belt reminders (*Moving Ahead for Progress in the 21st Century Act (MAP-21)*, 2012), and evidence that drivers have generally been supportive of belt reminders for rear-seat use (Kidd & McCartt, 2014). In 2015, only 3% of vehicle models in the United States had belt reminder systems that detect belt use in the rear seat (Insurance Institute for Highway Safety, 2016).

This study has several limitations that should be considered when interpreting the findings. Because of social norms, respondents may be more likely to report always using their seat belt. However, the percentage of respondents who reported always wearing their seat belt is consistent with national belt-use observational studies (91% reported vs. 89% observed for the front seat, respectively, and 72% reported versus 75% observed for the rear seat, respectively; Pickrell & Li, 2016). In addition, this study focused on those who self-identified as part-time belt users or nonusers, which may not be representative of all rear-seat occupants

and their experiences with rear seat belts. For example, issues related to design, comfort, and usability also may affect full-time belt users, but those respondents were not asked detailed questions about their experience.

Despite these limitations, this study provides insight into the prevalence of rear-seat belt use, and reasons for part-time belt use and non-use in the rear seat. Many reasons for not using the seat belt in the rear seat are similar to reasons in the front seat such as forgetfulness, inconvenience, or discomfort, but one notable difference is that many rear-seat passengers perceive using the seat belt is not necessary because the back seat is safer than the front. More than half of part-time belt users and nonusers reported interventions such as more comfortable belts, rear-seat belt reminders, and stronger belt-use laws may make them more likely to use their seat belt in the rear seat.

4.1. Practical applications

Passengers, particularly those who travel in taxis and other hired vehicles, are less likely to buckle up in the rear seat compared with the front. This study identifies barriers to rear seat belt use for those traveling in personal and hired vehicles that can be used to target interventions. These barriers include ambivalence, misperceptions of safety benefits, design and usability issues, and gaps in belt use laws; all of which point to the need for a multi-faceted approach to encourage belt use in the rear seat.

Acknowledgments

The authors would like to thank JoAnn Wells for her help with survey construction and administration. This work was supported by the Insurance Institute for Highway Safety.

References

- Beck, L. F., & Shults, R. A. (2009). Seat belt use in states and territories with primary and secondary laws—United States, 2006. *Journal of Safety Research*, 40(6), 469–472.
- Bhat, G., Beck, L., Bergen, G., & Kresnow, M. -J. (2015). Predictors of rear seat belt use among U.S. adults, 2012. *Journal of Safety Research*, 53, 103–106.
- Bilston, L. E., Du, W., & Brown, J. (2010). A matched-cohort analysis of belted front and rear seat occupants in newer and older model vehicles shows that gains in front occupant safety have outpaced gains for rear seat occupants. *Accident Analysis & Prevention*, 42(6), 1974–1977.
- 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 and Prevention*, 53, 100–104.
- Boyle, J. M., & Lampkin, C. (2008). *2007 motor vehicle occupant safety survey, volume 2: Seat Belt report*. (DOT HS 810 975). Washington, DC: National Highway Traffic Safety Administration.
- Durbin, D. R., Jermakian, J. S., Kallan, M. J., McCartt, A. T., Arbogast, K. B., Zonfrillo, M. R., & Myers, R. K. (2015). Rear seat safety: Variation in protection by occupant, crash and vehicle characteristics. *Accident Analysis and Prevention*, 80, 185–192.
- Farmer, C. M., & Williams, A. F. (2005). Effect on fatality risk of changing from secondary to primary seat belt enforcement. *Journal of Safety Research*, 36(2), 189–194.
- Freedman, M., Levi, S., Zador, P., Lopdell, J., & Bergeron, E. (2007). *The effectiveness of enhanced seat belt reminder systems—Observational field data collection methodology and findings*. (DOT HS 810 844). Washington, DC: National Highway Traffic Safety Administration.
- Ichikawa, M., Nakahara, S., & Wakai, S. (2002). Mortality of front-seat occupants attributable to unbelted rear-seat passengers in car crashes. *Lancet*, 359(9300), 43–44.
- Insurance Institute for Highway Safety (2016). *Q&A: Safety belts*. Arlington, VA: Insurance Institute for Highway Safety.
- Kidd, D. G., & McCartt, A. T. (2014). Drivers' attitudes toward front or rear child passenger belt use and seat belt reminders at these seating positions. *Traffic Injury Prevention*, 15(3), 278–286.
- Kim, K., Yamashita, E., & Transportation Research, B (2003). Click it or ticket: Boosting seat belt use in Hawaii. *Transportation Research Record*, 1830, 18–24.
- MacLennan, P. A., McGwin, G., Jr., Metzger, J., Moran, S. G., & Rue, L. W., III (2004). Risk of injury for occupants of motor vehicle collisions from unbelted occupants. *Injury Prevention*, 10(6), 363–367.
- Mayrose, J., Jehle, D., Hayes, M., Tinnies, D., Piazza, G., & Wilding, G. E. (2005). Influence of the unbelted rear-seat passenger on driver mortality: "The backseat bullet". *Academic Emergency Medicine*, 12(2), 130–134.
- Moving Ahead for Progress in the 21st Century Act (MAP-21), Pub. L. No. 112-141 § 31202(2012).
- National Highway Traffic Safety Administration (2017). *Traffic safety facts 2015 data: Occupant protection in passenger vehicles*. (Washington, DC).
- New York City Taxi and Limousine Commission (2014). *2014 taxicab fact book*. (New York, NY).
- Nichols, J., Chaffe, R., Solomon, M., & Tison, J. (2016). *The click it or ticket evaluation, 2013*. (pp. 5p) National Highway Traffic Safety Administration.
- Pickrell, T. M., & Li, H. (2016). *Seat Belt use in 2016—Overall results*. (pp. 4p) Washington, DC: National Highway Traffic Safety Administration.
- Pickrell, T. M., Li, H., & Kc, S. (2016). *Occupant restraint use in 2015: Results from the NOPUS controlled intersection study*. (DOT HS 812 330). Washington, DC: National Highway Traffic Safety Administration.
- Pickrell, T. M., & Ye, T. J. (2010). *Occupant restraint use in 2009—Results from the National Occupant Protection Use Survey Controlled Intersection Study*. (DOT HS 811 414). Washington, DC: A. National Highway Traffic Safety.
- Reagan, I. J., McClafferty, J. A., Berlin, S. P., & Hankey, J. M. (2013). Using naturalistic driving data to identify variables associated with infrequent, occasional, and consistent seat belt use. *Accident Analysis & Prevention*, 50, 600–607.
- Reinfurt, D. W. (2004). Documenting the sustainability of a mature click it or ticket program: The North Carolina experience. *Journal of Safety Research*, 35(2), 181–188.
- Sahraei, E., Digges, K., & Marzougui, D. (2010). Reduced protection for belted occupants in rear seats relative to front seats of new model year vehicles. *Annals of Advances in Automotive Medicine*, 54, 149–158.
- Shults, R. A., Elder, R. W., Sleet, D. A., Thompson, R. S., & Nichols, J. L. (2004). Primary enforcement seat belt laws are effective even in the face of rising belt use rates. *Accident Analysis & Prevention*, 36(3), 491–493.
- Solomon, M. G., Ulmer, R. G., & Preusser, D. F. (2002). *Evaluation of click it or ticket model programs*. (DOT HS 809 498). National Highway Traffic Safety Administration.
- Strine, T. W., Beck, L. F., Bolen, J., Okoro, C., Dhingra, S., & Balluz, L. (2010). Geographic and sociodemographic variation in self-reported seat belt use in the United States. *Accident Analysis & Prevention*, 42(4), 1066–1071.
- Tison, J., Williams, A. F., & Chaudhary, N. K. (2010). *Daytime and nighttime seat belt use by fatally injured passenger vehicle occupants*. (DOT HS-811-281). Washington, DC: National Highway Traffic Safety Administration.
- Vasudevan, V., Nambisan, S. S., Singh, A. K., & Pearl, T. (2009). Effectiveness of media and enforcement campaigns in increasing seat belt usage rates in a state with a secondary seat belt law. *Traffic Injury Prevention*, 10(4), 330–339.

