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Strategies to Increase Seat Belt Use: An Analysis of Levels of Fines And the Type of Law

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16. Abstract

The main objectives of this study were to determine the relationships between seat belt use in the States and (1) the type of seat belt law enforcement (primary versus secondary), and (2) seat belt fine levels.

The study examined law type and levels of fines as predictors of seat belt use for two time periods (1997 to 2002 and 2003 to 2008) using panel regression analyses. Two outcome measures were examined: seat belt use among front-seat occupants over age 8 killed in passenger vehicle crashes from the Fatality Analysis Reporting System (FARS) and the observed statewide seat belt use of front-seat occupants in passenger vehicles.

The results indicated that primary law upgrades were associated with 9- to 10-percentage-point increases in FARS use and 10- to 12-percentage-point increases in observed seat belt use. By comparison, increasing a State's fine amount from $25 (the current median value) to $60 was associated with a nearly 4-percentage-point increase in both FARS and observed seat belt use. Alternatively, increasing the fine amount from $25 to $100 was associated with a nearly 7-point increase in use.

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Executive Summary

Background

Increasing seat belt use in the United States has proved to be a difficult task. It has been approximately 30 years since the National Highway Traffic Safety Administration conducted the first State seat belt and child restraint workshops in 1978 and 1979, and only recently has observed daytime use exceeded 80%. Since 1984 laws and enforcement have received the greatest emphasis as a means for increasing use, and strong and consistent evidence has shown that such actions have been effective. Less emphasis has been placed on increasing fine amounts, in spite of circumstantial and limited research evidence that such actions could be effective. Further, public opinion surveys have shown reasonably strong public support for fines of up to $50, and it appears that such support has increased over time. There was a need to examine how the penalties for violation of occupant protection laws affect compliance based on current data.

Objectives

The main objectives of this study were to determine the relationships between seat belt use in the States and (1) the type of seat belt law enforcement (primary versus secondary), and (2) seat belt fine levels.

Another objective was to develop a database of fines and fees as practiced as an index of total penalties levied for seat belt laws and child passenger safety violations. State laws and practices were examined to determine fines, fees, and court costs currently being imposed for seat belt and child passenger safety (CPS) violations. From these data, a summary of sanctions for 2008 was developed that could be compared with similar data collected in 2000 by the American Coalition for Traffic Safety (ACTS). However, fine data (without fees) were the only penalty data available for nearly all States over multiple years. Thus, a database was developed with fine amounts for 14 years, from 1995 through 2008, and these data were used in panel regression analyses. Complete sanction data for 2000 and 2008 are provided in Appendix A of this report.

Methods

All predictors of seat belt use were coded as annual measures. The predictors of primary interest and the years for which data were available were (1) law type, primary or secondary (1982-2008); and (2) fines for seat belt violations in dollar amounts (1995-2008). Additional enforcement activity and media expenditure variables were examined as potential predictors in the regression analyses.

Two measures of annual seat belt use were selected as dependent variables: (1) the buckled percentage of front-seat occupants (older than age 8) killed in passenger vehicles, which were obtained from NHTSA's Fatality Analysis Reporting System (FARS), a census of all motor vehicle fatalities, and (2) the percentage of occupants of passenger vehicles observed to be

buckled on U.S. roads from annual statewide surveys conducted by each State in accordance with criteria established by NHTSA.

Longitudinal panel regression analyses (cross-sectional time series) were used to determine the association of each of the predictor variables with the outcome measures. Outcomes associated with predictor variables were examined in two ways: (1) comparison of raw seat belt usage rates, across States, at any given point in time; and (2) changes in the odds of being buckled during any one period (i.e., State-year), relative to a baseline period. Although raw usage rates provide comparative evidence of the effect of various predictors, odds ratios provide evidence of change in use associated with such variables.

Results

Penalties (Fines Plus Fees) for Seat Belt Violations

Fine and fee information obtained from the States for 2000 and 2008 showed that penalty amounts increased during this period. The sum of these charges averaged $35 in 2000 and $49 in 2008, an absolute increase of $14 and a relative increase of 41%. Twenty-six jurisdictions increased their penalty amounts by at least $5. In these jurisdictions, the average penalty increased from $39 to $70, an absolute increase of $31 and a relative increase of nearly 80%. During this same period, FARS seat belt use in these States increased by an average of about 9.1 percentage points (unweighted average). Twenty-four States either decreased their penalties or increased them by less than $5. In these States, the average penalty amount declined from about $30 in 2000 to $26 in 2008, a decline of about $4 or just under 14%. FARS seat belt use in these States increased, but by a smaller amount, an average of 6 percentage points. This represented about two-thirds of the gains experienced by States that increased their penalty amounts by more than $5.

Preliminary Analyses

Fines were generally higher in primary law States than in secondary law States, and they increased modestly over time.

All States plus the District of Columbia were ranked in terms of their observed seat belt use rates in 2007 and 2008. Nine of the 10 highest ranked States had primary seat belt laws; fewer than half (48%) of a middle group of 31 States (which includes the District of Columbia), and only 3 of the 10 lowest ranked States had primary laws. New Hampshire, which was among the 10 States with the lowest use, has no adult seat belt law. Table 1 shows that compared with the middle and bottom groups, the top 10 States also had higher fines and higher overall penalties (fines and fees). The middle group had the highest per capita *Click It or Ticket (CIOT)* citation rates, and the bottom 10 States had the highest per capita expenditures for paid media during *CIOT* mobilizations.

Table 1. High-, Middle-, and Low-Seat-Belt-Use States*

	Top 10 States (Average)	Middle 31 States (Average)	Bottom 10 States (Average)
Observed Belt Use (2007-08)	94.0%	84.0%	71.7%
FARS Belt Use (2006-07)	59.2%	45.2%	33.5%
Fines Only (2003-08)	$52.63	$23.58	$24.67
Fines Plus Fees (2008)	$81.62	$43.79	$26.28
Citations, per 10K Pop. (2003-08)**	23.0	21.7	13.4
Media $, per Capita (2003-08)**	$0.07	$0.08	$0.09

* States were grouped on the basis of observed statewide seat belt use rates in 2007 and 2008.

