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## **Attitudes toward Seat Belt Use and In-Vehicle Technologies for Encouraging Belt Use**

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## **ABSTRACT**

**Objectives:** In-vehicle seat belt reminders and interlocks can encourage belt use, but widespread adoption of these features depends on the degree of acceptance among both belted and unbelted occupants. The current study collected information about attitudes toward belt use and in-vehicle technologies for encouraging belt use.

**Methods:** A national telephone survey of 1,218 adult drivers and passengers was conducted using random samples of landline and cellphone numbers. Part-time belt users and non-users were over-sampled. All respondents were asked about frequency of belt use, buckling routines, and support for different types of belt interlocks. Part-time belt users and non-users were queried in more depth about different types of reminders and reminder strategies.

**Results:** Almost all respondents said they always use their seat belts (91%). Few said they did not always (8%) or never (1%) used belts. Driving a short distance (67%), forgetting (60%), and comfort (47%) were common reasons why part-time belt users do not buckle up; comfort (77%), not needing a seat belt (54%), and disliking being told what to do (50%) were most frequently cited among non-users. Half of full-time belt users and 19 percent of part-time belt users said they generally buckle up before ignition; 90 percent of full-time belt users and about half of part-time belt users buckle up before the vehicle is moving. When asked about various types of belt interlocks, part-time belt users and non-users most often said that ignition interlocks would make them more likely to buckle up (70% and 44%, respectively). However, only 44-51 percent of all respondents supported using the different types of interlocks to increase belt use. A larger proportion of part-time belt users and non-users said they would be more likely to buckle up in response to auditory and haptic reminders than visual reminders. More than two-thirds of part-time belt users and at least one-third of non-users said they would be more likely to buckle up in response to belt reminders that become more intense or continue indefinitely; these reminders would be acceptable to about half of part-time belt users and around one-fifth of non-users.

**Conclusions:** The Moving Ahead for Progress in the 21st Century law allows the National Highway Traffic Safety Administration to strengthen minimum requirements for belt reminders or allow the use of interlocks to meet federal safety standards. Even though most people always buckle up, belt interlocks are supported by only about half of full-time belt users and by fewer part-time belt users and

non-users. Ignition interlocks would inconvenience a large proportion of full-time belt users and part-time belt users who buckle up after ignition. Technologies that encourage belt use after the vehicle is moving would be less intrusive. Enhanced reminder systems are more acceptable than belt interlocks and are viewed as almost as effective as interlocks if persistent enough.

**Key words:** Seat belts; Belt use technologies; Interlocks; Seat belt reminders; Seat belt use

## **INTRODUCTION**

Seat belts are an effective method of reducing injuries and preventing deaths among vehicle occupants in crashes. In 2011, seat belts saved an estimated 11,949 lives of occupants 5 and older in the United States (National Highway Traffic Safety Administration (NHTSA) 2012). Mandatory seat belt use laws and campaigns combining advertising with enforcement, such as “Click It or Ticket,” have helped increase belt use among front-seat passenger vehicle occupants from 54 percent in 1994 to more than 86 percent in 2012 (Pickrell & Ye 2012). However, recent increases in seat belt use have been modest, which suggests traditional enforcement campaigns may be reaching their maximum potential. People who do not regularly use seat belts tend to be riskier drivers (Evans & Wasielewski 1983), so increasing belt use among part-time belt users or non-users potentially could lead to large reductions in crash deaths and injuries. NHTSA (2012) estimates an additional 3,384 lives could have been saved in 2011 if all passenger vehicle occupants 5 and older had buckled up. Alternative approaches may be needed to increase belt use among people who remain resistant to traditional enforcement campaigns.

Using in-vehicle technology is a promising strategy for achieving higher belt use rates. Unlike large-scale enforcement campaigns, in-vehicle technology can continuously monitor belt use and provide immediate feedback whenever an occupant is unbuckled. It may be especially useful for people who forget to buckle up.