Appendix A

Table A1

Summary of rear-seat coverage and enforcement for state belt-use laws during the study period.

State	Belt-use law covers adults in the rear seat	Primary or secondary enforcement for rear-seat belt-use law
Alabama		
Alaska	X	Primary
Arizona		
Arkansas		
California	X	Primary
Colorado		
Connecticut		
Delaware	X	Primary
District of Columbia	X	Primary
Florida		
Georgia		
Hawaii	X	Primary
Idaho	X	Secondary
Illinois	X	Primary
Indiana	X	Primary
Iowa		
Kansas	X	Secondary
Kentucky	X	Primary
Louisiana	X	Primary
Maine	X	Primary
Maryland	X	Secondary
Massachusetts	X	Secondary
Michigan		
Minnesota	X	Primary
Mississippi		
Missouri		
Montana	X	Secondary
Nebraska		
Nevada	X	Secondary
New Hampshire		
New Jersey	X	Secondary
New Mexico	X	Primary
New York		
North Carolina	X	Secondary
North Dakota		
Ohio		
Oklahoma		
Oregon	X	Primary
Pennsylvania		

Table A1 (continued)

State	Belt-use law covers adults in the rear seat	Primary or secondary enforcement for rear-seat belt-use law
Rhode Island	X	Primary
South Carolina	X	Primary
South Dakota		
Tennessee		
Texas	X	Primary
Utah	X	Primary
Vermont	X	Secondary
Virginia		
Washington	X	Primary
West Virginia		
Wisconsin	X	Primary
Wyoming	X	Secondary

Jessica S. Jermakian is a Senior Research Engineer at the Insurance Institute for Highway Safety. Dr. Jermakian joined the Institute in 2009 and has conducted research on topics ranging from crash avoidance and crashworthiness to child passenger safety. She holds bachelor's and master's degrees in Mechanical Engineering, and a doctorate in Transportation Safety Engineering, all from The George Washington University.

Rebecca A. Weast is a Research Scientist at the Insurance Institute for Highway safety. Dr. Weast joined the Institute in 2016 and conducts research on a range of topics including issues related to young drivers and drowsy driving. She received her bachelor's degree in psychology from Franklin and Marshall College, and her M.A and Ph.D. in Psychology, with a focus on human cognition and visual perception, from the University of Virginia.