Experiences of Model Year 2011 Dodge and Jeep Owners With Collision Avoidance and Related Technologies

JESSICA B. CICCHINO and ANNE T. MCCARTT
Insurance Institute for Highway Safety, Arlington, Virginia

Received 24 January 2014, Accepted 16 June 2014

Objective: Crash avoidance technologies have the potential to prevent or mitigate many crashes, but their effectiveness depends on drivers’ acceptance and proper use. Owners of 2011 Dodge Charger, Dodge Durango, and Jeep Grand Cherokee vehicles were interviewed about their experiences with their vehicles’ technologies.

Methods: Interviews were conducted in April 2013 with 215 owners of Dodge and Jeep vehicles with adaptive cruise control and forward collision warning and 215 owners with blind spot monitoring and rear cross-path detection.

Results: Most owners said that they always keep each collision avoidance technology turned on, and more than 90% of owners with each system would want the technology again on their next vehicle. The majority believed that the systems had helped prevent a collision; this ranged from 54% of drivers with forward collision warning to more than three-quarters with blind spot monitoring and rear cross-path detection. Some owners reported behavioral changes with the systems, but overreliance on them is not prevalent. Reported use of the systems varied by the age and gender of the driver and duration of vehicle ownership to a greater degree than in previous surveys of luxury Volvo and Infiniti vehicles with collision avoidance technologies. Notably, drivers aged 40 and younger were most likely to report that forward collision warning had alerted them multiple times and that it had prevented a collision and that they follow the vehicle ahead less closely with adaptive cruise control. Reports of waiting for the alert from forward collision warning before braking were infrequent but increased with duration of ownership. However, these reports could reflect confusion of the system with adaptive cruise control, which alerts drivers when braking is necessary to maintain a preset speed or following distance but a crash is not imminent.

Conclusions: Consistent with previous surveys of luxury vehicle owners with collision avoidance technologies, acceptance and use remains high among owners of more mainstream vehicles. Varying experiences with the technologies by driver age and gender suggest that safety benefits are not uniform for all drivers, and differential benefits may become increasingly apparent as collision avoidance technologies become available to a more heterogeneous population of drivers. The potential for overreliance on the technologies should continue to be monitored, especially as drivers gain more experience with them.

Keywords: crash avoidance technology, driver assistance systems, driver behavior, adaptive cruise control, forward collision warning, blind spot monitoring, rear cross-traffic alert

Introduction

Collision avoidance technologies that assist drivers with warnings or automatic braking when a crash is imminent have great potential to reduce traffic injuries and fatalities. Jermakian (2011) estimated that forward collision avoidance and side-view assist systems could prevent or mitigate up to 20% and 7% of all police-reported crashes, respectively. Evidence from insurance claims data suggests that some collision avoidance technologies are preventing crashes. The Highway Loss Data Institute (2011, 2012a, 2012b) found that the rates of property damage liability claims per insured vehicle year were significantly lower for models equipped with forward collision avoidance systems than for the same models without. Property damage liability claims cover damage to the other vehicles and property hit by an at-fault driver. Forward collision avoidance systems with automatic braking appeared to reduce claims to a greater extent than systems providing only a warning.

The effects of crash avoidance technologies depend on how they are used. To date, most information about drivers’ experiences with the technologies is drawn from owners of luxury vehicles, which are generally the first to have new technologies. For example, surveys of owners of luxury Volvo with forward collision avoidance with autonomous braking found that about 9 in 10 owners always kept the system on and wanted it on their next vehicle (Braitman et al. 2010; Eichelberger and McCartt 2014a). Eight-two percent of Volvo drivers with side-view assist always drove with the system on, and 95% wanted the system again (Braitman et al. 2010). Nearly three-quarters reported receiving false or unnecessary warnings. Few drivers...
with either system reported negative behavioral changes with the system. It is important to assess experiences with these systems among owners of a variety of vehicle types as the technologies proliferate through the vehicle fleet. The current study surveyed owners of nonluxury Dodge and Jeep vehicles on their use of 4 technologies. The study also is the first to assess drivers’ experiences with a forward collision warning system without autonomous braking and a rear cross-traffic alert system.

Methods

System Descriptions

Surveys were conducted with owners of model year 2011 Dodge Charger, Dodge Durango, and Jeep Grand Cherokee vehicles with some combination of the following technologies, offered as optional equipment: adaptive cruise control, forward collision warning, blind spot monitoring, and rear cross-path detection. All 4 technologies are bundled in the Jeep Grand Cherokee. On the Dodge Charger and Durango, adaptive cruise control and forward collision warning are bundled, and blind spot monitoring and rear cross-path detection are bundled.