Until recently, there were severe restrictions on NHTSA’s capability to require or allow the use of in-vehicle technology to encourage belt use. In 1973, NHTSA required that all new cars not providing passive restraints (e.g., airbags) be equipped with a belt ignition interlock that prevented the vehicle from starting if the driver or front-seat passenger was not buckled up. Belt ignition interlock systems increased seat belt use but were unpopular with many people. As a result of the public outcry, in 1974 Congress banned NHTSA from requiring belt interlocks or allowing them to be used to meet a safety standard

(Motor Vehicle and Schoolbus Safety Amendments of 1974 1974), and prohibited the agency from requiring an auditory belt reminder lasting longer than 8 seconds. In 2012, the Moving Ahead for Progress in the 21st Century (MAP-21) law removed most of these restrictions on NHTSA. The agency now can require auditory belt reminders longer than 8 seconds and can allow manufacturers to voluntarily install belt interlocks to meet a federal safety standard.

For any in-vehicle technology that encourages belt use to be successful, it must not only provide sufficient motivation to buckle up but also achieve a minimum level of acceptance among both the belted and unbelted populations. Most people who do not regularly use their seat belts are part-time belt users. Part-time belt users generally are not opposed to using seat belts but rather forget to buckle up or buckle up only in certain situations (e.g., longer trips) (Boyle & Lampkin, 2008). Enhanced reminders, with auditory reminders lasting longer than the federal minimum requirements, are a way to increase belt use among part-time belt users. Auditory reminders lasting 8 seconds or less do little to increase belt use (Geller et al. 1980; Robertson & Haddon Jr. 1974), but enhanced reminders have been shown to increase driver belt use by 5-12 percentage points (Ferguson et al. 2007; Freedman et al. 2007; Lie et al. 2008; Williams et al. 2002). Enhanced reminders are common in newer vehicles. They are standard equipment for the driver and front passenger in 91 and 77 percent, respectively, of 2012 vehicle models. Requiring all vehicles to have more intense enhanced reminders is a promising way to increase belt use among part-time belt users, but public acceptance still is a concern because the characteristics that make reminders more effective also are the characteristics that make them more annoying (Lerner et al. 2007). It is not clear how intense a reminder needs to be to increase belt use among the remaining part-time belt users and non-users and what trade-off in annoyance is acceptable.

Belt use interlocks, which require belt use for different vehicle functions, may be more successful with increasing belt use. However, based on the experience with ignition interlocks in the early 1970s, NHTSA and automakers may be leery about using interlocks. Findings from recent focus group studies of part-time belt users suggest that even though belt use rates have increased dramatically since 1970, belt ignition interlocks still are perceived negatively and are not acceptable to most people (Eby et al. 2004; Equals Three Communications 2002). Less intrusive types of belt use interlocks that allow some mobility or prevent the use of convenience or entertainment vehicle features may be more acceptable than

ignition interlocks. Two studies of drivers of fleet and service vehicles found that preventing drivers from placing the vehicle in gear for a short period of time or making the accelerator pedal harder to press can increase belt use (Van Houten et al. 2010; Van Houten et al. 2011). Most drivers in these studies also found these approaches acceptable. Disabling the audio entertainment system when the driver is unbuckled is another promising approach, but a national survey of people who had not used a seat belt on at least one occasion in the past year found that this approach was unacceptable to more than half of the respondents (Eby et al. 2004).

Only a few studies have examined how drivers and passengers would respond to different technologies for encouraging belt use. Most of this research is based on small samples of part-time belt users whose opinions may not reflect the nationwide population of part-time belt users. Additionally, these studies did not look at whether drivers and passengers who always use seat belts would support different technologies for encouraging belt use or be inconvenienced by them. Lastly, previous research examined a small selection of technologies. A more comprehensive look at the effectiveness and acceptability of a range of in-vehicle technologies to encourage belt use is needed. In the current study, a national telephone survey of all types of belt users was conducted to update self-reports of seat belt use and gather new, detailed information on perceptions of a variety of in-vehicle technologies for encouraging belt use.

## **METHOD**

### **Sample Design**

Telephone interviews were conducted in three different sampling phases to achieve a minimum sample size of 1,200 completed interviews with at least 300 respondents who do not use seat belts all of the time and at least 250 respondents who transport children 8-15 years old riding in back seats and using seat belts. Interviews were conducted only with people 18 and older. In each sampling phase, random samples of landline numbers and cellphone numbers were obtained from an industry supplier of telephone samples (Marketing Systems Group, Horsham, PA). In all, samples of more than 39,000 landline numbers and 20,000 cellphone numbers were obtained. Telephone interviews were conducted between May 8, 2012 and July 15, 2012, by OpinionAmerica, Inc. (Cedar Knolls, NJ), a professional survey organization.

