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# Estimated Medical Cost Savings In Vermont by Implementing A Primary Seat Belt Law

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16. Abstract

This report examines 2005 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 the State of Vermont if a primary seat belt law is implemented. The savings are calculated using costs based on the report *Economic Impact of Motor Vehicle Crashes* (DOT HS 809 446). In Vermont, there is an expectation of a primary law reducing the burden of insurance companies by about $1.3 million from crashes occurring in a single year alone. The people of Vermont would benefit by a reduction of more than $130,000 while the Federal Government would reduce its costs by about $125,000 before reimbursing Vermont for a portion of Medicaid expenditures. Vermont would also reduce its spending by more than $498,000 ($248,000 after reimbursement).

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## INTRODUCTION

> On Saturday, May 20, 2006, at 11:23 a.m., an 80-year-old male was driving on an urban minor arterial road in Shelburne, Vermont, when he was involved in a head-on collision. The other vehicle was driven by a 49-year-old female. The woman, belted, survived. The man, not wearing a seat belt, died.
>
> On Thursday January 5, 2006, at 1:35 p.m., two vehicles were involved in a crash on a rural minor arterial road in St. Johnsbury, Vermont. The driver of one vehicle, an unbelted 21-year-old male, sustained a moderate injury. His 25-year-old female passenger was killed. She was unbelted. The driver of the second vehicle, a 49-year-old male only suffered a minor injury. He was belted.

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 (e.g. SUV's, minivans and pickup trucks).[1]

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 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 belt law unless it is observed in association with another violation. That is, if the belt violation is the only visible infraction, police are not allowed to enforce the law in a secondary law State.

According to the National Highway Traffic Safety Administration, the passage of primary seat belt laws would likely induce 40 percent 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.[2]

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 Vermont.

## METHODS

### Medical Cost Estimates

We used values from Vermont's 2005 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 Vermont'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.[3] 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 Vermont.

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 Vermont there were 3.9% 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**

| | Body Part | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Brain | | Other Head/Neck/Face | | SCI | | Trunk, Abdomen | | Upper Extremities | | Lower Extremities | | Other | |
| MAIS | % | 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% | * |
| **M** | **$221,596** | | **$66,772** | | **$1,086,910** | | **$37,723** | | **$12,862** | | **$41,795** | | **$1,465** | |

**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 all injury diagnoses that excluded E-Codes (3%) 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 58.93% of the Medicaid charges to Vermont and these costs become Federal Government expenditures.[4]

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. 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.[5] Using this estimate we would expect Vermont's belt use among people hospitalized for injuries sustained in motor vehicle crashes to go from 87.1% to 92.3% (a 5.2-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.[1] 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 47%. 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 a 5.2-percentage-point increase in seat belt use, and that of those newly belted people 47% 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 5.2% from that. The formula for this is:

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

Where $C$ = current costs, $U$ = current belt use, and $E$ = the effectiveness of the belt (in this case 47%). This formula was applied to each payer. These values are then multiplied by the expected percentage point increase and 47% (the estimated effectiveness of the belt) to determine the amount saved.

### Results

There were a total of 428 motor-vehicle-crash-related patients discharged from Vermont hospitals in 2005 (11 of them were deceased). The actual cost of these motor-vehicle-generated injuries was $15,956,004 in direct hospital costs alone. Of that, $10,283,468 of the charges was billed to insurance companies. Another $617,163 was paid by the patients. The State of Vermont covered

$4,454,190, primarily in Medicaid expenditures, and the Federal Government was charged $601,183 (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 $49,770,584 for injuries occurring in a single year. The estimated costs also show that insurance companies cover the greatest amount for traffic-related injuries ($31,302,510). Estimated charges for the State government are $11,849,045 and are $2,979,690 for the Federal Government. Finally, residents of Vermont can expect to pay $3,142,381 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 $1,316,004 from crashes occurring in that year alone. The residents of Vermont would benefit by a reduction of $130,702 while the Federal Government would reduce its costs by $125,271. The State of Vermont would also reduce its spending by about $498,152.

The Federal Government reimburses States for a portion of their Medicaid expenditures. We estimated that the Medicaid portion of the Vermont costs would be $425,112 (leaving $73,040 as non-Medicaid costs). The Federal Government would reimburse Vermont 58.93% of its Medicaid costs ($250,518). 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 2005 | Estimated Total Medical Costs for 2008 | Saved by Primary | After Gov't Reimbursement |
|---|---|---|---|---|---|---|
| Insurance | 279 | 7 | $10,283,468 | $31,302,510 | $1,316,004 | |
| State Gov't (e.g., Medicaid) | 62 | 0 | $4,454,190 | $11,849,045 | $498,152 | $247,633 |
| Federal Government | 42 | 4 | $601,183 | $2,979,690 | $125,271 | $375,789 |
| Paid by Vermont Crash Victims | 34 | 0 | $617,163 | $3,142,381 | $130,702 | |
| ALL | 417 | 11 | $15,956,004 | $49,770,584 | $2,070,129 | |

** 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.[6]

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, Vermont could expect to save at least $498,000 ($248,000 after reimbursement) from injuries prevented in 2008 alone on its medical costs. The total savings to all payers will be more than $2.0 million.

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