** During the national *Click It or Ticket* seat belt campaign.

Results of Longitudinal Panel Regression Analyses

Based on the availability of predictor variables, there were two time periods (1997 to 2002 and 2003 to 2008) for analysis in this study. During these periods, the association of each predictor variable with raw seat belt use rates (both FARS and observed) and with the odds of being buckled relative to a baseline period (both FARS and observed) were examined. The following is a summary of outcomes.

Enforcement was related to higher seat belt use. However, these indicators involved imperfect indices of enforcement that were limited to May mobilization periods. Although the enforcement measures were statistically significant in some analyses, these measures were deemed too unreliable to estimate potential gains in seat belt use. The enforcement variables were retained in the final regression models where they were statistically significant, in order to statistically control for enforcement.

The analysis did not find a significant association between media expenditures and seat belt use rates. This may be because media affects usage only in conjunction with enforcement. Nearly all enforcement efforts during this period also involved paid media. Further, as indicated, there was evidence of a greater emphasis on media than on enforcement in low-use States and more emphasis on enforcement than on media in high-use States. Other studies have shown that, although publicity is essential for effective enforcement programs, it does not appear to be effective when used alone.

Effect on Raw Usage Rates

Across the two periods, primary seat belt laws, compared to secondary laws, were consistently associated with higher seat belt use. Table 2 shows that primary laws, compared with secondary laws, were associated with 10- to 12-percentage-point-higher observed seat belt use and about 9-percentage-point-higher FARS use.

The amount of fine was also significantly associated with higher seat belt use. A comparison of usage rates across the more than 600 State-years of data included in the analysis suggested that increasing the fine amounts from $5 to $25 or from $25 to $60 were both associated with a 3- to 4-percentage-point gain in use (observed and FARS) under both primary and secondary law conditions. These effects of law type and fines were additive. Thus, a fine increase from $5 to $60 was associated with a 6- to 8-point gain in belt use, and an increase from the median of $25 to a high of $100 was associated with a 6- to 7-point gain in observed or FARS use. Little improvement was suggested for fines higher than $100, but there were few examples of such fines.

Table 2. Percentage-Point Increases in Raw Seat Belt Use Associated With Laws and Fine Amounts

	Percentage-point increase in seat belt use			
	1997–2002 period		2003–2008 period	
	FARS	Observed	FARS	Observed
Law upgrade				
Secondary to primary	**+9.2**	**+11.9**	**+9.0**	**+10.4**
Fine increase				
$5 to $100	**+9.4**	**+8.7**	**+10.6**	**+10.8**
$5 to $25	+3.3	+3.1	+3.8	+3.8
$25 to $60	+3.3	+3.1	+3.7	+3.8
$60 to $100	+2.7	+2.5	+3.1	+3.1

Effect on the Odds of Seat Belt Use

As indicated, odds ratios were also used to measure the influence of each of the predictors. An odds ratio is the ratio of seat belt users to nonusers at any given time (i.e., in any given State-year) divided by the ratio of users to nonusers during a baseline period. It is a measure of change in the odds of being buckled up. The rationale behind using this measure is similar to the rationale behind NHTSA's use of conversion rates (i.e., the proportion of nonusers converted to users). It is more sensitive to relative change for States that already have high use rates and thus have less room for large absolute increases. The panel regression analysis examined the odds ratios for each of the more than 600 State-years of data and determined the association of each of the predictor variables with this measure of change while controlling for the influence of the other predictors. A summary of the results is provided in Table 3.

Table 3. Percent Increases in Odds of Seat Belt Use Associated With Laws and Fine Amounts

	Percent increase in odds of seat belt use			
	Operation ABC: 1997–2002		*CIOT*: 2003–2008	
	FARS	Observed	FARS	Observed
Primary law	17.9	26.2	7.9	20.0
Fine increase				
$0-$100	35.7	25.1	22.5	59.1
$5-$100	27.7	19.5	17.5	45.9
$25-$100	17.9	12.6	11.3	29.6
$25-$60	9.8	6.9	6.2	16.2

Percentage change is relative to baseline: 1995–1996 for the *Operation ABC* period and 2000–2002 for the *CIOT* period.

The effect of primary laws on the odds of being buckled (relative to a baseline period) was greater during the *Operation ABC* period than during the *CIOT* period, and it was greater in terms of observed use than in terms of FARS use. For FARS use, primary laws were associated with about an 18% (not percentage points) increase in the odds of being buckled during the *Operation ABC* period and an 8% increase during the *CIOT* mobilization period. For observed use, primary laws were associated with a 26% increase during the *Operation ABC* period and a 20% gain during the more recent *CIOT* period.

Fines were significantly related to increases in the odds of seat belt use. During the *Operation ABC* period, a fine increase from $5 to $100 was associated with a 28% gain in the odds of FARS use, while there was a 20% gain in the odds of observed use that was not statistically significant. During the *CIOT* period, the relationship between fines and the odds of buckling up was significant for both FARS use and observed use. An increase from $5 to $100 was associated with an 18% gain in terms of FARS use and a large 46% gain in the odds of observed use.

Summary and Conclusions

The results of this study confirmed that primary seat belt laws were associated with higher use rates and with increases in the odds of being buckled. However, few studies have examined the relationship between the fine amount for a violation and compliance to occupant protection laws. Key findings from this study include the following:

1. The evidence regarding the potential for fine amounts to affect seat belt use was consistent across the two time periods under study and for both FARS and observed belt use. The results showed that an increase in fine level from $25 (the current median value in both primary and secondary law States) to $60 was associated with a 3- to 4-percentage-point increase in both FARS and observed seat belt use. Increasing a State's fine level from $25 to $100, was associated with a 6- to 7-point increase in both use rates.