The first sampling phase was designed to conduct interviews with a large random sample of households. Random samples of 14,499 landline numbers and 7,496 cellphone numbers were used. Interviews were conducted with persons 18 and older who drove or rode in passenger vehicles at least once a week. Interviews were completed with 799 people in the first sampling phase, with about half the respondents using their cell phones.

The second sampling phase targeted part-time belt users and non-users, using random samples of 20,270 landline numbers and 12,538 cellphone numbers. People were interviewed only if they said they used their seats belt “most of the time,” “some of the time,” “rarely,” or “never.” Interviews were completed with 198 part-time belt users and 32 non-users, with about 86 percent of them conducted with landline phone users.

The third sampling phase targeted people who drive at least once per week with a child 8-15 years old who uses a seat belt rather than a child safety seat in the back seat, using a random sample of 5,000 landline numbers of households with children 8-15 years old. Interviews were completed with 189 people meeting the sampling criteria. Information about the belt use of respondents’ 8-15-year-old child passengers is reported in a companion paper (Kidd & McCartt 2013), but respondents’ own reported belt use and attitudes about technologies for encouraging belt use are included in the current study.

In all three sampling phases, if the respondent was on a cellphone, the interviewer asked if the respondent was driving and, if so, ended the call and called back later. From an initial combined sample of 59,803 numbers, 8,555 were reached. The cooperation rate (American Association for Public Opinion Research 2011) was 14.2 percent, resulting in 1,218 respondents. Among the households that were reached but did not participate, 2,730 did not qualify and 4,607 qualified but refused. Table 1 summarizes the completion results for each sampling phase and the total combined sample.

### **Survey Instrument**

All respondents were asked for basic demographic information including age, gender, educational attainment, household income, and state of residence. All respondents were asked questions about their belt use including the frequency of use and at what point they buckled up when starting a trip. They also were asked whether they supported using four different types of belt use interlocks to increase belt use: ignition interlock, speed interlock, transmission interlock, and entertainment system interlock.

People classified as part-time belt users and non-users were asked additional questions about their attitudes towards seat belts and methods of increasing belt use. The questions about attitudes were taken from the 2007 Motor Vehicle Occupant Safety Survey (Boyle & Lampkin 2008) and included reasons for non-use. The respondents were asked about their likelihood of buckling up in response to different technologies and whether several technologies would be acceptable. The technologies included a seat belt reminder, resistance in the accelerator pedal, a speed interlock, an entertainment system interlock, and an ignition interlock. The part-time belt users and non-users also were asked detailed questions about the features and characteristics of seat belt reminders that would make them more likely to buckle up and would be acceptable.

### **Data Analysis**

Data from the three sampling phases were combined for analyses, as follows. First, respondents from the first sampling phase (i.e., random sample of drivers and passengers) were placed into six groups based on two factors: belt use (full-time, part-time, non-user) and whether the respondent transports an 8-15-year-old child who uses a seat belt in the back seat (yes, no). Table 2 shows the distribution of respondents in the Phase 1 random sample across these six groups. This distribution was assumed to reflect that of the U.S. population of drivers and passengers 18 and older.

Also as shown in Table 2, the combined sample had a disproportionate number of part-time belt users and non-users (26%) and drivers transporting children using seat belts in the back seat (21%) compared with the Phase 1 random sample (9% and 7%, respectively). Weights for each of the six groups were created to normalize the distribution of the combined sample back to the distribution in the random sample; this was accomplished by dividing the number of respondents in the Phase 1 random sample in each group by the number of respondents in the combined sample in that group. The resulting weighted combined sample size was 799, equal to the size of the Phase 1 random sample.

All analyses were performed using the weighted combined data. Chi-square tests were used to assess the statistical significance of differences in responses among different types of belt users. Missing responses, refusals, or cases where respondents indicated they did not know an answer were excluded from the statistical tests and the percentages reported below unless noted otherwise. The sampling tolerance for the combined sample was about  $\pm 3$  percentage points at the 95 percent confidence level.

