Comparison of Influences on Seat Belt Use in States

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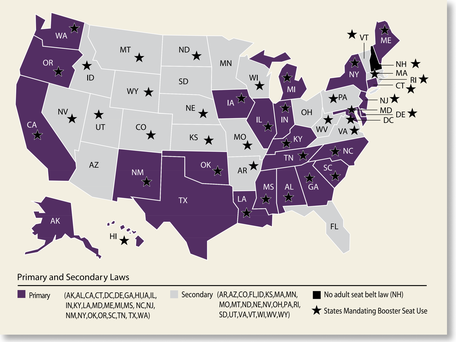
1. Background

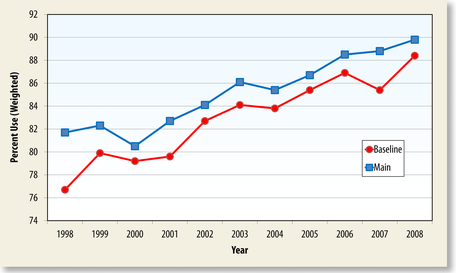
Seat belts save lives. Passenger cars have been required to include seat belts as standard safety gear since 1968. Other vehicles such as vans, SUVs and trucks have required seat belts since 1978. The first laws requiring seat belt use were in enacted in 1984 in New York. At that time, the seat belt rate, nationally, was quite low at 67 percent compliance.[1] This is because of resistance to wearing belts and the lack of a primary seat belt law. A primary seat belt law enables law enforcement officers to stop and ticket drivers and passengers for the seat belt violation on its own. A secondary law means that vehicles must be stopped for another violation before a seat belt ticket can be issued.

Figure 1. States With Primary and Secondary Seat Belt Laws and Booster Seat Requirements[2]



In 1993 North Carolina developed and implemented the original Click-It-Or-Ticket program. This high visibility educational and enforcement campaign had a significant effect on seat belt use in North Carolina. In **Figure 2** below, the baseline (pink) line indicates seat belt use prior to the Click-It-Or-Ticket campaign. The main survey (blue) line represents seat belt use immediately following the campaign.

Figure 2. needs a title[3]



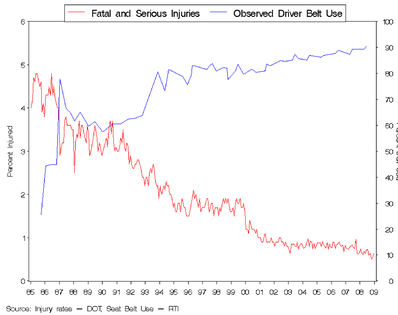
1. Background *(continued)*

North Carolina typically experiences an increase in belt use from before the Click-It-Or-Ticket program to after the enforcement period. Like most interventions, the effect wanes with time and the seat belt use rates reduce slightly. The small increases in recent years demonstrate the plateau effect that some higher performing states are experiencing. In the home of Click-It-Or-Ticket, the program remains successful by increasing seat belt use rates, even if that increase is smaller each year. In 2009 North Carolina conducted 2,146 checkpoints and over 13,000 seat belt citations were issued.

In addition to encouraging seat belt use and ticketing noncompliant drivers, the Click-It-Or-Ticket program includes other benefits such as making arrests for other offenses. In 2009 6,300 other criminal violations, such as drug violations and felony arrests, were issued.

Figure 3 below depicts the change in driver seat belt wearing rates and the change in serious and fatal injuries in North Carolina.

Figure 3. NC Driver Seat Belt Use and Covered Occupant Injury Rates, 1985–March 2009



The number of serious injuries and deaths, in red, decreases as the percent belt use, in blue, increases. This kind of effect is also seen nationally.

There are very real costs to society for nonuse of seat belts. In 2004, seat belt nonuse alone caused an estimated $18 billion in economic costs to society. Unbelted crash victims receive worse injuries and more fatalities than belted crash victims, thus increasing the cost of treating those injuries. Inpatient rehabilitation costs for motor vehicle injuries average $11,265 per patient. In general, it costs more than twice as much to treat an unbelted victim than a belted one, due to the increased severity of the injuries.[4]

CLICK IT OR TICKET.