2. An upgrade from secondary to primary enforcement was associated with a 10- to 12-percentage-point increases in observed use and 9-point increases in FARS use. Such an increase would be additive to that associated with the fine increase.

In summary, the results suggested that increasing fine levels is another strategy that has potential to further raise seat belt use, in addition to primary law upgrades and high-visibility enforcement. Although the regression analyses did not find a statistically significant effect associated with media, the public, however, needs to be aware of laws and fine changes before compliance is likely. Publicizing fine increases would likely be essential for maximizing the effects of such actions.

Background

History of Increases in Seat Belt Use and Associated Efforts

Seat belts were 1st installed in passenger cars in the late 1950s, and their installation in all new vehicles was required in 1968. About the same time, several public awareness efforts were implemented in the United States (as well as in Australia) to encourage seat belt use. Perhaps the most widely known of the early U.S. efforts was the *Buckle Up for Safety* campaign sponsored by the National Safety Council in 1968. This was an extensive public service campaign that was recognized and remembered by a high percentage of the public. However, this campaign appeared to have little, if any, effect on seat belt use. Observational surveys conducted by NHTSA in 19 cities across the United States found that seat belt use by drivers was only about 11% as late as 1979 (Phillips, 1983). Other public information programs were implemented by the automobile industry in Michigan, one of which was a paid media campaign, but neither produced a substantial increase in use (e.g., Oakland County Traffic Improvement Association, 1969, and Motorists Information Institute, 1978).

Efforts to enact seat belt use laws, including an incentive program for the States, were also unsuccessful in the 1970s, but a 1976 *Highway Safety Needs Report* provided a stimulus to continue efforts to find ways to increase seat belt use. It suggested increasing seat belt use was the single most effective measure that could be implemented to reduce the deaths and injuries associated with motor vehicle crashes (U.S. DOT, 1976). This report was followed by a 1977 NHTSA project to develop a compendium of known methods for increasing seat belt use (Waller, Li, Campbell, & Herman, 1977) and a series of workshops with the States, from 1979 through 1981, to stimulate such efforts. As a follow-up to these workshops in 1982, a national conference (now called *Lifesavers*) was held in Detroit, Michigan, to consolidate the ideas generated by these workshops to increase seat belt use (and reduce alcohol-related deaths). One other major activity began before enactment of seat belt laws in 1984. It was an extensive outreach program by NHTSA to engage public- and private-sector organizations at the national, State, and local levels in efforts to encourage voluntary seat belt use. This activity, which began in 1980, was associated with a 3-percentage-point increase in observed use (from 11% in 1979 to 14% in 1983), as measured by NHTSA's 19-city survey.

In spite of these efforts and even with the legislative and enforcement efforts that were to follow, increasing seat belt use in the United States has proven to be a slow task. It has taken 30 years since the initial 1979 workshop series to reach the 2009 national use rate of about 84%. Nearly all of that increase has occurred since 1984 and has been associated with legislatively required seat belt use and vigorous enforcement of the laws. A recent review by Nichols and Ledingham (2008) reported that the greatest effects have been associated with a combination of mandatory seat belt use laws enacted in 49 States since 1984; currently 22 primary law upgrades enacted since 1993, which allow law enforcement officers to issue a citation solely on the observation of a seat belt citation; and a series of national, State, and local high-visibility enforcement efforts, initiated primarily since 1990, but greatly enhanced after 1996. Nichols and Ledingham also

pointed out that there is circumstantial evidence that fine levels have been positively associated with higher use rates but that there have been few studies of this relationship.

Initial Seat Belt Use Laws

The first seat belt law was enacted in 1984 in New York, followed by 8 additional States in 1985, 14 States (and 1 repeal) in 1986, 7 (and another repeal) in 1987, 2 in 1988, 4 (and 2 more repeals) in 1989, and 2 (and 1 reinstatement) in 1990. By the end of 1990, laws in 37 States were in effect: 9 allowed for primary (standard) enforcement, and the remainder required secondary enforcement. Primary laws allow a police officer to stop and ticket a seat belt nonuser for that violation alone. Secondary laws, on the other hand, require that some additional violation be observed before stopping the vehicle. From 1983 through 1990, NHTSA's 19-city observational survey measured more than a tripling of use, from 14% to almost 50%. Most of these increases occurred from 1984 through 1986 when the majority of laws were enacted and implemented. After 1986, there continued to be increases, but they were smaller and diminishing, with an average of just three to four States enacting laws each year, along with three repeals. This slowdown in progress, with some slight reductions in law States where no enforcement was evident, became cause for concern in the late 1980s.

High-Visibility Enforcement

Since 1990, when NHTSA launched a nationwide campaign called the national "*70% by '92" Safety Belt Program* to increase use by means of high-visibility enforcement (HVE) programs in the States, the combination of laws (mostly primary law upgrades) and HVE appears to have been associated with nearly all of the documented increase in observed seat belt use. Important events that have shaped this period, from 1990 to the present, include:

- The *70% by '92* program;
- A 1993-1994 *CIOT* program launched in North Carolina;
- The first primary law upgrade enacted in California in 1993 and the 21 upgrades that have followed (through 2009);
- A series of about 20 occupant protection Selective Traffic Enforcement Program (STEP) demonstrations implemented nationwide from 1993 through 1998;
- A series of national HVE mobilizations called *"Operation ABC"* launched in 1997 by the Air Bag & Seat Belt Safety Campaign in cooperation with NHTSA's Buckle Up America program;
- A second statewide *CIOT,* implemented in South Carolina in 2000;
- A regionwide, 8-State *CIOT* implemented in the Southeast Region in 2001;
- A 14-State HVE/*CIOT* program implemented in 2002;
- National *CIOT* mobilizations, replacing *Operation ABC* in 2003; and
- Targeted HVE demonstration programs implemented in nearly 30 States since 2004 (i.e., rural, pickup truck, teen, and multiple-wave demonstrations); usually these targeted efforts have been coupled with *CIOT* mobilizations.