## RESULTS

Phone interviews were completed with 1,218 people (799 weighted). The weighted sample was almost evenly divided between males and females. Nearly half of respondents were 30-59 years old and slightly more than one-third were 60 or older. Nearly one-third of respondents' household incomes were more than \$75,000; about 47 percent reported a household income of less than \$50,000.

Most respondents (91%) indicated that they always use their seat belts. The percentage of full-time belt users was larger for respondents who travel as passengers (94%) than for those who were drivers (90%), but the difference was not significant ( $\chi^2[2]=1.8$ ,  $p=0.4$ ). About 8 percent of respondents reported that they use their seat belts most of the time, some of the time, or rarely when travelling in a vehicle and were classified as part-time belt users. Nearly 8 percent of drivers were part-time belt users, and 5 percent of passengers were part-time belt users. Lastly, 1 percent of respondents were non-users who reported that they never use their seat belts. Two percent of respondents who drove at least once per week were non-users, whereas less than 1 percent of passengers were non-users.

The demographic characteristics of full-time belt users, part-time belt users, and non-users were fairly similar (see Table 3). The only statistically significant difference among these groups was the gender distribution. Non-users and part-time belt users were more likely than full-time belt users to be male ( $\chi^2[2]=6.1$ ,  $p<0.05$ ). The type of vehicle that respondents predominantly travel in also differed by frequency of belt use. A larger proportion of non-users reported travelling in pickup trucks ( $\chi^2[8]=13.4$ ,  $p=0.1$ ).

### **Buckling Routines and Reasons for Non-Use of Belts**

All survey respondents were asked to describe when they generally first put on their seat belt (Table 4). Overall, about 50 percent of respondents said they buckle up before the vehicle starts, one-third buckle up after the vehicle starts but before it is placed in gear, 5 percent buckle up after the vehicle is in gear but before it is moving, and 4 percent buckle up after the vehicle is moving. Buckling routines differed significantly between full-time and part-time belt users ( $\chi^2[6]=91.1$ ,  $p<0.001$ ). Most full-time belt users buckle up before the car is started (52%), placed in gear (85%), or moving (90%). Far fewer part-time belt users buckle up before the vehicle is started (19%), placed in gear (48%), or moving (54%).

One-fifth of part-time belt users buckle up after the vehicle is moving, compared with only 3 percent of full-time users. About three times as many part-time belt users (20%) as full-time belt users (7%) indicated that the point at which they buckle up varies from trip to trip.

Part-time belt users and non-users were asked if they agreed with 11 potential reasons for not using a belt. Their responses are listed in Table 5. The most frequent reasons among part-time belt users were driving a short distance (67%), forgetting (60%), and that the belt is uncomfortable (47%). Comfort also was an issue for non-users; it was the most frequent reason for not using a seat belt (77%). Other prevalent reasons were not needing a seat belt (54%) and disliking being told what to do (50%).

### **Opinions about In-Vehicle Technologies That Encourage Belt Use**

All survey respondents were asked if they would support, oppose, or did not know if they would support or oppose the use of the following types of interlocks for drivers to increase belt use: an ignition interlock, a speed interlock that limits the vehicle speed to 15 mph unless the driver is buckled up, a transmission interlock that prevents the vehicle from being placed in gear if the driver is unbuckled, and an entertainment system interlock (see Table 6). Around half of full-time belt users said they support using each type of interlock to increase belt use. Part-time belt users and non-users showed less support for each type of interlock. Around one-third of part-time belt users and one-fifth of non-users supported each belt use interlock. The differences in support among the belt use groups were statistically significant for each type of interlock except the entertainment interlock. The interlock that was supported by the fewest full-time and part-time belt users was an ignition interlock (46% and 27%, respectively); a speed interlock received the least support from non-users (16%). Less than 6 percent of respondents in each belt use group said they did not know if they would support or oppose using each type of interlock to increase driver belt use.

