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# **Estimated Medical Cost Savings in Rhode Island by Implementing A Primary Seat Belt Law**

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16. Abstract  <p>This report examines 2006 hospital discharge data reporting cases where the external cause of injury to a vehicle occupant was a motor vehicle crash to predict the estimated savings to Rhode Island if a primary seat belt law is implemented. The savings are calculated using costs based on the report <i>Economic Impact of Motor Vehicle Crashes</i> (DOT HS 809 446). In Rhode Island, there is an expectation of a primary law reducing the burden of insurance companies by about \$1.9 million from crashes occurring in a single year alone. The people of Rhode Island would benefit by a reduction of more than \$397,000 while the Federal Government would reduce its costs by about \$278,000 before reimbursing Rhode Island for a portion of Medicaid expenditures. Rhode Island would also reduce its spending by \$553,000 (\$374,000 after reimbursement).</p>			
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## INTRODUCTION

On Wednesday, February 15, 2006, at 10:44 a.m., a 77-year-old woman was involved in a crash on an urban arterial road in Burrillville, Rhode Island. The driver of the other vehicle was a 58-year-old woman. The 77-year-old woman, unbelted, was killed in the crash. The 58-year-old survived the crash. She was belted.

On Saturday April 15, 2006, at 11:09 p.m., a 79-year-old man was driving on an urban local street in Warwick, Rhode Island, when he struck another vehicle. The other vehicle was driven by a 64-year-old man. The 64-year-old man, belted, did not suffer any injury. The 79-year-old man, unbelted, was completely ejected from the vehicle and died.

On Monday, December 18, 2006, at 5:33 p.m., a 36-year-old female was driving on an urban minor arterial road in Burrillville, Rhode Island when she was involved in a head-on collision. The other vehicle was driven by a 75-year-old male. The man, properly restrained, survived. The woman, not wearing a seat belt, died.

Seat belts can reduce the risk of death for front seat occupants of passenger cars by 45%. Similarly, belt use reduces the risk of serious non-fatal injuries by 50% for front-seat occupants of passenger cars. Belts are associated with a 65% decreased risk of injury while in light trucks (SUVs, minivans and pickup trucks).<sup>1</sup>

There are two types of belt laws. “Primary” seat belt laws allow police officers to enforce a violation of a seat belt law after observing a seat belt use infraction by itself. That is, the police can treat a seat belt violation as they would any other violation. “Secondary” laws prevent police from enforcing the seat belt law unless it is observed in association with another violation. That is, if the seat belt violation is the only visible infraction, police are not allowed to enforce the law in a secondary law State.

According to NHTSA, the passage of primary seat belt laws would likely induce 40% of current nonusers to wear seat belts. One study by the National Safety Council estimated that if all States had primary laws from 1995 to 2002 more than 12,000 lives would have been saved.<sup>2</sup>

Additionally, there are real financial costs to a secondary law State. These costs associated with failure to implement a primary seat belt law are dispersed to the State’s budget in terms of Medicaid and other State medical expenditures, the individual residents of the State, private insurance companies and the Federal Government. This study estimates the *minimum* dollars saved, including direct medical costs (primarily paid through Medicaid), by the implementation of a primary seat belt law in Rhode Island.

## **METHODS**

### Medical Cost Estimates

We used values from Rhode Island's 2006 Hospital Discharge data to estimate the complete medical costs of such motor vehicle related injuries. This data includes diagnosis and cost information, payer information and status at discharge for each person discharged from Rhode Island's hospitals. For diagnoses that describe injuries, there are also "E-Codes" which describe the external cause of the injuries. E-codes can indicate whether the cause of the injury was a motor vehicle and whether the person injured was an occupant of a motor vehicle. It should be noted that "in theory" every injury diagnosis should have an associated E-Code, but this is rarely the case. Using this information we identified which occupants of motor vehicles (excluding motorcycles) received injuries as a result of crashes.

