An Evaluation of the Relationship between the Seat Belt Usage Rates of Front Seat Occupants and Their Drivers

Vinod Vasudevan  
Transportation Research Center  
University of Nevada, Las Vegas  
4505 S. Maryland Pkwy, Box 454007  
Las Vegas, NV 89154  
vinodv@trc.unlv.edu

Shashi Nambisan  
Center for Transportation Research and Education  
Iowa State University  
2711 S. Loop Drive, Suite 4700  
Ames, IA, 50010  
shashi@iastate.edu

ABSTRACT

Death as a result of ejection of unrestrained occupants from the vehicle is the highest cause of fatalities in a motor vehicle crashes. In 2002, in the United States, about 70% of unrestrained occupants fatal motor vehicle crashes were ejected and killed. Data from the National Highway Safety Administration (NHTSA) show that overall seat belt usage rates in the United States are showing an increasing trend. However, a review of the literature did not reveal any prior studies regarding whether the seat belt usage of a driver affects the seat belt usage of passengers in the same vehicle. This paper provides a summary of an analysis to identify the seat belt usage rates of front seat occupants in a vehicle based on the seat belt usages of their drivers for three vehicle types: sedans/station wagons, pick-up trucks, and vans/SUVs. The results show that irrespective of the vehicle type, the seat belt usage rates of front seat occupants change significantly with the driver’s seat belt usage characteristics. When the drivers use seat belts, there is a significant increase in the overall usage rates of front seat occupants, whereas when the drivers do not use seat belts, there is a substantial decrease in front seat occupants’ seat belt usage rates. However, in general, the seat belt usage rates by drivers have a bigger impact on the seat belt usage rates of passengers in pick-up trucks than in sedans or vans. This indicates that media campaigns and enforcement campaigns could be effective by focusing on drivers’ seat belt usage, and this would increase the seat belt usage rates of front seat occupants as well. Equally, strategies to increase seat belt usage by occupants (e.g., education) are likely to lead to increases in seat belt usage by drivers. This result also means that by observing seat belt usage rates of drivers, the seat belt usage pattern of front seat occupants could be estimated.

Key words: occupant protection—safety—seat belt
INTRODUCTION

Records for the year 2002 from the National Highway Traffic Safety Administration (NHTSA 2005) indicate that motor vehicle crashes are the 8th leading cause of death among all ages that year. However, crashes were ranked first among the different causes of death for every age from 3 through 33 (NHTSA 2002). Seat belts are intended for use by passengers as a restraining device and aimed at reducing the severity of injury to occupants of a vehicle involved in a crash. Proper use of seat belts also helps reduce the potential for ejection from the vehicle and to reduce the impact of occupant contact with the vehicle interior or other objects. Evans (1987) showed that unbelted driver involvement rates in fatal crashes were 28% to 86% higher than those for belted drivers for seven types of traffic accidents/crashes. Steptoe et. al (2002) described seat belt usage as one of the most effective methods of reducing injury in motor vehicle crashes. Depending on the type of vehicle and seating position, the proper use of seat belts can significantly improve the chance of surviving a potential fatal crash (Blincoe et. al. 2002). NHTSA and state offices of traffic safety invest significant resources to improve seat belt usage rates by occupants of motor vehicles. Data from NHTSA show that overall seat belt usage rates in the United States show an increasing trend (NHTSA 2007) However, a review of the literature shows a need to evaluate the relationships between seat belt usage of driver and that of passengers in the same vehicle. This paper summarizes findings of a study to identify the relationship between seat belt usages of drivers and passengers for two conditions: when the driver is wearing a seat belt and when the driver is not using the seat belt. Seat belt usage rates for four years from 2003 to 2006 at 50 sites across the state of Nevada are used for this study.

OBJECTIVE

The objective of this paper is to identify whether a relationship exists between seat belt usage rates of the driver and passengers in the same vehicle. In other words, it aims to determine if any differences exist in the seat belt usage pattern of front seat occupants when drivers (a) use a seat belt and (b) do not use a seat belt. The results of this study would greatly benefit safety advocates and decision makers by focusing on drivers and passengers separately in education and enforcement campaigns in order to attain higher seat belt usage rates.