Part-time belt users and non-users were asked detailed questions about how their belt use would be affected by various belt interlocks and a belt reminder that chimed, presented a warning light or text display, or gave a physical cue like a seat vibration, and if these technologies would be acceptable. In general, fewer non-users than part-time belt users would be more likely to buckle up in response to these in-vehicle technologies (see Table 7). The largest number of part-time belt users (70%) and non-users (44%) would be more likely to buckle up in response to an ignition interlock that keeps the car from

starting until the seat belt is buckled. More than half of part-time belt users would be more likely to buckle up with a speed interlock that prevents them from going faster than a certain speed such as 15 mph if they were unbuckled (56%) or the seat belt reminder (53%). About one-third of non-users said they would be more likely to buckle up if their vehicles had a speed interlock or reminder. Less than half of non-users and about one-fifth of non-users said they would be more likely to buckle up in response to an interlock preventing use of the in-vehicle entertainment system or technology making the gas pedal more difficult to push until the driver buckles up.

Acceptance of the different types of belt interlocks was low among part-time belt users and non-users. About one-third of part-time belt users and less than one-fifth of non-users said an accelerator interlock, entertainment interlock, speed interlock, or ignition interlock would be acceptable in their vehicles. Acceptance was greatest for the belt reminder; about 60 percent of part-time belt users and about one-quarter of non-users said that a belt reminder would be acceptable.

### **Enhanced Seat Belt Reminders**

Part-time belt users and non-users were asked about different types of reminders in terms of the likelihood of buckling up and their acceptability. The top three types of reminders that would make part-time belt users more likely to buckle up were non-visual (see Table 6). About 56 percent of part-time belt users said they would be more likely to buckle up in response to a buzzer/chime, and slightly more than half said they would buckle up more often in response to a physical cue like a vibration in the seat or to a voice message. About one-quarter or less of non-users would be more likely to buckle up in response to any of the reminder types. A buzzer/chime (22%) and physical cue (20%) were the options for which most non-users said they would be more likely to buckle up.

The majority of part-time belt users said each type of reminder would be acceptable. In contrast, acceptance among non-users was far lower. A buzzer/chime and voice message were the most acceptable to part-time belt users (62% and 64%, respectively), and an illuminated seat belt buckle and physical cue were the least acceptable (53% and 52%, respectively). The reminders that were most acceptable to non-users were a text display, buzzer/chime, or voice message, although these reminders were acceptable only to a little more than 20% of all non-users.

With regard to reminder strategies, nearly three times as many part-time belt users would be more likely to buckle up in response to an enhanced reminder that continues indefinitely (71%) or becomes more intense (70%) as would be more likely to buckle up in response to a basic reminder that comes on for a few seconds and stops (26%). This pattern also was observed for non-users, although half as many non-users as part-time belt users would be more likely to buckle up in response to each strategy.

Although part-time belt users and non-users were least likely to say they would buckle up in response to a reminder that came on for only a few seconds, 62 percent of part-time belt users and 35 percent of non-users said this strategy would be acceptable — the most among all the reminder strategies. The reminder strategies that were acceptable to the fewest part-time belt users were reminders that become more intense as the vehicle speeds up (44%) and reminders that become more intense the longer the occupant was unbuckled (47%). These reminder strategies also were acceptable to the fewest number of non-users.

## **DISCUSSION**

Recent changes in federal law give NHTSA much more latitude in requiring or allowing in-vehicle technologies for encouraging belt use. In choosing the optimal technology, there is an inherent trade-off between technologies that achieve the highest belt use and technologies that are acceptable. Additionally, to achieve widespread acceptance, the technology cannot unduly inconvenience people who always use belts. To aid in identifying the best technologies, the current study updated information on part-time belt users' attitudes toward buckling up and various types of belt reminders, while gathering new information about opinions toward in-vehicle technologies for encouraging belt use from all belt use groups.

Consistent with earlier research, the large majority of survey respondents who do not always use seat belts were part-time belt users. This is the main group targeted by laws, enforcement campaigns, and in-vehicle technologies for encouraging belt use. Part-time belt users' main reasons for not buckling up were forgetting, the circumstances of the trip (e.g., traveling a short distance), or discomfort. Belt use interlocks and strong belt reminders can cue forgetful part-time belt users to buckle up and motivate those who do not use belts in certain situations to buckle up. Most non-users also said the belt is

uncomfortable, but half also said they do not use belts because they do not like being told to use them. It is harder to develop strategies that can address deep-seated views about government's role, but some non-users may be persuaded to buckle up with interlocks or reminders especially if the comfort of belts can be improved.