The costs listed in the database represent only the tip of the iceberg in terms of total medical costs from injuries. Often, especially with more severe injuries, there are extensive medical costs incurred after the hospitalizations. There are likely follow-up medical visits, future surgeries and perhaps even rehabilitation for example. As such, hospital costs may grossly underestimate actual medical costs for injuries. We therefore use estimated medical costs provided by Blincoe et al.<sup>3</sup> These estimates, calculated specifically for injuries associated with motor vehicle crashes, include lifetime costs for the specific injuries associated with a crash. They include estimates for specific body parts for each severity of injury using the Maximum Abbreviated Injury Scale (MAIS). This scale identifies the severity of the worst injury (noting that individuals may have multiple injuries) on a scale of 0 to 6. Zero indicates no injury, 1 is minor injury, up to 5 is severe injury and 6 is not survivable (or fatal) injury. Using diagnosis codes we are able to map injuries to specific body parts but discharge data do not indicate the severity of injury. Therefore we used the distribution of injury severity by body part for MAIS 1 to 5 (excluding fatal injuries) to calculate an average cost per body part. The distribution was calculated by the National Center for Statistical Analysis using an average distribution from 2002 to 2006 Crashworthiness Data System (CDS). Fatal injuries were excluded because they have no future medical costs and therefore actual hospital charges are used.

According to the Bureau of Labor Statistics medical costs have increased 35% from 2000 to 2007. We therefore adjusted the Blincoe et al. costs by this amount to make them more likely to reflect 2008 medical costs. Table 1 shows the final estimated costs per body region in 2006 dollars. These estimates were used to calculate costs of motor vehicle crash-related injuries in Rhode Island.

Some other adjustments are necessary to make the estimates more likely to reflect actual medical costs. E-Codes do not identify whether a hospital patient is an occupant of a passenger vehicle or a large truck. Primary seat belt laws would not be expected to affect injuries sustained to occupants of large trucks. Therefore we used the proportion of large trucks in NHTSA's Fatality Analysis Reporting System (FARS), a census of all fatal crashes on public roadways in the United States, to estimate the proportion of hospitalizations in the State that were likely occupants of large trucks and

remove them from the analyses. Specifically, the General Estimate System (GES) indicates that nationally, the proportion of all fatally injured occupants who were in large trucks and buses is the same as the proportion of all non-fatally injured occupants who were in large trucks and buses. In Rhode Island there were 4.1% of the fatal injuries who were occupants of non-passenger vehicles. Therefore we reduced costs by this amount to account for those injuries likely to stem from these large trucks.

**Table 1. Costs and Injury Distribution\*\* by Body Part**

MAIS	Body Part													
	Brain		Other Head/Neck/Face		SCI		Trunk, Abdomen		Upper Extremities		Lower Extremities		Other	
	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost
1	6%	\$41,047	21%	\$1,597	0%	*	17%	\$1,685	24%	\$1,160	12%	\$1,735	100%	\$1,465
2	27%	\$42,286	29%	\$16,227	0%	*	24%	\$15,368	32%	\$7,412	29%	\$11,599	0%	*
3	22%	\$261,610	30%	\$75,801	25%	\$479,361	34%	\$44,134	44%	\$23,320	43%	\$42,198	0%	*
4	22%	\$278,899	13%	\$240,685	39%	\$1,113,597	19%	\$71,500	0%	*	11%	\$55,989	0%	*
5	23%	\$378,308	6%	\$124,344	36%	\$1,470,010	6%	\$85,005	0%	*	5%	\$282,991	0%	*
<b>M</b>		<b>\$221,596</b>		<b>\$66,772</b>		<b>\$1,086,910</b>		<b>\$37,723</b>		<b>\$12,862</b>		<b>\$41,795</b>		<b>\$1,465</b>

\*No Injuries of This Severity

\*\* Source: NCSA analysis of 2002-2006 CDS

A second adjustment was also made to the data to account for incomplete use of E-Codes by hospitals. We calculated the percentage of the first three diagnoses, when they contain an injury, and excluded E-Codes (9%) and adjusted our values by that amount. We assumed that the distribution of external cause of injury would be the same for cases in which the E-Code was present and when it was not (i.e. E-Codes are excluded randomly across all injury sources).