METHODOLOGY

The study that forms the basis of this paper used observational surveys to obtain data regarding seat belt usage rates of drivers and passengers in vehicles. Trained observers made field observations regarding seat belt usage rates at locations where traffic speeds were slow enough to make these observations. The data collection and site selection aspects of the study follow.

Data Collection

Data required for the study were collected by field observations at 50 locations across the state of Nevada. The data were collected for the years 2003 to 2006. At each site, a minimum of 400 vehicles were observed for seat belt usage rates of drivers and front seat passenger. In total, over 20,000 observations were made each year. On an average, 33.6% of the observed vehicles had occupants present in the front seat. The data were further categorized based on gender and age group of passengers, vehicle type, and area type.
Site Selection

The sites for data collection include 50 locations across the state of Nevada. The locations of these sites were determined using NHTSA’s guidelines for “State Observational Surveys of Seat Belt Use” (NHTSA 2000). They were distributed based on functional classification proportionate to the statewide annual vehicle miles of travel. The 50 sites are at locations where stopped or slow moving traffic can be observed.

Types of Analyses

In order to determine relationship of seat belt usage between drivers and passengers, the drivers and passengers are identified based on their gender. Vasudevan and Nambisan (2005) show that the seat belt usage rates change based on vehicle type. Three types of vehicles are considered: sedan/station wagon, pick-up truck, and van/SUV. Analyses are performed based on vehicle type to identify relationships of seat belt usage between drivers and passengers of these vehicle classifications.

SUMMARY OF ANALYSES

Vasudevan and Nambisan (2003, 2004, 2005, and 2006) showed that the seat belt usage patterns of drivers and front seat passengers vary based on vehicle category and area type. Therefore, the analyses presented herein include the relationships of seat belt usages for drivers and front seat passengers for the following vehicle types: sedan/station wagon, pick-up truck, and van/SUV. The analyses are divided into two major sections: when drivers use a seat belt and when drivers do not use a seat belt. They are described in detail in this section. Table 1 shows the seat belt usage rates for different categories of front seat occupants, viz. male and female passengers for different vehicle type, without considering driver’s seat belt usage. Figure 1 compares seat belt usages of passengers to that of drivers for the years 2003 to 2006. Figure 1 shows that, in general, the seat belt usage rates of passengers are higher than the usage rates of drivers. Figure 2 summarizes the seat belt usage rates of passengers in comparison to drivers’ seat belt usages. This figure clearly shows that the front seat occupants’ seat belt use is dependent on seat belt usages of drivers.
Table 1. Average seat belt usage rates for front seat passengers

<table>
<thead>
<tr>
<th>Year</th>
<th>Category</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passengers</td>
<td>Total #</td>
<td>% SB</td>
<td>Passengers</td>
<td>Total #</td>
</tr>
<tr>
<td></td>
<td>With SB</td>
<td>Passengers</td>
<td>Usage</td>
<td>With SB</td>
<td>Passengers</td>
</tr>
<tr>
<td>Sedans/Station Wagons</td>
<td>Male</td>
<td>740</td>
<td>966</td>
<td>76.6%</td>
<td>795</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1,730</td>
<td>2,031</td>
<td>85.2%</td>
<td>1,764</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>2,470</td>
<td>2,997</td>
<td>82.4%</td>
<td>2,559</td>
</tr>
<tr>
<td>Pick-ups</td>
<td>Male</td>
<td>469</td>
<td>752</td>
<td>62.4%</td>
<td>458</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>631</td>
<td>799</td>
<td>79.0%</td>
<td>634</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>1,100</td>
<td>1,551</td>
<td>70.9%</td>
<td>1,092</td>
</tr>
<tr>
<td>Vans/SUVs</td>
<td>Male</td>
<td>519</td>
<td>672</td>
<td>77.2%</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1,069</td>
<td>1,237</td>
<td>86.4%</td>
<td>1,154</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>1,588</td>
<td>1,909</td>
<td>83.2%</td>
<td>1,634</td>
</tr>
<tr>
<td>All Vehicles</td>
<td>Male</td>
<td>1,728</td>
<td>2,390</td>
<td>72.3%</td>
<td>1,733</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3,430</td>
<td>4,067</td>
<td>84.3%</td>
<td>3,552</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>5,158</td>
<td>6,457</td>
<td>79.9%</td>
<td>5,285</td>
</tr>
</tbody>
</table>
Figure 1. Comparing overall seat belt usages of passengers and drivers (2003–2006)
Figure 2. Comparing seat belt usage rates of front seat occupants based on drivers’ seat belt usage
Occupants’ Seat Belt Usage Based on Drivers’ Seat Belt Usage

Next, data pertaining to the seat belt usage of occupants are compared to that of drivers when the drivers wear seat belts. These data are again divided based on vehicle types.