Of the various belt use interlocks examined, the largest proportion of part-time belt users (70%) and non-users (44%) thought an ignition interlock would make them more likely to buckle up. However, less than half of all full-time belt users and less than 30 percent of part-time belt users and non-users said they would support using ignition interlocks to increase driver belt use. Even 51 percent of survey respondents who always use their belts said they oppose ignition interlocks. Opposition to ignition interlocks in the current survey is consistent with prior research (Eby et al. 2004; Equals Three Communications 2002).

Other types of belt use interlocks that, on the surface, seem to be less intrusive than ignition interlocks also were viewed negatively. Using a speed interlock, entertainment interlock, or transmission interlock to increase driver belt use was opposed by 44-47 percent of full-time belt users, 59-63 percent of part-time belt users, and 75-84 percent of non-users. A national survey conducted by Eby et al. (2004) also found entertainment interlocks were unacceptable to part-time belt users, but negative opinions towards transmission interlocks among respondents in the current survey were surprising considering a recent field study found high levels of acceptance for this technology among fleet and service drivers (Van Houten et al. 2010). It is possible that opposition to various types of interlocks may be due in part to the survey respondents' unfamiliarity with the technologies or their recollections of the backlash against ignition interlocks of the 1970s. Perhaps the reality of interlocks would not be as onerous as the image invoked by the description in the survey. Additionally, people who always buckle up may see little personal benefit from interlocks. Promoting a better understanding of the societal benefits of higher belt use rates may increase support for technologies such as interlocks among full-time belt users. Regardless, it seems that belt interlocks of any type would be a hard sell to many drivers and passengers.

It is important to gauge how the technologies would affect people who always buckle up, not just people in the target populations (i.e., part-time belt users and non-users). Full-time belt users represent

the large majority of passenger vehicle occupants. Information about buckling routines provides one means of judging how intrusive interlocks could be to full-time belt users. For instance, about 40 percent of full-time belt users said they generally buckle up after starting the car. Thus, an ignition interlock that prevents the vehicle from starting unless the seat belt is buckled would unduly inconvenience a large percentage of people who always use belts. About 90 percent of full-time belt users buckle up before the vehicle is moving (c.f., Malenfant & Van Houten 2008) compared with around half of all part-time belt users. About one-fifth of part-time belt users buckle up after the vehicle is moving. However, another one-fifth said their buckling routines vary, so the actual percentage of part-time belt users who buckle up after the vehicle is moving may be even greater. Based on these self-reported buckling routines, it appears that interlocks or other technologies that are activated after the vehicle is moving would be the least intrusive to people who always use a belt as well as part-time belt users.

Of the technologies included in this survey, entertainment interlocks, speed interlocks, resistance in the accelerator pedal, and belt reminders can intervene after the vehicle is moving. A seat belt reminder, however, was acceptable to about twice as many of part-time belt users and a larger proportion of non-users than the other technologies and also was judged to be similarly or more effective at increasing belt use. However, some types of belt reminders are significantly more effective at increasing belt use than others. Of the different types of belt reminders surveyed, part-time belt users and non-users said they would be more likely to buckle up in response to auditory and haptic belt reminders than visual reminders. This is consistent with previous research (Lerner et al. 2007). Additionally, more than two-thirds of part-time belt users and at least one-third of non-users said they would be more likely to buckle up in response to belt reminders that become more intense or continue indefinitely. In contrast, only about one-quarter of part-time users and 13 percent of non-users said that they would be more likely to buckle up in response to a basic reminder that stops after a short period of time. This also is consistent with previous research that found higher belt use in vehicles with enhanced reminders compared with vehicles with basic reminders that did not exceed the minimum federal requirement (Ferguson et al. 2007; Lie et al. 2008; Williams et al. 2002).