Finally, we needed to adjust who paid some of the charges given that the Federal Government repays a portion of the State's Medicaid costs. That is, some of the charges that the database indicates belong to the State (only the portion that are Medicaid), are moved to be charges for the Federal Government. That is, the Federal Government returns 52% of the Medicaid charges to Rhode Island and these costs become Federal Government expenditures.<sup>4</sup>

Estimates of Cost Reductions by Implementation of Primary Seat Belt Law

Once we obtained a dollar value for motor vehicle injury costs, a determination of how much would be saved as a result of a new primary seat belt law was made. In order to accomplish this we need

to estimate how much belt use would increase as a result of a primary seat belt law and how many fewer injuries would result from that increase.

### **Estimating Seat Belt Usage Increase From Primary Law**

We based our estimate of seat belt use increase following primary law upgrade on NHTSA estimate of a 40% conversion rate.<sup>5</sup> That is NHTSA estimates that 40% of those who are non-seat-belt users will become seat belt users following a change to primary law. Using this estimate we would expect Rhode Island's belt use among people hospitalized for injuries sustained in motor vehicle crashes to go from 79.0% to 87.4% (an 8.4-percentage-point increase).

### **Estimating Belt Use Effectiveness**

Next we need to estimate how effective the seat belt will be. That is, once we establish how many new people will be restrained we need to determine how many of these newly restrained individuals will benefit from the seat belts. NHTSA has determined that the seat belt is roughly 50% effective for cars and 65% effective for light trucks.<sup>1</sup> These percentages are in terms of reduction of serious injury (MAIS 2 to 5). For less severe injuries (MAIS 1) the effectiveness is 10% in both vehicle types. Hospital discharge data cannot tell us what vehicle type the victim was in. Therefore, we estimate the distribution of cars to light trucks using FARS. According to 2006 GES, the ratio of cars to light trucks is the same for injuries as it is for fatalities. Consequently, we used FARS to identify the proportion of cars to light trucks for the State. Given the proportion of cars to light trucks (and the proportion of injuries that are MAIS 1) the weighted average effectiveness was calculated to be 45%. The estimates of cost reduction assume that this percentage applies to those hospitalized as a result of motor vehicle crashes.

### **Calculating Savings**

To calculate savings we use the fact that we expect an 8.4 percentage point increase in seat belt use, and that of those newly belted people 45% will avoid injury. To turn the percentage point increase into a percent we calculate what the cost would have been had no one been restrained and take 8.4% from that. The formula for this is:

$$\text{Cost at 0 belt use} = \frac{C}{1 - UE}$$

Where  $C$  = current costs,  $U$  = current belt use, and  $E$  = the effectiveness of the belt (in this case 45%). This formula was applied to each payer. These values are then multiplied by the expected percentage-point increase and 45% (the estimated effectiveness of the seat belt) to determine the amount saved.

## Results

There were a total of 570 motor vehicle crash related patients discharged from Rhode Island hospitals in 2006 (22 of them were deceased). The actual cost of these motor-vehicle-generated injuries was \$27,810,781 in direct hospital costs alone. Of that, \$15,319,341 of the charges was billed to insurance companies. Another \$2,663,288 was paid by the patients. The State of Rhode Island covered \$6,426,634 primarily in Medicaid expenditures, and the Federal Government was charged \$3,401,518 (primarily through Medicare).

The dollar values increase when we estimate what they would be for all medical care associated with the vehicle crash. Overall, we estimate that traffic crashes cost all payers in the State \$51,646,682 for injuries occurring in a single year. The estimated costs also show that insurance companies cover the greatest amount for traffic related injuries (\$33,001,540). Estimated charges for the State government are \$9,408,599 and are \$4,725,195 for the Federal Government. Finally, people of Rhode Island can expect to pay \$6,480,237 for all injuries to occupants of passenger cars stemming from crashes.

Some portion of these estimated costs are expected to be decreased with the implementation of the primary seat belt law. The estimates of all cost results indicate that the greatest savings would be to insurance companies. There is an expectation of a primary law reducing the burden of insurance companies for injuries occurring in 2008 by \$1,939,167 from crashes occurring in that year alone. The people of Rhode Island would benefit by a reduction of \$397,377 while the Federal Government would reduce its costs by \$277,652. Rhode Island would also reduce its spending by about \$552,848.