Several important characteristics associated with these programs should be mentioned. The 1993 North Carolina *CIOT* was the first statewide program to receive substantial funding to implement a statewide, highly coordinated HVE program (about $1.5 million). It also marked the first time

paid media was used statewide to increase seat belt use. Finally, it marked the beginning of an emphasis on "hard" enforcement messages, in that the message of the *CIOT* slogan was that seat belt laws were being vigorously enforced. Previously, most campaigns had relied on public service announcements and news media (also known as earned media) and softer messages (e.g., *What's Holding You Back?*).

After the North Carolina benchmark, NHTSA attempted to stimulate similarly intensive efforts in other States with a series of more than 20 occupant protection STEP demonstration grants. Even with additional funding provided by General Motors Corporation, none of these programs received resources equivalent to those expended in North Carolina. Likely related to the lower resources, none of the STEP States documented program intensity comparable to that of the North Carolina program, where about $600,000 was spent on paid media, 6,000 checkpoints were implemented, and nearly 60,000 citations were issued for seat belt nonuse over two waves of activity.

This situation changed after 1998 when a new transportation authorization bill was enacted by Congress. This was the *Transportation Equity Act for the 21st Century*, referred to as "TEA-21." Among other provisions, Section 157 of this act provided for innovative grants to the States to increase seat belt use. NHTSA gradually began to encourage innovative enforcement as it channeled these funds to the States, increasingly focusing on State participation in *Operation ABC* mobilizations.

In 2000, the Air Bag & Seat Belt Safety Campaign (AB&SBSC) and NHTSA sought to replicate the benchmark North Carolina *CIOT* program in neighboring South Carolina, re-emphasizing the use of checkpoints (3,000 in a single 2-week wave), the *CIOT* enforcement message, and the use of paid media (with approximately $500,000 provided by AB&SBSC). Although this program did not have quite the same effect on observed seat belt use as the North Carolina program had (achieving a 7-point increase in South Carolina versus a 16-point increase in North Carolina), it again demonstrated the potential for HVE programs with checkpoints and paid media to immediately increase observed seat belt use. Large and significant increases in public awareness of the *CIOT* slogan and enforcement efforts, particularly checkpoints, provided evidence that the use of paid media had contributed to the success of the South Carolina program. This provided a stimulus for using Section 157 funds to support paid media as well as enforcement in additional States. Thus, 8 States in NHTSA's Region 4 received Section 157 funds in 2001 for paid media to support their *CIOT* efforts; 14 additional States received such funds in 2002 for paid media; and in 2003, more than 40 States received such funding. In addition, NHTSA purchased national media in 2003 and subsequent years to support the *CIOT* mobilizations. Thus, additional funding provided by Section 157, the use of paid media, and the shift to hard enforcement messaging expanded to nearly all States in 2003.

From an evaluation standpoint, it is important to note that uniform documentation of media and enforcement activities began in most States with the 2003 national *CIOT* program. Previously, such data were documented only for special emphasis programs (such as the North Carolina, South Carolina, Region 4, and model *CIOT* programs), although enforcement agency participation during *Operation ABC* mobilizations was documented by AB&SBSC from 1998 through 2004. However, the only nationwide, uniformly reported data associated with efforts to increase use (from 1990 through 2002) were (1) use rates (observed and in FARS); (2) legislative information, including enforcement status (e.g., primary versus secondary) and statutory fine

levels; and (3) funding levels (Sections 157, 402, 403, 405, etc.). There was no uniform data reporting for enforcement and media activity (other than for demonstrations outlined hereinbefore) before 2003.

Primary Law Upgrades

One of the factors associated with increases in seat belt use since 1990 has been the upgrading of seat belt use laws to allow for primary enforcement. This phase began in 1993, when the first change from secondary to primary (i.e., standard) enforcement was implemented in California. This upgrade was followed by 21 additional State upgrades through June 2009, resulting in a total of 30 States, the District of Columbia, and Puerto Rico having primary laws and 19 States with secondary laws. Like the initial seat belt use laws, upgrades affected individual States more directly than the Nation as a whole. Thus, it has been more difficult to measure the effectiveness of such upgrades as they occurred at the rate of only one or two per year nationwide. However, Nichols and Ledingham pointed out that, among 15 States that participated in HVE programs from 2000 through 2002 (i.e., in the South Carolina, Region 4, and model *CIOT* programs), the greatest increases in use were found in 5 States that also upgraded their laws during this period. More will be said regarding the effect of law upgrades in the next section.

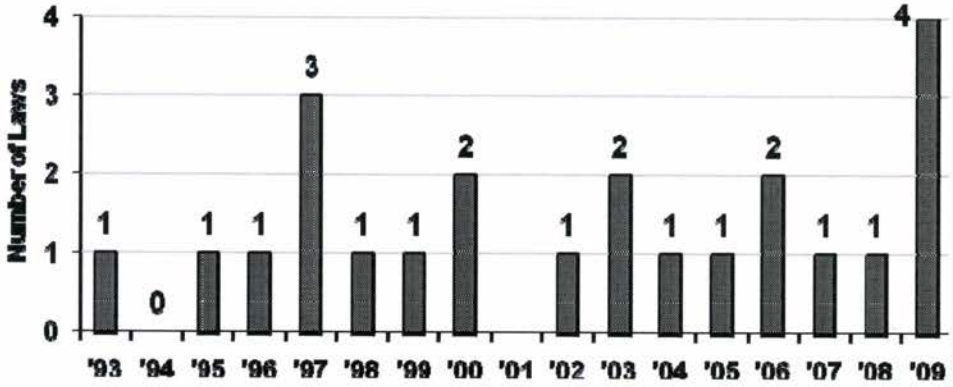


Figure 1. Number of primary law upgrades implemented from 1993-2009 among 50 States and the District of Columbia

Fines and Points

Sanctions for safety belt violations in the United States have historically been minimal compared to penalties for other traffic violations. For example, fines for stop-sign violations are greater than for nonuse of seat belts (ACTS, 2001). Yet, some of these other violations are likely not as important, in terms of their injury-reduction potential, than nonuse of a seat belt.