With adaptive cruise control, drivers set a cruising speed and following distance, and the system maintains the preset speed when its radar sensor does not detect another vehicle ahead or the preset distance when there is a vehicle ahead. The following distance to other vehicles can be set at long, the default setting; medium; or short. The system is off when the vehicle is started and can be turned on and off while driving. If the system’s maximum braking level is insufficient to maintain the set distance, it emits a proximity warning, where a chime sounds and a warning flashes in the instrument panel and continues to brake. The system operates at speeds above 20 mph.

Forward collision warning uses radar-based sensors to detect potential collisions with vehicles ahead and alerts drivers with a chime and a flashing warning in the instrument panel. For the Durango and Grand Cherokee, the images accompanying the flashing warning and the chime differ from the adaptive cruise control proximity warning. For the Charger, the warnings look and sound the same. Settings include the default far setting that gives an earlier warning, the near setting, and off. The system operates at 10 mph or faster and continues to brake. The system detects another vehicle entering the blind spot, a warning light illuminates in the side mirror and a chime. Blind spot monitoring and rear cross-path detection turn on and off together and retain the latest setting after the vehicle is turned off until it is changed by the driver.

Questionnaires

Separate questionnaires were prepared for adaptive cruise control/forward collision warning and blind spot monitoring/rear cross-path detection. Questions were based on previous surveys of luxury vehicle owners with collision avoidance technologies (Braitman et al. 2010; Eichelberger and McCartt 2014a). Features of each system were described prior to questions regarding the system. Survey recipients were asked to give the questionnaire to the primary or a frequent driver of their Dodge or Jeep. Recipients who no longer owned their vehicle, or who were unsure whether it was equipped with the technologies, were asked not to return the questionnaire.

A list of names and addresses of owners who had purchased the study vehicles with the technologies was obtained from a confidential industry source. Each questionnaire was mailed to 1,200 randomly selected owners with the relevant technologies in April 2013, along with postage-paid envelopes for returning completed questionnaires. Reminder postcards were sent 1 week after the initial mailing. Surveys were administered by Westat, a research organization, and the study was approved by Westat’s Institutional Review Board.

Each questionnaire was returned fully or partially completed by 215 owners (18%). A few respondents no longer owned their vehicles or did not know whether they were equipped with the technologies. Responses from these drivers were excluded.

Analyses

Chi-square analysis was used to examine relationships between experiences with the systems and driver age and gender and the duration of vehicle ownership. The Mantel-Haenszel chi-square statistic tested the significance of linear trends in experiences with the systems and driver age and gender. Characteristics of respondents to the 2 surveys were remarkably similar (Table 1). Across the surveys, 56% were male. Twelve percent were aged 40 and younger and 33% were aged 61 and older. About half owned their vehicle for 2 years or longer.

Adaptive Cruise Control

Ninety-two percent of owners surveyed about adaptive cruise control reported using it at least once. Fifty-four percent always used it on high-speed roads with few or no traffic signals, and 8% always used it on lower-speed roads with traffic signals or stop signs (Table A1, see online supplement). Most system
users (92%) were aware of the following distance settings, and 74% had adjusted them. The far setting (42%) was typically used most often (Table A1).

Among system users, 36% reported that they followed lead vehicles less closely when using the system compared to not using it, and 87% did not change how often they looked away from the road (Table A1). Seventy-six percent received a proximity warning and, of these owners, 84% braked in response to their most recent warning.

### Forward Collision Warning

Experiences with forward collision warning are summarized in Table A2 (see online supplement). Eighty-four percent of owners surveyed about forward collision warning said that they always kept it on. Seventy percent said that the system never failed to alert them when another vehicle was in a blind spot. Three-quarters of owners said that the system never failed to alert them when a leading vehicle slowed to turn (49%), roadside objects such as guardrails or parked cars were ahead (42%), driving on curvy roads (38%), and turning (23%).

Among drivers who experienced warnings, 94% agreed that the chime was useful; few agreed that it was annoying (12%), too loud (2%), or too quiet (6%). Seventy-eight percent had seen the flashing warning; 80% of these drivers agreed that it was useful, 6% agreed that it was annoying, 8% agreed that it was distracting, and 73% agreed that it was easy to see.

### Blind Spot Monitoring and Rear Cross-Path Detection

All drivers surveyed about these systems had used them and 95% reported always driving with them on (Table A3, see online supplement). Seventy-four percent said that they were aware of the settings that control whether a chime also sounds but only 10% ever changed them. Most owners (67%) typically used the lights/chime mode.