One drawback of making belt reminders more intense is that they also become more annoying (Lerner et al. 2007). The current study did not ask specifically about annoyance, but consistent with

Lerner et al. (2007), reminders that become more intense or continue indefinitely were not viewed as acceptable as a basic reminder (44-52% vs. 62%). However, it is encouraging that about half of part-time belt users found various types of more persistent reminders acceptable. Additionally, more persistent reminders were acceptable to a larger proportion of part-time belt users than the various types of belt interlocks.

The enactment of MAP-21 allows NHTSA to strengthen the federal belt reminder requirement. One possibility is to require an enhanced reminder, but allow flexibility in its design similar to what has been implemented successfully in Europe. The European New Car Assessment Programme (Euro NCAP) credits vehicles with reminders that meet certain design requirements, such as requiring a “loud and clear” auditory tone and a visual icon lasting at least 90 seconds during a single continuous period or across multiple intermittent periods. Even though the requirements permit a range of designs, reminders meeting Euro NCAP’s requirements are judged to be similarly effective at increasing belt use (Kidd 2012) and are more effective at increasing belt use than reminders that do not meet Euro NCAP’s requirements (Lie et al. 2008).

There are some limitations to the current study. The findings are based on self-reports. Self-reported full-time belt use (91%) in this study was slightly higher than self-reported belt use (88%) in NHTSA’s 2007 Motor Vehicle Occupant Safety Survey (Boyle & Lampkin 2008), although this difference is consistent with an increase in observed daytime belt use since 2007 (Pickrell & Ye 2012). Overestimates of belt use likely reflect in part respondents answering in a socially desirable manner; this also may have positively biased opinions about technologies in this survey. Information on the survey population, people who travel in a passenger vehicle at least once a week, was unavailable. The demographic characteristics of the survey sample were not representative of the total U.S. adult population in some respects. The proportion of the survey respondents who were 60 or older or had at least a college degree was somewhat overrepresented compared with the U.S. population, and 18-24 year olds and those who had not completed high school were underrepresented (U.S. Census Bureau 2010).

In summary, MAP-21 allows NHTSA to strengthen minimum requirements for belt reminders or incentivize the use of interlocks through federal safety standards. Even though most people always

buckle up, belt interlocks are supported by only about half of full-time belt users. Technologies that encourage belt use after the vehicle is moving would be less intrusive than those activated sooner. Enhanced reminder systems are more acceptable than interlocks and are viewed as almost as effective as interlocks if persistent enough.

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**Table 1.** Results of attempted contacts by sampling phase.

	Sampling phase			Total combined sample
	Phase 1: Random sample of drivers and passengers	Phase 2: Part-time belt users and non-users	Phase 3: Drivers with 8-15 year-old in back seat	
Initial sample	21,995	32,808	5,000	59,803
Reached	2,841	4,898	816	8,555
Did not qualify	589	1,705	436	2,730
Qualified, but refused	1,453	2,963	191	4,607
Completed interview	799	230	189	1,218
Cooperation rate (%)	28.1	4.7	23.2	14.2

**Table 2.** Number (percentage) of random sample of drivers and passengers ages 18 and older and of total combined sample as a function of belt use group and transporting 8-15 year-olds using seat belt in back seat.

Driver with 8-15 year-old using seat belt in back seat	Phase 1: Random sample of drivers and passengers (n=799)			Combined sample (n=1,218)		
	Full-time belt user	Part-time belt user	Non-user	Full-time belt user	Part-time belt user	Non-user
Yes	49 (6%)	2 (<1%)	2 (<1%)	208 (17%)	42 (3%)	4 (<1%)
No	677 (85%)	59 (7%)	10 (1%)	693 (57%)	230 (19%)	41 (3%)

**Table 3.** Percent distribution of the demographic characteristics, seating position, and type of vehicle of full-time belt users, part-time belt users, and non-users.

	Full-time belt users (n=901; weighted n=726)	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)
Age			
18-24	8	10	8
25-29	7	5	0
30-59	51	40	52
60+	34	45	39
Gender			
Male	45	54	76
Female	55	46	24
Educational attainment			
Less than high school graduate	4	4	7
High school graduate	28	35	47
Some college	23	23	30
College graduate+	45	38	17
Household income			
<\$15,000	9	10	3
\$15,000-49,999	38	36	40
\$50,000-74,999	22	27	27
\$75,000-99,999	12	11	17
\$100,000+	19	17	13
Seating position			
Driver	87	92	96
Passenger	13	8	4
Primary vehicle			
Car	58	52	33
Minivan	8	5	14
Pickup	14	23	43
SUV	19	19	10
Other type of van	<1	<1	0

**Table 4.** Percentage of different belt users who agree with various statements describing when they first put on a seat belt.