Relative to the historical emphasis placed on seat belt use laws, law upgrades, and HVE, there has been relatively less focus on increasing fines as a means to increase seat belt use. Fines vary from State to State, with a median level of about $25. There have been some increases in fines over the past 15 years, with the *average* fine increasing from about $20 in 1995 to just over $30 in 2009. However, the *median* fine level has remained at $25. There has been considerable public opinion expressed in national polls and circumstantial evidence that increasing fines could have a positive effect on use rates.

Data from an early study of safety belt laws showed that if a fine had been in effect when a primary law was implemented, there would have been an average increase in use of about 38 percentage points. When no fine was in effect, such as during a warning-only period, the average increase in use associated with the primary law was only 23 percentage points, about the same as that associated with a secondary law, with or without any sanctions in effect (Campbell, Stewart, & Campbell, 1987).

In addition, Winnicki (1995) found that the largest increases in use among people in potentially fatal crashes (FARS use) were in primary law States where fines were in effect within 4 months after implementation of the law. There was a median increase of 21 percentage points in those States. Winnicki also showed a significant increase in use when a seat belt use law went into effect *and* when the fine went into effect in several States (Florida, Missouri, North Carolina, Tennessee, and Washington). Based on his regression analyses, Winnicki reported that each $10 increase in fine level was associated with about a 7.4% increase in usage among occupants involved in potentially fatal crashes. He suggested that States with a fine level of $25 had, on average, 11.1% higher usage in potentially fatal crashes than States with a $10 fine, all other factors controlled for.

A third example was provided by the State of Washington. When it enacted a primary law upgrade in 2002, it was coupled with highly publicized enforcement efforts and increased sanctions for all traffic law violations. Observed belt use in passenger vehicles on the roads increased significantly. The new fine for a seat belt violation was $101, compared to the previous fine of $86. This increase in fines was publicized extensively, including the use of road signs. Salzberg and Moffat (2004) concluded that the publicized increase in fines probably played a role in the observed increase in belt use in Washington.

The most recent study of the impact of fine levels on seat belt use comes from Houston and Richardson (2005). These researchers examined annual statewide observed seat belt use from 1991 through 2001, using time-series, cross-section analyses similar to the approach used in the current study. They found primary laws to be associated with a 9.1-percentage-point increase in observed use, compared with secondary laws, and they found that fine level was associated with higher use. They estimated that the $25 median fine level was associated with a 3.8-percentage-point increase in seat belt use compared to no fine, apart from any effect associated with enforcement type.

One reason for the current low fine levels has to do with attitudes regarding sanctions for seat belt nonuse that date back to the 1980s when seat belt laws were first being enacted in the United States. There was hesitancy at the time to attach anything other than minimal fines to the new laws. More recently, however, about two-thirds of nonusers and part-time users surveyed by the ACTS said that they would probably or definitely be more likely to buckle up if fines were increased (ACTS, 2001). Seventy-six percent of these respondents indicated that they would buckle up if nonuse resulted in penalty points assessed against their driver's licenses. When asked what would be the most effective way to get them to buckle up, 30% responded that penalty points would be most effective compared to about 15% who indicated that increased fines would be most effective.

A telephone survey of persistent nonusers in North Carolina found that 62% said they would <u>not</u> buckle up regardless of the magnitude of the fine. They also indicated that they did not know how high a fine would have to go before it convinced them to buckle up (Reinfurt, Williams,

Wells, & Rodgman, 1996). These nonusers, typically young males with poor driving records, were considered to be among the least likely to buckle up and were usually driving older vehicles or pickup trucks. However, 62% of these respondents said that they would buckle up if a violation resulted in points assessed against their licenses.

Penalty points have been implemented in some Canadian provinces and territories as part of a national effort to increase use. In Canada, a national seat belt use rate of 90% was achieved in 1994. Penalty points (in 9 of 12 jurisdictions) probably played a role in that increase. Boase, Jonah, and Dawson (2004) explained that the principle involved in the various demerit point systems in Canada is that the points for seat belt violations add up; consequently, repeat violations can lead to a loss of license and/or an increased cost of insurance.

In the ACTS survey of nonusers and part-time users, respondents were asked to choose which measure would be the most effective way to get them to buckle up: increased enforcement, a primary law upgrade, increased fines, penalty points on their record, or reduced insurance awards. The most frequently selected option was penalty points (30%), followed by increased fines (17%), increased enforcement (or) primary laws (14% each), and reduced awards (12%) (Figure 2).

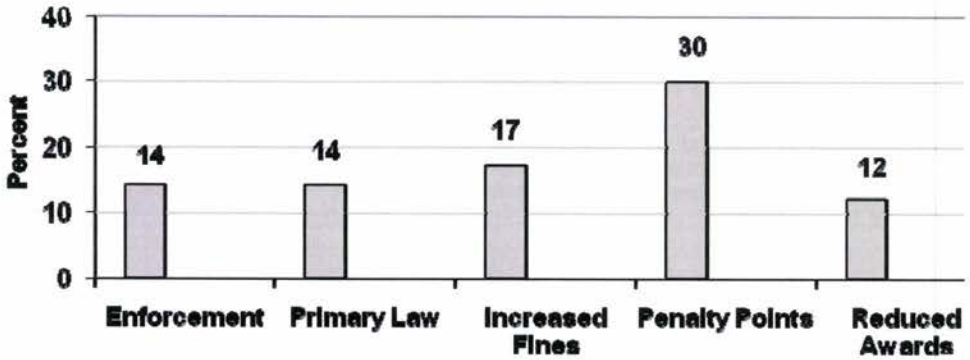


Figure 2. Responses to the question: What would be the most effective way to get you to buckle up more frequently? (ACTS, 2001)