2. Motivation

Twenty seven states have a primary seat belt law and impose fines on violators. With the exception of New Hampshire that has no adult seat belt law, the other states enforce a secondary seat belt law. Currently, some states are experiencing a plateau of belt use rates around the 88–90% level. Highway safety advocates are examining other ways to encourage higher belt use. Other states have not yet enacted strict legislation to encourage seat belt use. This research will explore what demographic, legislative and enforcement characteristics predict higher seat belt use. We hope to show there are actions that states can take to improve seat belt use, and thus reduce the number of serious and fatal injuries. Policymakers can use these results to help inform and support their decisions.

3. Demographic Information

It is important to consider the demographic characteristics of state residents when looking at state seat belt rates. It is established that females have higher belt use rates than males. Further, seat belt use increases with age, income and education.[5]

In light of this known information about seat belt use, we constructed a dataset with rows for each state. The columns are the demographic characteristics of the states. Information such as the seat belt use rate, type of law, number of seat belt citations, amount of the seat belt fine, race and ethnic information, median income and other variables. An example of the data is below.

State	Type of Seat Belt Law	Seat Belt Fine Amount	Points	Number Fatalities in 2008	2008 Median HH Income	Region	State population	Percent Urban	Seat Belt Rate	Medicaid $	Medicaid $ per capita	Citations	Citations per capita	% Deaths on Rural Principal Arterial Interstate	% Deaths on Rural Principal Arterial Other	% Deaths on Rural Minor Arterial	% Deaths on Rural Major Collector	% Deaths on Rural Minor Collector	% Deaths on Rural Local Road or Street	% Deaths on Urban Principal Arterial Interstate	% Deaths on Urban Principal Arterial Other
Alabama	Primary	25	0	1,885	44,155	South	4,708,708	60.4	84.10%	$ 2,341,178	$0.52	70,414	236.2	4.4	15.2	12.2	15.1	5.7	10.1	0.6	6.1
Alaska	Primary	10	0	123	66,701	West	698,473	67.1	84.90%	$ 153,030	$0.50	2,476	36.2	34.1	5.5	9.1	5.5	5.5	10.9	3.6	5.6
Arizona	Secondary	10	0	1,015	47,972	West	6,595,778	87.9	79.90%	$ 202,000	$0.04	19,531	34.7	15.3	7.8	5.8	10.3	2.1	8.3	0.1	2.7
Arkansas	Primary	25	0	571	40,974	South	2,889,450	51.0	79.40%	$ 1,022,163	$0.47	12,404	45.4	7.2	16.1	16.3	17.2	0.0	17.2	0.0	3.3
California	Primary	20	0	4,115	57,440	West	36,961,664	92.4	95.70%	$ 5,793,787	$0.18	459,254	129	4.9	10.2	5.8	8.3	3.1	5.1	0.0	9.8
Colorado	Secondary	75	0.5	464	61,017	West	5,024,748	82.4	81.70%	$ 1,365,336	$0.30	10,056	77.1	21.2	13.7	12.1	9.1	3.7	4.6	0.0	5.9
Connecticut	Primary	15	0	347	65,844	Northeast	3,518,288	79.1	86.00%	$ 9,555,128	$1.76	49,990	146.1	1.2	2.8	5.7	8.4	0.8	3.3	0.0	23.4
Delaware	Primary	25	0	100	57,513	Northeast	873,092	75.4	90.00%	$ 301,489	$0.41	18,484	126.8	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