	Full-time belt users (n=901; weighted n=726)	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)	Entire sample (n=1,218; weighted n=799)
Before the car starts	52	19	0	49
After the car starts but before the transmission is placed in gear	33	29	0	32
After the car starts and is in gear, but before it is moving	5	6	0	5
After the vehicle is moving	3	21	0	4
When I put my seat belt on varies	7	20	0	8
I do not wear my seat belt	0	3*	100	2
Don't know	<1	<1	0	<1

*Note:* Percentages do not always sum 100 percent because some respondents refused to answer;

\*These respondents indicated they “rarely” use a seat belt.

**Table 5.** Percentage of respondents who agreed with various reasons for not using a seat belt by belt use group.

Reason	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)
Do not need a seat belt	25	54
Don't like being told what to do	28	50
Don't want my clothes to get wrinkled	11	8
Driving a short distance	67	44
Driving in light traffic	27	28
Forget	60	23
In a rush	44	20
Other occupants not using seat belts	9	10
Probability of being in a crash is low	40	45
Seat belt is broken	6	10
Seat belt is uncomfortable	47	77

Note: Multiple responses allowed; percentages sum to more than 100 percent.

**Table 6.** Percentage of respondents who support or oppose different seat belt interlocks by belt use group.

	Full-time belt users (n=901; weighted n=726)		Part-time belt users (n=272; weighted n=61)		Non-users (n=45; weighted n=12)		Entire sample (n=1,218; weighted n=799)	
	Support	Oppose	Support	Oppose	Support	Oppose	Support	Oppose
Prevents vehicle from starting if driver's seat belt unfastened	46	51	27	69	20	80	44	53
	$\chi^2[4]=11.4, p<0.05$							
Prevents vehicle from being placed in drive or gear if driver's seat belt unfastened	53	44	33	63	18	78	51	46
	$\chi^2[4]=91.1, p<0.001$							
Prevents vehicle from traveling faster than 15 mph if driver's seat belt unfastened	53	44	34	62	16	84	51	46
	$\chi^2[4]=15.5, p<0.01$							
Prevents use of radio, CD player, other in-vehicle entertainment and communication systems if driver's seat belt unfastened	48	47	36	59	21	75	47	49
	$\chi^2[4]=7.1, p=0.13$							

Note: Percentage that support and oppose do not always sum to 100 percent; remaining respondents "Did not know."

**Table 7.** Percentage of part-time belt users and non-users who said different technologies for encouraging belt use would make them more likely to buckle up and are acceptable.

	More likely to buckle up		Acceptable	
	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)
Prevents the car from starting	70	44	30	16
Only allows the vehicle to travel at low speeds like less than 15 mph	56	31	30	8
Prevents you from using in-vehicle entertainment systems	41	23	30	16
Makes the gas pedal more difficult to push	47	23	32	10
Chimes, presents a warning light or text display, or gives a physical cue like a seat vibration	53	38	61	27

**Table 8.** Percentage of part-time belt users and non-users who said different reminder types and reminder strategies would make them more likely to buckle up and are acceptable.

	More likely to buckle up		Acceptable	
	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)	Part-time belt users (n=272; weighted n=61)	Non-users (n=45; weighted n=12)
<b>Reminder type</b>				
Buzzer or chime	56	22	62	23
Physical cue like a vibration	53	20	52	13
Voice message	52	16	64	21
Continuously lit or flashing warning light	42	13	61	17
Text display	35	13	57	23
Illuminated seat belt buckle	29	16	53	8
<b>Reminder strategy</b>				
More intense the longer belt was not used until buckled	71	33	47	18
Repeats every 15 seconds until buckled	70	37	52	18
Repeats every minute until buckled	69	39	51	23
More intense as car speeds up until buckled	68	36	44	16
On for a few seconds and not on again	26	13	62	35