Effect on Fatality Risk of Changing from Secondary to Primary Seat Belt Enforcement

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ABSTRACT

Background: Most seat belt use laws originally passed in the United States contained language restricting enforcement to drivers already stopped for some other reason. States that have since removed this secondary enforcement restriction have reported increased seat belt use. The purpose of the present study was to estimate the effect of these law changes on driver fatality rates.

Method: Trends in passenger vehicle driver death rates per billion miles traveled were compared for 10 states that changed from secondary to primary seat belt enforcement and 14 states that remained with secondary enforcement.

Results: After accounting for possible economic effects and other general time trends, the change from secondary to primary enforcement was found to reduce annual passenger vehicle driver death rates by an estimated 7 percent (95 percent confidence limits 3.0-10.9).

Conclusion: The majority of U.S. states still have secondary enforcement laws. If these remaining secondary laws were amended, an estimated 696 deaths per year could be prevented.

INTRODUCTION

Since January 1996, the District of Columbia and all U.S. states except New Hampshire have required seat belt use for front-seat occupants of cars and light trucks. Some states also require belt use for occupants in rear seats. However, many of these laws have an unusual feature unique to U.S. motor vehicle law. They allow only for secondary enforcement; that is, motorists can only be issued a seat belt citation after they have been stopped for some other reason. In contrast, primary (standard) enforcement laws allow a police officer to stop and cite a motorist solely for not using a seat belt.

The first statewide mandatory seat belt law went into effect in New York in December 1984 and allowed for standard enforcement. The second belt law, passed in New Jersey in 1985, contained language restricting enforcement. Due to concerns that police might use a belt law to harass minorities, the New Jersey legislators provided, “[e]nforcement of this act … shall be accomplished only as a secondary action when a driver … has been detained for suspected violation of [motor vehicle law] or some other offense” (NJ Stat. Ann. 39:3-76.2i (1985)). All laws are primary unless they contain language similar to the New Jersey provision. Most states followed the New Jersey lead and prohibited officers from stopping vehicles solely because of a belt use violation. As originally passed, 39 of the 50 belt use laws contained secondary provisions.

Secondary belt use laws are more difficult to enforce, a situation understood by many motorists. For example, in a national telephone survey 58 percent of those in primary enforcement states said they thought it likely that someone not belted would be stopped and cited, compared with 42 percent in secondary states (Cammisa et al., 2000). There are some exceptions, but belt use usually is higher in
primary law states. In the most recent national observational survey, belt use rates for front-seat occupants averaged 84 percent in primary states and 73 percent in secondary states (Glassbrenner, 2004). Two recent systematic literature reviews on belt law effectiveness concluded that both primary and secondary laws reduce deaths and nonfatal injuries, but primary laws have the greater effect (Dinh-Zarr et al., 2001; Rivara et al., 1999). Summarizing the relevant studies, the incremental effect of primary versus secondary laws on fatalities was calculated to be between 3 and 14 percent (Dinh-Zarr et al., 2001). None of these studies actually looked at the effects of changing belt laws from secondary to primary enforcement. Rather, they were based on studies of primary laws versus no law, compared with studies of secondary laws versus no law.

Because of the superiority of primary enforcement belt laws in reducing injuries, many states have considered changing to primary laws, and some have done so. California was first, in 1993, and 13 others have converted since then. Belt use increased in California, from 58 to 76 percent, and fatalities were found to decrease by 16 percent during the first 5 months of the law, compared with those same months in prior years (Ulmer et al., 1994). A later California study reported a significant decrease in injuries but not a decrease in fatalities as a result of the upgraded law (Houston and Richardson, 2002). Subsequent studies have consistently found increases in belt use coincident with the shift to primary enforcement (e.g., 52 to 68 percent in Louisiana, 47 to 56 percent in Oklahoma, 66 to 80 percent in D.C., 71 to 83 percent in Maryland, 50 to 62 percent in Georgia, 70 to 83 percent in Michigan) (Cosgrove and Preusser, 1998; Eby et al., 2001; Preusser and Preusser, 1997; Solomon et al., 2001).