### Experiences With Blind Spot Monitoring

Drivers’ experiences with blind spot monitoring appear in Table A4 (see online supplement). Eighty percent said that they always looked at the system’s warning light in the side mirror when changing lanes. Sixty-five percent of drivers said that blind spot monitoring alerted them when they changed lanes on all/most trips, and 79% reported that it had prevented a lane-change crash. No owners had a lane-change collision in their Dodge or Jeep.

Three-quarters of owners said that the system never failed to alert them when another vehicle was in a blind spot. Owners reporting failures said that this occurred in inclement weather (28%) and when another vehicle approached very quickly (28%) or was too close to their vehicle (22%). According to the owners’ manuals for the study vehicles, the system will not alert if another vehicle enters a blind spot at 30 mph or faster than their vehicle or when passing at a speed 10 mph or faster than the other vehicle. Snow, ice, and road debris also can impair the system’s sensors.

Thirty-eight percent of drivers said that the system had alerted them when there was not another vehicle in a blind spot. This most often occurred when driving past roadside objects such as trees and guardrails (66%).

All owners were asked whether their lane-changing behaviors had changed compared to before they had the systems. Eighty-seven percent indicated no differences in how often they changed lanes. When changing lanes, 17% used their turn signal more often, one-third turned their heads less often, and 20% checked side mirrors more often.

### Experiences With Rear Cross-Path Detection

Table A5 (see online supplement) details drivers’ experiences with rear cross-path detection. Two-thirds of drivers reported that the system alerted them while backing on all/most trips, and 81% said that it had prevented a collision with another vehicle. Six owners (3%) reported a collision with another
vehicle while backing. Two owners said that they were alerted prior to their crash, 3 were not alerted, and one did not know.

Most owners (75%) reported that the system never failed to alert them when another vehicle was in a blind spot as they were backing. Failures to alert that occurred were most often reported when another vehicle approached very quickly (39%). Thirty-four percent of owners reported experiencing alerts when there was nothing in a blind spot. This occurred in inclement weather (25%); with objects to the side not in danger of being struck, such as garage doors or parked cars (25%); and when the sun was rising or setting and/or there was sun glare or shadows (20%).

Twenty-seven percent of owners reported that they backed quickly less often compared to before they had the system. Fewer reported that they parked between large vehicles that block their view less (12%) or more often (9%) or parked head-on in a spot they would later have to back out of less (6%) or more often (13%).

Opinions of Alerts From Both Systems
There were 189 owners who had heard the chime while changing lanes and 203 who had heard it while backing. Among these owners, 85% agreed that it was useful while changing lanes, and 95% agreed that it was useful when backing. Nearly all (99%) owners who had been alerted by blind spot monitoring reported seeing the warning lights while changing lanes, and 95% of the owners alerted by rear cross-path detection had seen them while backing. Of these owners, 97% agreed that the lights were useful while changing lanes and 75% agreed that they were useful while backing.

Almost all owners (99%) had heard the chime and seen the warning lights in some circumstances. Eleven percent agreed that the chime was annoying, 2% agreed that it was too loud, and 2% agreed that it was too quiet. Only 1% agreed that the warning lights were annoying, and 89% agreed that they were easy to see.

General Opinions of Systems
More than 90% of all owners said that they would want each technology again (Table A6, see online supplement). The percentage reporting that technologies relieved them of stress while driving ranged from 50% for forward collision warning to 74% for blind spot monitoring. Less than 10% found any system distracting. Few owners with adaptive cruise control and forward collision warning said that either system was annoying (7% and 6%, respectively, data not shown).

Owners most often learned how to use the systems from the owner’s manual (77%), trying out the systems on the roadway (54%), or a dealership demonstration (30%); top responses were the same for both sets of systems, and answers were combined. When asked to rate their understanding of how the systems work on a scale of 1–10, with 1 meaning not understanding at all and 10 meaning completely understanding, 60% of owners surveyed about blind spot monitoring and rear cross-path detection and 42% surveyed about adaptive cruise control and forward collision warning rated their understanding a 10.

Differences by Driver Age and Gender and Duration of Ownership
Notable linear trends by driver age are summarized in Table A7 (see online supplement). Of greatest interest, the proportion of drivers who had been warned by forward collision warning more than once and believed that it prevented a collision (Figure 1), always kept it on, and thought that their most recent warning came too early decreased with age; the proportion who completely understood how to operate forward collision warning and adaptive cruise control also decreased with age. Younger drivers were similarly most likely to report positive changes in their driving behavior with adaptive cruise control (Figure 2). The percentage who more often checked their side mirror while changing lanes with blind spot monitoring increased with age (Figure 3). Drivers age 40 and younger were the most likely to agree that the chimes from the systems were annoying.