District of Columbia	Primary	30	0	34	34,192	South	599,657	100	90.00%					3.1	0.0	0.0	0.0	0.0	6.3	0.0	12.5
Florida	Primary	30	0	3,101	46,206	South	18,537,969	84.8	81.70%	$ 8,404,124	$0.55	214,757	126	4.3	7.3	3.3	0.3	0.0	20.8	0.1	7.4
Georgia	Primary	15	0	1,659	49,309	South	9,829,211	65.2	89.60%	$ 1,881,943	$0.21	114,027	129.9	5.0	8.7	11.0	15.7	5.0	7.0	0.1	8.0
Hawaii	Primary	92	0	176	66,002	West	1,295,178	89	97.00%	$ 500,000	$0.40	12,046	96.6	0.0	11.8	18.6	11.8	2.9	8.8	0.0	8.9
Idaho	Secondary	10	0	242	49,247	West	1,545,801	57.4	76.40%	$ 491,800	$0.34	28,842	208.2	15.2	21.1	21.8	5.8	7.0	2.8	0.0	5.2
Illinois	Primary	25	0	1,808	55,809	Midwest	12,910,409	84.6	90.30%	$ 3,968,597	$0.32	104,723	125.9	3.4	7.2	7.9	10.5	1.4	6.6	0.2	7.4
Indiana	Primary	25	0	1,010	47,048	Midwest	6,423,113	71.9	85.10%	$ 1,966,000	$0.31	61,000	94.9	10.0	10.8	9.8	9.8	2.0	5.9	0.0	5.9
Iowa	Primary	25	0	364	50,460	Midwest	2,937,856	60.4	92.00%	$ 296,478	$0.10	20,024	47.9	12.6	20.4	24.8	12.8	0.0	12.0	0.0	0.0
Kansas	Secondary	80	0	346	49,118	Midwest	2,818,747	69.1	77.40%	$ 699,441	$0.24	12,992	47.0	7.8	22.7	21.8	17.8	2.3	14.7	0.0	0.3
Kentucky	Primary	25	0	1,004	41,058	South	4,314,113	51.0	75.60%	$ 2,590,100	$0.61	70,0	70.0	7.0	19.4	19.3	15.8	0.1	12.8	0.1	2.9
Louisiana	Primary	25	0	1,590	41,250	South	4,492,076	68.1	75.90%	$ 1,810,284	$0.41	26,952	58.4	6.1	5.5	8.7	13.8	6.4	15.5	0.0	7.1
Maine	Primary	50	0	183	46,474	Northeast	1,317,207	44.4	81.80%					14.2	15.8	18.9	5.7	0.0	5.7	0.0	9.9
Maryland	Primary	25	0	1,003	65,902	South	5,699,478	84.6	91.60%	$ 1,560,000	$0.30	20,130	45.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
Massachusetts	Secondary	25	0	347	65,315	Northeast	6,593,587	84.1	69.80%	$ 1,719,113	$0.27	27,282	42.5	0.0	0.0	2.1	1.5	0.0	4.2	0.0	14.6
Michigan	Primary	25	0	1,604	50,328	Midwest	9,969,727	76.3	97.20%	$ 4,558,532	$0.46	123,270	124.7	3.0	8.7	14.8	16.9	2.4	13.0	0.1	4.8
Minnesota	Primary	25	0	630	57,837	Midwest	5,266,214	69.9	86.90%	$ 1,106,094	$0.22	44,587	88.2	7.8	14.3	14.7	15.0	8.6	8.3	0.2	5.4
Mississippi	Primary	25	0	1,268	37,579	South	2,951,996	47.1	71.30%	$ 1,055,631	$0.38	14,196	49.0	8.0	10.0	4.5	18.4	5.1	3.1	0.4	2.3
Missouri	Secondary	25	0	1,012	48,908	Midwest	5,987,580	68.7	75.80%	$ 591,038	$0.10	23,820	27.5	3.0	17.9	9.3	18.0	1.9	9.6	0.0	8.0
Montana	Primary	25	0	224	43,200	West	1,032,949	55.9	76.60%	$ 1,107,177	$1.28	5,938	80.7	34.5	15.5	20.7	13.8	3.4	3.4	0.0	3.4
Nebraska	Secondary	25	0	365	52,096	Midwest	1,796,619	64.1	83.40%	$ 411,000	$0.23	4,000	2.2	8.4	23.6	22.9	13.0	5.3	12.2	0.0	0.0
Nevada	Secondary	25	0	375	55,440	West	2,643,085	88.2	90.90%	$ 1,059,904	$0.40	15,897	52.4	8.2	14.8	5.6	4.8	2.0	1.1	1.0	5.4
New Hampshire	None	0	252	65,175	Northeast	1,324,575	61	65.20%						7.8	5.0	23.8	11.7	18.0	18.3	0.0	0.0
New Jersey	Primary	20	0	1,032	64,070	Northeast	8,707,739	89.4	91.80%	$ 1,107,000	$0.18	214,379	249	3.3	2.5	3.0	3.4	2.1	2.3	0.0	20.2
New Mexico	Primary	25	0	450	44,081	West	2,059,475	75	91.10%	$ 347,078	$0.17	21,479	155.3	23.5	26.7	5.4	4.8	3.5	3.5	4.9	2.3

4. Modeling

We produced our model in SAS® using *proc glm* and used Minitab for our graphics.