The issue of penalties, however, needs to be considered in the context of their potential effect on enforcement. Fines that are too low are likely to be ineffective, but fines that are too high may influence some police to not issue citations. Nichols and Ledingham (2008) suggested that, among the U.S. public, there is currently reasonable support for increased fines of up to about $50, but less support for penalty points. The 2007 Motor Vehicle Occupant Safety Survey (MVOSS) found that 68% of the public favored fines for seat belt violations, but only 32% favored penalty points (Boyle & Lampkin, 2008). Respondents were also asked if someone they knew who did not buckle up all of the time would wear their seat belts if they were assessed various fine amounts. As the proposed fine level increased, up to $50, so did the expectation that it would change the behavior of the person in question. With a fine of $50, 64% of the respondents indicated that a nonuser known to them would likely buckle up, whereas only 44% said that such person would buckle up with a proposed fine of $25 to $30, and only 29% said such person would buckle up with a proposed fine of $10 (Figure 3). At a fine level of $75, there was a decline in the expectation that others would buckle up.

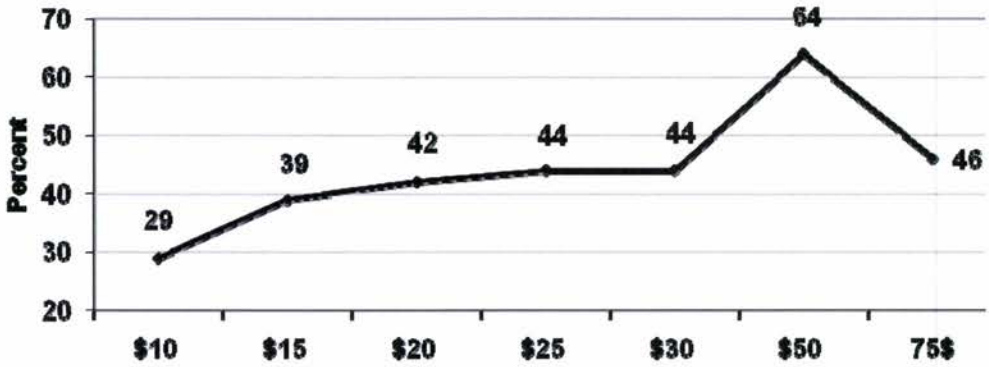


Figure 3. Percentage of respondents stating that it is likely that a nonuser that they know would buckle up if assessed the State fine, by fine level (from Boyle & Lampkin, 2008)

In summary, compared to the evidence regarding the effect of laws, upgrades, and enforcement, there is considerable circumstantial evidence but less research evidence regarding the potential effect of fines and demerit points on seat belt use. However, the evidence that does exist suggests that increased fines and the assessment of demerit points likely would result in increased seat belt use. Further, recent surveys suggest that a fine increase (up to about $50) would be supported by a majority of the public and that such acceptance is increasing over time.

Recent Research Evidence of Past Effects

Before describing the methods and results of the current effort to evaluate the effect of primary laws and fines on seat belt use, a review of two recent reports provides an important background to the analytic approach and its results. They include a 2008 NHTSA report by Hedlund, Gilbert, Ledingham, and Preusser; and a 2010 NHTSA report by Tison and Williams.

The Hedlund report investigated why some States have higher seat belt use than others, in an attempt to determine what strategies low-use States might employ to increase seat belt use. Their approach was to compare a group of States with high belt use to a group with low belt use on a large number of geographic, demographic, and cultural factors. Hedlund and colleagues selected 16 States with high seat belt use rates and 15 States with low-use rates, and then compared these groups on a number of variables. Their findings with greatest relevance to this study were that during the 2005 May CIOT mobilization, high-use States issued about twice as many seat belt tickets per capita as low-use States; low-use States spent about 40% more per capita on paid media than high-use States during this mobilization; and more respondents from high-use States than from low-use States thought that seat belt enforcement was important and that the risk of getting a ticket for nonuse was high.

These researchers plotted monthly FARS data for 2005 and 2006. These data showed modest increases in use immediately following May *CIOT* mobilizations (i.e., in June and July), followed by gradual declines in between mobilizations (in 2005 and 2006), although there was a second increase in use in the fall of 2006. A time-series analyses of FARS data among 6 States that upgraded to primary enforcement (2000-2004) found that all 6 of these States experienced immediate and statistically significant increases in use among front-seat occupants in fatal crashes and that 2 States, Michigan and Washington, experienced significant reductions in fatalities among such occupants.

Hedlund and colleagues concluded that the most important difference between high-use and low-use States was enforcement, not demographics or dollars spent on media. They also pointed out that, although it is possible to achieve a high-use rate in a secondary law State, it is much more difficult to do so, likely because of the greater difficulty in enforcing a secondary law.

Tison and Williams (2010) conducted a comprehensive evaluation that had some overlap in objectives and approach with the current study. These researchers examined the influence of enforcement and media expenditures on changes in public awareness, knowledge, attitudes, and seat belt use. They also examined the relative effectiveness of primary versus secondary laws and of primary law upgrades. Tison and Williams examined the effect of the national *CIOT* program (2003-2006) and 3 years of the national *Operation ABC* mobilizations implemented just prior to the *CIOT* program (2000-2002).

These researchers compared the media and enforcement rates in 5 States with the greatest increases in use over time with the media and enforcement rates in 5 States with the least change over time. There was no difference between the high-change and low-change groups in terms of media expenditures but there was a much higher enforcement rate in the high-change States. A comparison of changes in attitudes and perceptions in States with large increases in use with changes in States with little change in use showed significant changes in key perceptions over time, but there were few differences between high-use and low-use States.