Collectively there has been an increase in belt use of about 14 percentage points in states that have shifted from secondary to primary laws (Shults et al., 2004). However, other than the preliminary and conflicting data from California, no study has looked systematically at the bottom line effect: the change in occupant fatalities associated with shifting to a primary enforcement law. Because of this lack, and because many of the evaluation studies of primary and secondary laws have been hampered by weak research designs, the conclusion of the systematic review on this topic was that “at this time we cannot reliably estimate the expected benefit from a change in the United States from a secondary to a primary enforcement law” and cited “a clear need to conduct a rigorous study directly comparing the effect of primary laws and of secondary laws, as well as examining the change from secondary law to primary” (Rivara et al., 1999). In the present study, an estimate of that effect is provided.

**METHOD**

Data on annual passenger vehicle driver deaths in each state during 1989-2003 were extracted from the Fatality Analysis Reporting System, a national census of fatal crashes on U.S. public roads. Front-seat passengers and some rear-seat passengers also were subject to the changes in seat belt law
enforcement, but possible changes in vehicle occupancy rates over time could have affected the number of passenger deaths. Therefore, analyses concentrated on driver deaths. Data on estimated vehicle miles of travel (VMT) in each state for the same years were obtained from the Federal Highway Administration (2004). Annual estimates of the average number of employed and unemployed persons in each state were obtained from the Bureau of Labor Statistics (2004).

Nationwide counts of traffic-related deaths fluctuated somewhat during 1989-2003. For example, there were more than 45,000 deaths in 1989, only 39,000 in 1992, then more than 43,000 in 2002. However, vehicle travel increased by about 50 billion miles each year. So fatality rates per billion VMT declined steadily from 21.7 in 1989 to 14.8 in 2003 (National Highway Traffic Safety Administration, 2004). Although VMT tends to increase at approximately a constant rate each year, the rate of increase is different for each state. Thus, differing trends in driver death counts among states may be partially explained by differing rates of increase in VMT.

Nine states and the District of Columbia had secondary seat belt laws in 1989 that were amended to primary laws by the end of 2002 (Table 1). These comprised the study states for evaluating the effect of the law changes. Alabama changed from secondary to primary enforcement in 1999 but was excluded from study because the secondary law did not exist until 1991. Delaware and Illinois changed their laws in mid-2003, but these states were excluded because the new laws had as yet insufficient exposure for evaluation. There were 14 states with secondary belt laws for the entire period 1989-2003 (Table 2). These comprised the control states. The remaining 24 states had either no seat belt law or a primary law in 1989.

### Table 1
**States that Changed from Secondary to Primary Seat Belt Enforcement**

<table>
<thead>
<tr>
<th>State</th>
<th>Date of Change</th>
<th>State</th>
<th>Date of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>1/1/1993</td>
<td>Oklahoma</td>
<td>11/1/1997</td>
</tr>
<tr>
<td>Louisiana</td>
<td>9/1/1995</td>
<td>Indiana</td>
<td>7/1/1998</td>
</tr>
<tr>
<td>Maryland</td>
<td>10/1/1997</td>
<td>Washington</td>
<td>7/1/2002</td>
</tr>
</tbody>
</table>

### Table 2
**States with Secondary Seat Belt Enforcement during 1989-2003**

<table>
<thead>
<tr>
<th>State</th>
<th>State</th>
<th>State</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>Minnesota</td>
<td>Ohio</td>
<td>Virginia</td>
</tr>
<tr>
<td>Florida</td>
<td>Missouri</td>
<td>Pennsylvania</td>
<td>Wisconsin</td>
</tr>
<tr>
<td>Idaho</td>
<td>Montana</td>
<td>Tennessee*</td>
<td>Utah</td>
</tr>
<tr>
<td>Kansas</td>
<td>Nevada</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Tennessee’s law became primary in July 2004

Annual passenger vehicle driver fatality rates per billion VMT were computed for the study and control states during 1989-2003. A rough estimate of the (average) effect of the law changes from secondary to primary enforcement was computed as the percentage change over time in the fatality rate
for the study states relative to the change for the control states. However, this rough estimate ignores the fact that the law changes took place at different times in the different study states (see Table 1).

