The Effects of Changing to Primary Enforcement on Daytime and Nighttime Seat Belt Use

Scott Masten[1]

Background

As of January 1, 2007, 25 States and the District of Columbia had enacted primary enforcement of their seat belt laws. Primary enforcement provisions permit law enforcement officers to stop a vehicle solely on the basis of observing a seat belt violation. Primary seat belt laws have been found to increase observed daytime seat belt use, but there is little research to support that such laws have any impact on nighttime seat belt use.

Eighteen U.S. jurisdictions have upgraded to primary laws after having had laws with secondary enforcement provisions, which require law enforcement officers to have another reason for stopping a vehicle before citing an occupant for a seat belt violation. This study was conducted to determine how changing from secondary to primary enforcement in six of these States impacted daytime (5 a.m. to 8:59 p.m.) and nighttime (9 p.m. to 4:59 a.m.) occupant belt use.

Method

Multivariate Auto-Regressive Integrated Moving Average (ARIMA) interrupted time series analyses of monthly seat belt use were conducted to estimate the impact of a change from secondary to primary enforcement on occupant belt use during the daytime and nighttime hours (separately). The study used an 11-year (1994-2004) sample drawn from NHTSA's Fatality Analysis Reporting System (FARS) composed of car, sport utility vehicle, van/minivan, and pickup truck drivers and right front seat occupants age 13 or older involved in fatal crashes in six States (Alabama, Indiana, Maryland, Michigan, New Jersey, and Oklahoma) that changed to primary enforcement. These six States were chosen because they upgraded to primary enforcement during the study time period and had at least three years of crash data both before and after enactment of the primary enforcement provisions available for analysis. The District of Columbia was not evaluated because the numbers of fatal crashes were too few to provide stable estimates of seat belt use.

The daytime and nighttime seat belt use of occupants from 29 States (Alaska, Arizona, Arkansas, Colorado, Florida, Idaho, Kansas, Kentucky, Maine, Massachusetts, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, South Dakota, Utah, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming) served as the comparison sample to model and remove expected increases in seat belt use in the six intervention States that would be due to population background trends in daytime and nighttime seat belt use even without primary enforcement. These 29 States were chosen as the comparison group because they did not enact or have existing primary enforcement of their seat belt laws during the study period. Incidentally, four of these States (Alaska, Kentucky, Mississippi, and South Carolina) changed to primary enforcement *after* the study period.

Results

Table 1 presents the crude pre- and post-primary enforcement seat belt use for each intervention State and the combined comparison States.

In terms of the crude pre-post seat belt use percentages presented in Table 1, seat belt use appeared to increase during the daytime in all six intervention States following implementation of primary enforcement. Furthermore, with the exception of Maryland, nighttime seat belt use also appeared to increase after primary enforcement. However, given that seat belt use also increased in the comparison States, these crude numbers likely overestimate the actual impact of changing to primary enforcement.

Table 2 summarizes the results of the multivariate ARIMA analyses for estimating the impact of changing to primary

Table 1

Crude Average Percentages of Occupants Using Seat Belts Before and After Implementing Primary Enforcement of Seat Belt Laws, Crude Percentage-Point Changes, and Percentage Differences among Passenger Vehicle Drivers and Right Front Seat Passenger Vehicle Occupants Age 13 or Older Involved in Fatal Collisions in Six States Changing to Primary Enforcement and 29 Non-Primary Comparison States, 1994-2004

State	% Pre	% Post	PP	%
Daytime				
Alabama	49.2	63.1	+13.9	+28.3
Indiana	51.5	63.6	+12.1	+23.4
Maryland	72.1	76.1	+4.1	+5.7
Michigan	69.3	81.5	+12.3	+17.7
New Jersey	63.0	73.5	+10.6	+16.8
Oklahoma	40.7	57.1	+16.4	+40.4
Non-primary comparison group[a]	54.1	62.9	+8.8	+16.3
Nighttime				
Alabama	31.0	42.2	+11.1	+35.9
Indiana	33.7	44.2	+10.5	+31.2
Maryland	60.5	59.5	-1.1	-1.7
Michigan	48.3	63.4	+15.0	+31.1
New Jersey	46.5	60.5	+14.0	+30.2
Oklahoma	26.3	42.3	+15.9	+60.5
Non-primary comparison group[a]	35.2	43.1	+7.9	+22.5

Note. Intervention dates: AL (Dec 99), IN (Jul 98), MD (Oct 97), MI (Apr 00), NJ (May 00), OK (Nov 97). The table figures are not adjusted for preexisting trends or seasonality in seat belt use. % pre = average monthly seat belt use prior to the implementation of primary enforcement in each State. % post = average monthly seat belt use subsequent to implementation. PP = crude percentage point change in seat belt use subsequent to implementation of each State's primary enforcement law. % = crude percentage change in seat belt use relative to the time period prior to law implementation. Daytime = 5 a.m. to 8:59 p.m. Nighttime = 9 p.m. to 4:59 a.m. [a]Because there is no 'intervention' date from which to compute pre-post rates for the comparison States, these figures represent average comparisons of the first (1994) and last (2004) study years.