With regard to gender, males were more likely to have used adaptive cruise control and adjusted distance settings on systems that have them (Table A8, see online supplement). Females most often reported that rear cross-path detection alerted them frequently and prevented a collision and that...
their behavior changed with the system. They also most often agreed that systems or their components were annoying and that blind spot monitoring relieved them of stress.

Drivers who had owned their vehicle for 2 years or more were more likely than drivers who had owned their vehicle for less than 2 years to report very often/sometimes waiting for an alert from forward collision warning before slowing when approaching another vehicle (Figure 4) and less likely to report that their most recent forward collision warning came too early (Table A9, see online supplement).

**Discussion**

Collision avoidance technologies have the potential to prevent a substantial proportion of crashes, but they can only be successful if drivers use them consistently and respond to them appropriately. Similar to owners of luxury Volvo and Infiniti vehicles (Braitman et al. 2010; Eichelberger and McCartt 2014a) and Toyota vehicles (Eichelberger and McCartt 2014b) with forward collision avoidance and side-view assist systems, Dodge and Jeep owners overwhelmingly kept the safety systems turned on, would want each technology on their next vehicle, and did not find the systems and their components to be distracting or annoying.

The owners of Dodge and Jeep vehicles differed from owners of other vehicles with similar systems in their perceptions of receiving alerts they believed to be unnecessary. Though nearly three-quarters of Volvo drivers with a camera-based side-view assist system reported experiencing alerts that they perceived to be false or unnecessary (Braitman et al. 2010), only 38% of Dodge and Jeep drivers with the radar-based blind spot monitoring system reported being alerted when there was not a vehicle in a blind spot. This may be related to differences in the technologies. Camera-based sensors tend to be more sensitive than radar to poor visibility conditions such as rain or fog (Campbell et al. 2007), and the Volvo owners reported that perceived false alerts most commonly occurred in inclement weather (Braitman et al. 2010).

More than 60% of Dodge and Jeep drivers with forward collision warning reported alerts when they believed they were not at risk of a collision, whereas 16–43% of drivers with other forward collision avoidance systems reported alerts perceived to be unnecessary (Braitman et al. 2010; Eichelberger and McCartt 2014a, 2014b). It is unclear why this was the case. Some owners in the current study reported that such alerts occurred in situations when they could have been at risk of crashing, such as when the vehicle in front slowed to turn, but similar proportions of drivers with other forward collision avoidance systems who reported unnecessary alerts said that they occurred in these circumstances. One possibility is that Dodge and Jeep owners reported more false alerts because they were more likely to report being alerted at all. Nearly all Dodge and Jeep owners reported being alerted at least once by the system, compared to 40–81% of drivers of other vehicles with the systems (Braitman et al. 2010; Eichelberger and McCartt 2014a, 2014b).

Previous surveys of drivers of luxury vehicles with collision avoidance technologies did not report differences by driver age or gender or duration of ownership (Braitman et al. 2010; Eichelberger and McCartt 2014a), but there were such differences in the current survey. About one-quarter of drivers aged 40 and younger found the chimes from the systems annoying; this percentage decreased with age. Despite the annoyance, drivers age 60 and younger were more likely to always keep forward collision warning turned on than older drivers. Drivers age 40 and younger appeared to benefit most from forward collision warning. Nearly all of these drivers received more than one alert, and 80% believed that the system had prevented a collision. With adaptive cruise control, drivers under age 40 also most often reported following lead vehicles less closely and looking away from the road less often. Similar age effects were found with owners of nonluxury Toyota models with forward collision avoidance and adaptive cruise control systems (Eichelberger and McCartt 2014b). However, few owners interviewed in this study and by Eichelberger and McCartt (2014b) were younger than 30, and future studies should assess how the youngest, highest-risk drivers use these and other collision avoidance systems.

There is concern that drivers may become overly reliant on collision avoidance technologies or that the technologies will lead to other less safe behaviors. Some drivers reported increases in potentially less safe behaviors with the technologies
in the current study, including drivers with blind spot monitoring who said that they turn their heads to check blind spots less often while changing lanes compared to before they had the system and those with forward collision warning who said that they have waited for an alert from that system before slowing down when approaching another vehicle. Most drivers who reported doing so said that they wait for the alert rarely, but the percentage who said that they always or sometimes wait for the alert increased with longer duration of ownership. This suggests that the potential for overreliance on collision avoidance technologies should continue to be monitored as drivers gain more experience with them. However, it is possible that some of these drivers confused the forward collision warning alert with the proximity alert from adaptive cruise control that warns drivers that the system’s braking is not enough to maintain the preset following distance to the vehicle ahead. These alerts looked and sounded identical on the Dodge Charger.