We started our modeling process with a full model and reduced down to significant variables. There was so much confounding with road types that they were not used in the models. Despite the known information that certain race and ethnicity groups are less likely to wear seat belts, these variables were not significant in the model. Surprisingly, neither the number of total deaths nor the per capita deaths were significant in predicting seat belt use. An inverse effect was expected, but not observed. Other variables such as the size of the fine for noncompliance and the driver license points were not significant.

5. Results

The final model consisted of Type of Law, Number of Citations, and Median Household Income. The best main effect model to predict seat belt use is:

$$\text{Rate} = 0.60580 + 0.000004(\text{Income}) + 4.940(\text{Citations}) + 0.02822(\text{Law})$$

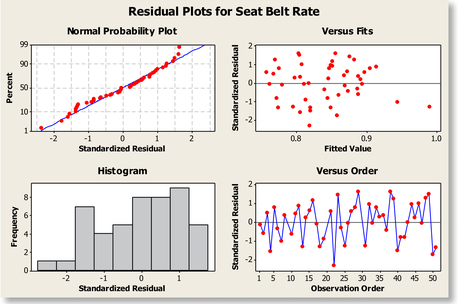
Overall, the model is very significant with an F value of 8.97 and model degrees of freedom of 3, yielding a p-value of less than 0.0001. The R-Square is 0.369192. The significance of the independent variables is below:

Table 1. Parameter Significance

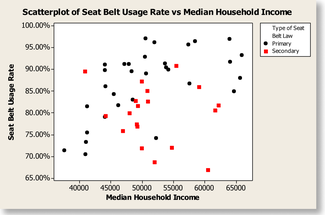
Source	F Value	p-value
Law	13.41	0.0006
Income	8.82	0.0047
Citations	4.70	0.0354

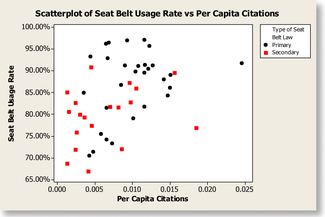
5. Results *(continued)*

The residual plots and normal probability plots indicate that the model is a good fit.



Below are scatterplots comparing the Seat Belt Rate with the Income and Citations per capita. Note that the type of seat belt law is designated by the circle or square points.





The Income scatterplot tends to show the Secondary Law states with a lower overall seat belt use rate. The Citations scatterplot clearly shows a positive relationship between the number of per capita citations and an increase in seat belt wearing rates. This relationship exists regardless of the type of seat belt law enacted in the state.

6. Discussion

The type of law is very significant in the model. Additionally, the number of per capita citations is significant. This is an important finding because regardless of the type of law in a state, the number of citations per capita is still very important in predicting seat belt use. Even in secondary law states, the act of regularly ticketing unbelted drivers helps increase the belt use rate. For a nearly 5% increase in citations, a state could expect a one percent increase in the seat belt use rate. This could be helpful to law enforcement agencies in planning their enforcement campaigns.

The income question is moderately significant. Income is highly correlated with education, which we know is positively correlated with a higher use of seat belt use. We also expected the amount of the fine and the driver license points to be significant. However since there are so few states that have driver license points, that may be the reason we didn't see significant results.

7. Future Research

The use of higher fines for seat belt violations and the addition of driver license points are areas to consider for future research. We thought that heavier fines and penalties such as license points would affect wearing rates.

All of the seat belt rates in this research are based on daytime observation. It is noted that nighttime seat belt use is lower than during the day. Additionally, the people not wearing their seat belts have additional characteristics that make them more dangerous to enforcement officers. For instance, unbuckled nighttime drivers are more likely to have outstanding warrants or be under the influence of drugs or alcohol. With the increase in nighttime enforcement and the potential of nighttime use rates, this analysis could be repeated to understand more about those who fail to buckle up at night.

CLICK IT OR TICKET DAY & NIGHT

References

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