Tison and William reported that 18 States had primary laws throughout the period of study; 22 had secondary laws; and 7 converted or upgraded from secondary to primary. All three groups showed increases in awareness indices from 2003 through 2007, with upgrade States generally showing the greatest gains. Similarly, an analysis of changes in use rates (observed and FARS) found the greatest gains among upgrade States, followed by secondary law States and primary law States (the latter of which had higher baseline rates).

Media alone and enforcement alone were not correlated with increases in use in primary law States, but the combination of media and enforcement was positively related to increased use in these States. In States that upgraded their laws during the study period, there was no clear pattern of correlation between media and enforcement (alone or in combination) and increases in seat belt use. In secondary law States, while there was no significant relationship between media (alone) and change in use, both enforcement (alone) and the combination of media and enforcement were significantly and positively related to increases in use.

These recent studies have confirmed that the type of law (primary versus secondary enforcement), intensity of law enforcement, and media publicizing this enforcement are all important factors related to higher seat belt use. The most recent studies, however, have not looked at the role of fines in increasing seat belt use. Using earlier data from 1991-2001 statewide surveys, Houston and Richardson (2005) showed that the amount of the fine was a significant predictor of seat belt use in addition to the type of law and enforcement. There have been changes to some States' levels of fines and laws since 2001, stimulating the need to use more current data to examine the relationships of fines and other potential predictors with seat belt use.

Objectives

The main objectives of this study were to determine the relationships between seat belt use in the States and (1) seat belt fine levels and (2) the type of seat belt law (primary enforcement versus secondary enforcement).

A third objective was to develop a database of fines and fees as practiced as an index of total penalties levied for seat belt laws and child passenger safety violations. State laws and practices were examined to determine fines, fees, and court costs currently being imposed for seat belt and child passenger safety (CPS) violations. From these data, a summary of sanctions for 2008 was developed that could be compared with similar data collected in 2000 by the American Coalition for Traffic Safety (ACTS). However, data on fines (without fees) were the only penalty data available for nearly all States over multiple years. Thus, a database was developed with amounts of fines for 14 years, from 1995 through 2008, and these data were used in panel regression analyses. Complete sanction data for 2000 and 2008 are provided in Appendix A of this report.

Analytic Methods

Period of Study

Based upon the availability of various measures of activity, the time periods chosen for examination were 1997 through 2002 (Phase 4, the *Operation ABC*); 2003 through 2008 (Phase 5, the *Click It or Ticket* period); and 1997 through 2008 (Phases 4 and 5 combined).

Statistical Methods for Repeated Measures Within States

The structure of the data set involved measures of restraint use that were repeated over time within each State, for a panel of States. This longitudinal panel design requires a time-series approach that properly accounts for variance due to a period unit (year), a panel unit (State), and correlated observations or error terms within State over time. We used a cross-sectional, time-series regression model traditional to econometric analyses, testing and incorporating first-order autoregressive (AR) and moving average (MA) parameters where they were significant. These temporal components were always presumed to be necessary and are removed only if markedly nonsignificant. As expected, in nearly every model tested the AR=1 parameters were highly significant and were retained in final models. Differencing and MA parameters were found to be markedly nonsignificant, and they produced worse model fits when forcibly included. As a result these parameters were excluded from the final models. Interaction terms were created for each combination of predictor variables and assessed for inclusion in the models. It should be noted, however, that most interaction terms were nonsignificant. Except for the instance when citation rate was a significant predictor in secondary law States but not in primary law States, none of the interactions were statistically significant or within acceptable tolerance bounds for noncollinearity. Nonsignificant interactions were thus eliminated from all models except the one already mentioned to avoid producing spurious outcomes due to overfitting. In summary, variables whose coefficients were nonsignificant were eliminated from the model. At each iterative stage, the analysis was then re-run to estimate the coefficients for remaining variables, again eliminating any subsequent variables with nonsignificant coefficients. This approach resolved relatively quickly to a more simple form described in this report.

Predictor Variables

All predictors of seat belt use were coded as annual measures. This section describes the variables tested as potential predictors and the years for which this data was available.

Law Type

Seat belt law type (primary versus secondary versus none) was available for 1982 to 2008. Given the history of law type as a consistent and substantial predictor of seat belt use in past studies, it was important to control this parameter in any examination of the effect of other predictors, such as fines.

Fines

Data on fines for seat belt violations was available in dollar amounts for 1995 to 2008 and was used in the descriptive analysis and panel regression analysis. Data on fines plus fees was available for 2000 and 2008; fine-plus-fee data was used in the descriptive analysis only.

A new database of fines plus fees was developed as an index of penalties. To accomplish this, knowledgeable people in the States were contacted to obtain information regarding the current fines, fees, and court costs imposed for seat belt and child passenger safety violations.[1] From the data obtained from these contacts, a database of fine and fee sanctions during 2007 and 2008 was developed that could be compared with similar data collected in 2000 (ACTS, 2001). Several considerations emerged regarding these data. First, there were indications of variations from jurisdiction to jurisdiction within some States regarding the fines and costs levied for seat belt violations. Second, the same people contacted in 2000 were not generally available for contact in 2008 and it appeared that there had been either different perceptions regarding fees collected or undocumented changes in such procedures from 2000 to 2008. In many States, contacts were not sure of complete fines and fees levied across the State during the current year, much less over the past 5 to 10 years. A summary of these "as practiced" fine and fee charges for seat belt and child passenger safety violations is provided in Appendix A.