Drivers also reported behaviors with the system that could increase safety. Thirty-six percent of all drivers and more than half of drivers aged 40 and younger said that they follow the vehicle ahead less closely when using adaptive cruise control. About a quarter of drivers with rear cross-path detection said that they are less likely to back up quickly with the system, and 17% of drivers with blind spot monitoring said that they use their turn signal when changing lanes more often. One in 5 drivers with blind spot monitoring reported checking their side mirrors more often when changing lanes with the system. This is consistent with reports from Volvo owners with a side-view assist system (Braitman et al. 2010) and a field operational test of a side-view assist system with middle-aged volunteer drivers (Kiefer and Hankey 2008). The tendency to check side mirrors more often with blind spot monitoring increased with age in the current study. Older drivers are overly involved in merging and overtaking crashes (Mayhew et al. 2006), and side-view assist systems may be especially beneficial to these drivers if the systems direct their attention to their mirrors as well as provide additional information about vehicles in a blind spot.

Some limitations of this study should be noted. The survey samples may not be representative of the population of U.S. drivers or of Dodge and Jeep owners. The technologies were optional equipment, and although the vehicles are not considered luxury vehicles, they were expensive. Suggested retail prices for the model year 2011 Dodge and Jeep vehicles with the technologies ranged from $30,920 to $49,250 (Automobile Invoice Service 2011). Survey respondents were older than the general driving population. Most drivers surveyed had multiple technologies on their vehicles and may have confused the systems or been unable to differentiate between them. For instance, drivers with rear cross-path detection also had rear parking sensors and a backup camera, and it is possible that their experiences with the latter systems influenced their opinions of rear cross-path detection.

Acceptance and consistent use of collision avoidance and related driver assistance systems has generally been high among early adopters, including owners of both luxury vehicles and nonluxury vehicles. The current findings suggest that younger drivers, who are at higher risk for crashing, may be receiving the greatest benefit from them. It is important to continue to monitor the experiences of drivers of different vehicle types and of drivers with different demographic characteristics as the population of users continues to expand and as current owners gain more experience with the systems.

Acknowledgments

The authors thank Chrysler Group LLC for their cooperation with this study, particularly Kristen Kreibich-Staruch, who provided information about the systems and addressed technical questions. The authors also are grateful for helpful comments from colleagues, including Angela Eichelberger, David Kidd, David Zuby, and Jessica Jermakian from the Insurance Institute for Highway Safety; Matt Moore from the Highway Loss Data Institute; and Jeremiah Singer from Westat.

Funding

This work was supported by the Insurance Institute for Highway Safety.

Supplemental Materials

Supplemental data for this article can be accessed on the publisher’s website.

References

Automobile Invoice Service. New Car Cost Guide. Gainesville, GA: Author; 2011.
Braitman KA, McCartt AT, Zuby DS, Singer J. Volvo and Infiniti drivers’ experiences with select crash avoidance technologies. Traffic Inj Prev. 2010;11:270–278.
Campbell JL, Richard CM, Brown JL, McCallum M. Crash Warning System Interfaces: Human Factors Insights and Lessons Learned. Washington, DC: NHTSA; 2007. Publication No. DOT-HS-810-697.
Eichelberger AH, McCartt AT. Volvo drivers’ experiences with advanced crash avoidance and related technologies. Traffic Inj Prev. 2014a;15:187–195.
Eichelberger AH, McCartt AT. Toyota Drivers’ Experiences With Dynamic Radar Cruise Control, the Pre-collision System, and Lane-keeping Assist. Arlington, VA: Insurance Institute for Highway Safety; 2014b.
Highway Loss Data Institute. Acura collision avoidance features: initial results. Loss Bulletin. 2011;28(21):1–8.
Highway Loss Data Institute. Mercedes-Benz collision avoidance features. Loss Bulletin. 2012a;29(7):1–22.
Highway Loss Data Institute. Volvo collision avoidance features: initial results. Loss Bulletin. 2012b;29(5):1–11.
Jermakian JS. Crash avoidance potential of four passenger vehicle technologies. Accid Anal Prev. 2008;40:683–690.
Kiefer RJ, Hankey JM. Lane change behavior with a side blind zone alert system. Accid Anal Prev. 2008;40:683–690.
Mayhew DR, Simpson HM, Ferguson SA. Collisions involving senior drivers: high-risk conditions and locations. Traffic Inj Prev. 2006;7:117–124.

Collison Avoidance and Related Technologies 303