Table 2

Summary of Sudden-Permanent Multivariate ARIMA-Adjusted Results for Monthly Proportions of Occupants Using Seat Belts Before and After Enacting Primary Enforcement of Seat Belt Laws, Adjusted Percentage-Point Changes, and Percentage Differences among Passenger Vehicle Drivers and Right Front Seat Passenger Vehicle Occupants Age 13 or Older Involved in Fatal Collisions in Six States, 1994-2004

State	PP	95% CI	%
Daytime			
Alabama	+10.2	+6.8, +13.5	+20.6
Indiana	+7.9	+5.3, +10.4	+15.3
Maryland	+1.9	-2.6, +6.3	+2.6
Michigan	+9.2	+6.8, +11.6	+13.3
New Jersey	+6.7	+4.1, +9.3	+10.6
Oklahoma	+12.2	+9.0, +15.3	+29.9
Nighttime			
Alabama	+9.4	+5.1, +13.6	+30.2
Indiana	+6.8	+1.9, +11.7	+20.3
Maryland	-2.0	-7.0, +3.0	-3.3
Michigan	+13.8	+9.9, +17.8	+28.6
New Jersey	+11.8	+7.2, +16.3	+25.4
Oklahoma	+13.4	+8.5, +18.2	+50.7

Note. Intervention dates: AL (Dec 99), IN (Jul 98), MD (Oct 97), MI (Apr 00), NJ (May 00), OK (Nov 97). PP = adjusted percentage point change in average monthly seat belt use subsequent to enactment of each State's primary enforcement law. 95%CI = 95% confidence interval for the adjusted percentage point change. % = adjusted percentage change in average monthly seat belt use relative to the time period prior to enactment. Daytime = 5 a.m. to 8:59 p.m. Nighttime = 9 p.m. to 4:59 a.m. All estimates shown are based on sudden-permanent intervention models using multivariate auto-regressive integrated moving average (ARIMA) interrupted time series analysis with the corresponding daytime or nighttime rate of non-primary States to control for historical trends in seat belt use. Series were evaluated as proportions belted and converted to a percentage point metric for the table. ARIMA intervention parameters: Alabama $\omega = 0.1015$, $t = 5.89$, $p = .000$ (day), $\omega = 0.0936$, $t = 4.31$, $p = .000$ (night); Indiana $\omega = 0.0786$, $t = 6.14$, $p = .000$ (day), $\omega = 0.0683$, $t = 2.73$, $p = .007$ (night); Maryland $\omega = 0.0185$, $t = 0.81$, $p = .419$ (day), $\omega = -0.0199$, $t = -0.78$, $p = .437$ (night); Michigan $\omega = 0.0919$, $t = 7.43$, $p = .000$ (day), $\omega = 0.1384$, $t = 6.93$, $p = .000$ (night); New Jersey $\omega = 0.0670$, $t = 5.05$, $p = .000$ (day), $\omega = 0.1179$, $t = 5.05$, $p = .000$ (night); Oklahoma $\omega = 0.1217$, $t = 7.50$, $p = .000$ (day), $\omega = 0.1335$, $t = 5.42$, $p = .000$ (night).

enforcement on daytime and nighttime seat belt use in each intervention State.

The multivariate ARIMA-adjusted percentage-point estimates shown in the table indicated that daytime seat belt use increased in five of the six intervention States after the primary enforcement laws were enacted, even after adjusting for local and national trends towards increased use. The exception was Maryland, for which essentially no impact was apparent (i.e., the percentage-point change was not statistically significant). The ARIMA analyses also indicated that nighttime seat belt use increased after enacting primary enforcement in all the intervention States except Maryland.

Conclusions

Changing from secondary to primary enforcement of seat belt laws was associated with increased seat belt use during both the daytime and nighttime hours in five of the six States evaluated in this study, even after accounting for preexisting local and national trends towards increased seat belt use. Though an increase in daytime seat belt use was expected based on the results of prior evaluations, this study also demonstrates that changing to primary enforcement increases nighttime belt use as well.

With regard to the findings of no effect for Maryland, it is interesting to note that both the daytime and nighttime pre-intervention seat belt use percentages in this State were high relative to the other States analyzed. This may suggest that the benefits of changing to primary enforcement have a ceiling effect when existing seat belt use is already quite high in a State.

The percentage-point increases in daytime seat belt use were smaller than those observed in prior evaluations of changing to primary enforcement, but for the most part this would be expected given that this evaluation explicitly controlled for preexisting local and nationwide increases in seat belt use.

Given that the analytical methods used in this study greatly reduced the chances that the estimated increases were the result of preexisting trends, these results provide strong support that change from secondary to primary enforcement increases occupant seat belt use during both the daytime and nighttime hours.