A more precise estimate of the effect of the law changes from secondary to primary enforcement was obtained using a time series analysis. This involved dividing the study states into seven subgroups according to when the states changed their laws (1993, 1995, 1996, 1997, 1998, 2000, and 2002). Logarithms of fatality rates were modeled as a function of year, state subgroup, and the average annual unemployment rate for each subgroup. Past studies have reported a negative correlation of unemployment rates to highway fatality rates (Partyka, 1991). Intervention effects for each subgroup were defined as zero up until the year of the law change and one thereafter. Thus, each state subgroup was part of the control states up until its intervention time. Estimation of model parameters was accomplished using the Time Series Cross Section Regression (TSCSREG) procedure of the SAS software (SAS Institute, 1993).

The estimated proportional reduction in driver fatality rates due to the seat belt law changes was computed as \( E = 1 - \exp(\text{parameter estimate}) \). The number of lives saved by the law changes was computed using the formula \( S = \frac{E \times F}{1 - E} \), where \( F \) represents the number of passenger vehicle driver deaths after the primary laws were in place (Klein and Walz, 1995).

**RESULTS**

Salzberg et al. (2002) showed that seat belt use rates for the general driving population are related to use rates for fatally injured drivers. This allows for a convenient check that use rates increased more for the study states than for the control states. Figure 1 plots the reported belt use rates for fatally injured drivers.
injured passenger vehicle drivers in the study and control states during 1989-2003. In 1989 use rates were similar for the study (21 percent) and control states (20 percent). Use rates rose consistently over the years but increased faster for the study states. By 2003 use rates were 47 percent for the study states compared with 36 percent for the control states.

Figures 2 and 3 show the trends in passenger vehicle driver deaths and death rates per billion VMT, respectively, for the study and control states during 1989-2003. Of the 22,554 passenger vehicle driver deaths nationwide in 1989, 6,543 occurred in the study states and 6,649 occurred in the control states. In 2003 there were 5,594 driver deaths in the study states and 7,018 in the control states. So, between 1989 and 2003, the annual number of passenger vehicle driver deaths declined 15 percent in the study states but rose 6 percent in the control states.
Of the 2,096 billion miles traveled nationwide in 1989, 670 billion occurred in the study states and 599 billion occurred in the control states. So the study states had 9.77 passenger vehicle driver deaths per billion VMT in 1989 compared with 11.10 in the control states. In 2003 the study and control states had driver death rates of 6.36 and 8.06, respectively. In other words, passenger vehicle driver death rates declined 35 percent for the study states and 27 percent for the control states. So, relative to changes in the control states, driver death rates for the study states declined roughly 10 percent.

The time series cross-section regression model signaled a negative relationship between unemployment rates and driver fatality rates, but it was not statistically significant (Table 3). After accounting for possible economic effects and other general time trends, the model signaled a statistically significant negative relationship between the law changes and fatality rates. Based on the time series analysis, changing from secondary to primary enforcement of belt use laws reduced annual passenger vehicle driver death rates by an estimated 7 percent (95 percent confidence limits 3.0-10.9). Cumulatively, an estimated 2,990 passenger vehicle driver lives have been saved since these 10 states converted to primary enforcement (Table 4). Also, based on the 5,594 driver deaths in these states in 2003, an estimated 421 lives will be saved each year in the near future.

### Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate</th>
<th>Standard Error</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment rate</td>
<td>-0.00712</td>
<td>0.0108</td>
<td>0.5111</td>
</tr>
<tr>
<td>Indicator of law change</td>
<td>-0.07248</td>
<td>0.0217</td>
<td>0.0011</td>
</tr>
</tbody>
</table>