The Federal Government reimburses States for a portion of their Medicaid expenditures. We estimated that the Medicaid portion of the Rhode Island costs would be \$343,264 (leaving \$209,585 as non-Medicaid costs). The Federal Government would reimburse Rhode Island 52% of its Medicaid costs (\$178,497). Thus, the State's net amount would decrease and the Federal Government's would increase. The last column of Table 2 shows what the post reimbursement costs would be to the State and the Federal Government.

**Table 2. Costs by Primary Payer**

Primary Payer	N Alive	N Dead	Actual Hospital Charges in 2006	Estimated Total Medical Costs for 2008	Saved by Primary	After Fed Gov't Reimbursement
Insurance	297	10	\$15,319,341	\$33,001,540	\$1,939,167	
State Gov't (e.g. Medicaid)	89	5	\$6,426,634	\$9,408,599	\$552,848	\$374,351
Federal Gov't	90	4	\$3,401,518	\$4,725,195	\$277,652	\$456,149
Paid by RI Crash Victims	72	3	\$2,663,288	\$6,480,237	\$397,377	
<b>ALL</b>	<b>548</b>	<b>22</b>	<b>\$27,810,781</b>	<b>\$51,646,682</b>	<b>\$3,167,045</b>	

*\* Adjusted for E-Code Usage and Large Truck*

## CONCLUSION

The estimates reported here are considered to be underestimations of savings associated with increased seat belt use associated with the implementation of a primary seat belt law. In this study, we do not explore the peripheral costs (loss of wages and tax revenues, productivity, loss of life, etc.). Additionally, research has shown that the costs of unbelted injuries are 25% higher than belted injuries and unbelted occupants are more likely to be Medicaid patients.<sup>6</sup>

There is also no attempt to project cost increases over time as far as what the savings would be in future years. Medical cost increases have traditionally far outpaced inflation. Costs reported here are merely small portions of the likely savings. Clearly, the State, its citizens and other payers can expect to reduce other associated costs by implementation of a primary enforcement seat belt law. For example, unemployment is much higher among disabled people and family members frequently needing to defer employment to become care takers. These costs not only reduce the tax base for the State but may also add to the number of people on other State-dependent money (e.g., welfare). We also do not address the savings to private business of the State. Last, we do not attempt to place a price on human life, and on pain and suffering.

All the costs in this study are based on conservative values. The goal was to produce a value that could be considered an absolute minimum value in that we chose to err on the conservative side when in doubt.

In summary, Rhode Island could expect to save at least about \$553,000 (\$374,000 after reimbursement) from injuries prevented in 2008 alone on its medical costs. The total savings to all payers will be about \$3.2 million.

## References

1. Kahane, C. J. (2000). Fatality reduction by safety belts for front-seat occupants of cars and light trucks: Updated and expanded estimates based on 1986-99 FARS Data. DOT HS 809 199. Washington, DC: National Highway Traffic Safety Administration.
2. Chaudhary, N. K., & Preusser, D. F. (2003). Lives lost by states' failure to implement primary safety belt laws. Report to the National Safety Council. Available: [http://www.nsc.org/public/Preusser\\_Study.doc](http://www.nsc.org/public/Preusser_Study.doc)
3. Blincoe, L., Seay, A., Zaloshnja, E., Miller, Romano, T. E., Luchter, S., & Spicer, R. (May 2002). The Economic Impact of Motor Vehicle Crashes, 2000. DOT HS 809 446. Washington, DC: National Highway Traffic Safety Administration.
4. Federal Financial Participation in State Assistance Expenditures. Available: <http://aspe.hhs.gov/health/fmap07.htm>
5. Blincoe, L., & Glassbrenner, D. (August 2006). Estimated Impact of Primary Laws. NHTSA (Unpublished Manuscript).
6. Gill, S. S., Jakub, J. W., Pease, M. C., & Woolen, C. D. (2002). The economic impact of motor vehicle crashes: The cost of restrained versus unrestrained occupants in South Carolina. *The American Surgeon*, 68, 569-574

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