For All Vehicles: Statewide Data

Figure 3 shows the summary of seat belt usage rates of front seat passengers when drivers use and not use seat belts, respectively, for all vehicles types for the years 2003 to 2006. Here, it is seen that when drivers use seat belts, the seat belt usage rates for front seat occupants over the four years is over 95%, except for the year 2003 when it was 91.5%, whereas when the drivers do not use seat belts, the corresponding seat belt usage rates of passengers decrease considerably to about 26%, except for the year 2006 when it was 37.8%.

For Sedans/Station Wagons

Figure 4 summarizes seat belt usage rates of passengers when drivers use and do not use seat belts, respectively, for sedans and station wagons for the years 2003 to 2006. Here, it is seen that when drivers use seat belts, the seat belt usage rates for front seat occupants for the four years is over 95%, except for the year 2003 when it was 91.4%, whereas when the drivers do not use seat belt, the corresponding seat belt usage rates decrease considerably to about 30%, except for the year 2006 when it was 37.8%.

For Pick-up Trucks

Figure 5 shows the summary of seat belt usage rates of passengers when drivers use and do not use seat belts respectively for pick-up trucks for the years 2003 to 2005. It is noted that when drivers use seat belts, the seat belt usage rates for front seat occupants for the four years is over 95%, except for the year 2003 when it was 89.2%. Conversely, when the drivers do not use seat belts, the corresponding seat belt usage rate by passengers drops noticeably to about 18% to 23%.

For Vans/SUVs

A summary of seat belt usage rates of passengers based on the drivers’ use of seat belts for sedans and station wagons for the years 2003 to 2006 is shown in Figure 6. It can be seen that when drivers use seat belts, the seat belt usage rates for front seat occupants for the four years is over 95%, except for the year 2003 when it was 93.3%. As in the cases of sedans/station wagons and pick-up trucks, the seat belt usage rates of passengers drops significantly to about 30% when the drivers do not use seat belts (except for the year 2006 when it was 48.1%).
Figure 3. Comparison of seat belt usages of passengers based on drivers’ seat belt usage (all vehicles)

Figure 4. Comparison of seat belt usages of passengers based on drivers’ seat belt usage (sedans/station wagons)
Figure 5. Comparison of seat belt usages of passengers based on drivers’ seat belt usage (pick-up trucks)

Figure 6. Comparison of seat belt usages of passengers based on drivers’ seat belt usage (vans/SUVs)
DISCUSSION

Figure 2 to 6 show that the seat belt usage rates of front seat occupants are closely linked to the use of seat belts by their respective drivers. This finding is very important, since it shows that if the drivers do not wear seat belts, the chance that the front seat occupants also do not wear seat belts is significantly high. This means that strategies to enhance seat belt usage would benefit significantly by focusing on drivers. Conversely, education strategies that encourage occupants to wear seat belts (e.g., in elementary and middle schools) could have positive influences on the use of seat belts by drivers. This correlates very well with anecdotal evidence of children asking their parents to buckle up before they start driving. It also indicates that by observing the seat belt usage of drivers, front seat occupants’ seat belt usage behaviour could be accurately estimated.
ACKNOWLEDGEMENTS

The authors are grateful to a number of individuals and organizations who provided invaluable support during the course of the project. Several students and staff from University of Nevada, Las Vegas, (UNLV) Transportation Research Center were instrumental in the data collection efforts. The support provided by Charles Abbott, Traci Pearl, and Bruce Mackey of the Nevada Office of Traffic Safety (OTS) is appreciated. The authors acknowledge the advice in formulating the statistical analysis from Dr. Ashok Singh, professor of statistics, UNLV. The authors also would like acknowledge financial support from the Nevada OTS. This support formed the basis of the initial efforts that led to the development of this paper. The authors are responsible for the accuracy of information presented in this paper, and the opinions presented herein are solely those of the authors, and they do not necessarily reflect those of the OTS or UNLV.

REFERENCES