*TSRCSREG procedure, Fuller-Battese method

### Table 4

<table>
<thead>
<tr>
<th>States</th>
<th>Year of Change</th>
<th>Deaths after Change</th>
<th>Lives Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>1993</td>
<td>18,469</td>
<td>1,388</td>
</tr>
<tr>
<td>Louisiana</td>
<td>1995</td>
<td>3,917</td>
<td>295</td>
</tr>
<tr>
<td>Georgia</td>
<td>1996</td>
<td>6,067</td>
<td>456</td>
</tr>
<tr>
<td>District of Columbia, Maryland, Oklahoma</td>
<td>1997</td>
<td>4,430</td>
<td>333</td>
</tr>
<tr>
<td>Indiana</td>
<td>1998</td>
<td>2,511</td>
<td>189</td>
</tr>
<tr>
<td>Michigan, New Jersey</td>
<td>2000</td>
<td>4,072</td>
<td>306</td>
</tr>
<tr>
<td>Washington</td>
<td>2002</td>
<td>307</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>39,773</td>
<td></td>
<td>2,990</td>
</tr>
</tbody>
</table>

*Assuming a 7.0 percent reduction in each state

**DISCUSSION**

Shifting from a secondary to primary seat belt law enhances belt use enforcement potential, and prior observational studies have found that this shift increases belt use. In the present study, converting to primary enforcement was associated with a decrease in fatalities.

During the latter years of the study period, many states initiated special “Click It or Ticket” seat belt enforcement programs, with funding from the Air Bag and Seat Belt Campaign and the National
Highway Traffic Safety Administration. These highly publicized, intensive enforcement and media campaigns are known to increase belt use (Williams et al., 1996) and have been shown to do so in both primary and secondary enforcement states (Solomon et al., 2002). However, if these programs were introduced mostly in primary states during the study period, the conclusion that the shift to primary enforcement alone produced the fatality reductions would have to be modified. In 2001 two study states (Georgia and Michigan) and two control states (Florida and Tennessee) participated in the “Click It or Ticket” campaign, along with the remaining five states of the Southeast. In 2002 there were a total of 30 participants, including eight study states and five control states. So it does seem that enhanced enforcement began earlier in the study states. The proper conclusion, then, is that the changes in belt use laws, in combination with increased enforcement, led to the decrease in fatalities.

There were a number of other law changes not controlled for in the model and possibly affecting fatalities differentially in the states studied. For example, the shift from 0.10 to 0.08 percent blood alcohol concentration (BAC) laws occurred largely during the time period studied. However, among the states in which 0.08 percent BAC laws went into effect during the study period, the laws were in effect an average of only 2 years in the study states and almost 3 years in the control states. So it is likely that the differences between study and control states would have been even larger were it not for the 0.08 percent BAC laws.

An estimated 2,990 lives have been saved in the states that converted to primary enforcement. Currently, the majority of states (28) have secondary enforcement laws, so the unrealized potential benefits of this simple conversion are large. There were a total of 9,946 passenger vehicle driver deaths in the secondary states in 2003. If these states had instead passed primary laws, then an estimated 7 percent, or 696, of these deaths could have been prevented. This study could not estimate the effect of the law changes on passenger death rates. If passenger death rates were reduced, then the number of lives saved would be even greater.

Studies in five states that changed to primary enforcement have found no evidence of increased harassment among minority motorists by police, a concern that led to the enactment of secondary laws. Results indicated that for minority motorists in these states, primary enforcement led to higher belt use rates and proportionately equal or fewer citations compared with whites (Preusser et al., in press). The National Urban League and other organizations representing minority groups have endorsed primary laws. A national telephone survey conducted in 2003 found that 64 percent of the population favored primary laws, with support highest among women (68 percent), blacks (67 percent), and Hispanics (74 percent). Majority support was present in both primary (71 percent) and secondary (56 percent) enforcement states (Boyle and Vanderwall, 2003).
Some states have changed from secondary to primary enforcement of belt use laws, but despite generally favorable public opinion and positive evidence from early adopters, many states have turned down such legislation. Issues of personal freedom and unnecessary government intrusion are frequently raised, and although 53 percent of the population in secondary states support a primary law, this also means that many do not. Federal legislation has been proposed that would provide financial incentives to states enacting primary laws. If passed, this might spur more states to consider the switch. From a safety perspective, converting from secondary to primary enforcement is a straightforward way to save significant numbers of lives, with no discernible downside.

ACKNOWLEDGMENT

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REFERENCES


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