For the longitudinal panel regression analysis, data was needed for all 12 years within the targeted study periods, plus the 1995-1996 baseline for the *Operation ABC* period. The fine amount as stipulated by statute provided the most uniformly documented measure for occupant protection violations. Several sources provided information on fine amounts. The first was NHTSA's legislative summaries (usually identified as "Key Provisions of Safety Belt Use Laws"). The second source was the seat belt legislative information provided by the Insurance Institute for Highway Safety (IIHS). IIHS personnel were helpful in our efforts to identify when various States changed their fine levels between 2000 and 2009.[2] Two additional sources for fine data included the GHSA and the National Conference of State Legislatures (NCSL). NHTSA reports were obtained for 1995, 1996, 1997, 1998, 2000, 2003, 2005, 2006, and 2007; and IIHS summaries were found for 2000, 2005, and 2009. There were some information gaps and

[1] The person engaged to conduct this review of 2008-2009 statutes in a manner similar to the 2000 review was Philip Haseltine, formerly the executive director of ACTS, the sponsor of the initial review.

[2] Michele Fields, an attorney with IIHS, and who has tracked and documented occupant protection laws for many years, aided us in this aspect of our research.

inconsistencies in the data provided in NHTSA legislative summaries and between the various data sources (i.e., NHTSA, IIHS, GHSA, and NCSL). Some of these inconsistencies resulted from reporting of the fee data as part of the fine amount. It also appeared that the minimum fine was being reported in some States, while maximum fine was being reported in others. In several instances, State highway safety personnel were contacted to determine the most valid fine entries for that State, generally looking for the maximum fine amount, for consistency. The fine amounts used for the analyses generally represent the maximum adult seat belt fine (without fees) for a first offense.

There were some (State-year) cells with missing data. Fine levels had to be estimated for those cells. In most cases, these were relatively straightforward estimates because the cells with missing data were preceded and followed by cells with identical fine amounts. In those cases, the intervening cells were filled with that value. In several States, however, there were missing data cells that were bounded by unequal fine amounts (usually from 2001 through 2005), signifying that, during that time interval, the fine had changed. When clarification was not available from the State, the values were interpolated for each cell across the period in question, increasing the fine level in equal intervals between two known values. In total, the values for 15 of 700 State-year cells (2.1%) were interpolated. In addition, for the *Operation ABC* period baseline (average of 1995 and 1996 fine levels), there were 14 missing values for 1995. In those cases, the 1996 fine was used as the baseline value. The final values for the fine data are shown in Appendix B by State for 14 years.

It should be noted that preliminary results indicated that the effects of fines on the outcome measures tended toward a curvilinear function, indicating diminishing marginal returns with higher fines. Because this measure was quite skewed, a square root transformed version of this variable was tested, which not only was more normally distributed but also produced a superior statistical fit against the outcome measures when compared with the original metric. This means that each dollar unit increase in fines does not yield the same benefit but is level dependent. Although this curvilinear relationship complicates the discussion of the effects for this variable, the findings are presented using intervals that represent changes between modal levels for fines.

Enforcement

Two variables were examined as potential predictors of seat belt use: *CIOT* citation rates for seat belt violations, defined as the number of citations issued per 10,000 residents over a 2-week *CIOT* enforcement period (2003-2008); and agency participation, defined as the percentage of agencies who reported participation in the two-week mobilizations (1998-2008).

CIOT citation rates for mobilizations from 2003 through 2008 were obtained from a previous study (Tison and Williams), a NHTSA database of mobilization data reported by the States, and summary reports created from this database. In addition, because these data were available only for the *CIOT* period, a second variable, proportion of statewide enforcement agencies participating in May mobilizations, was tested as a predictor variable. Agency participation data was reported to AB&SBSC as part of *Operation ABC,* from 1998 through 2002, and similar data was reported to NHTSA as part of *CIOT* mobilizations, from 2003 through 2008.

Because of limitations in the enforcement data, these variables were retained in the final models when they were statistically significant but are not shown in the results section. Agency participation data were inconsistent and unreliable across the years. Citation data are a more

objective measure of enforcement than agency participation, but year-round citation data were not available for all States. All enforcement data used in these analyses (i.e., agency participation and citation rates) were limited to a two-week period of the year.

Media

Paid media expenditures for *CIOT* mobilizations, defined as dollars spent per capita over a 2-week *CIOT* publicity period (2003-2008), constituted the only quantitative variable available to estimate media activity aimed at increasing seat belt use in the States. Media expenditure data reported to NHTSA for 2002 through 2008, normalized by population, were used for the analyses. The sources of these data were the same as for the CIOT citation data (State-reported mobilization data contained in data files from the Tison and Williams study, the NHTSA mobilization database, and summary reports from that database).

Outcome Measures (Dependent Variables)

Two measures of annual seat belt use were selected as dependent variables. The first was the buckled percentage of front-seat occupants older than age 8 killed in passenger vehicles (i.e., noncommercial, nonindustrial vehicle body types, excluding motorcycles and off-road vehicles). These data were obtained from NHTSA's Fatality Analysis Reporting System (FARS).

The second dependent measure was the percentage of occupants of passenger vehicles observed to be buckled in annual statewide observational surveys. For each State, there were 26 years of annual data aggregated from FARS (1982-2007), and 13 years of annual data from observational surveys (1996-2008). These data come from surveys conducted by each State in accordance with criteria established by NHTSA to maximize the accuracy and consistency of results. The criteria require that surveyors observe actual traffic on the roads at a predetermined number of sites across the State chosen via probabilistic means.

Two Perspectives on Outcome:

Raw Usage Versus Change in Usage

In each of the two time periods, outcome measures were examined in two ways: (1) level of seat belt use at varying times, and (2) improvement in use at varying times relative to a baseline period. The baseline for the *Operation ABC* period (and for the *Operation ABC* and *CIOT* periods combined) was 1995-1996, and the baseline for the *CIOT* period was 2000-2002. These baselines were selected because they immediately preceded two highly visible periods of national enforcement mobilizations: *Operation ABC* (1997-2002) and national *CIOT* (2003-2008). Thus, the effect of predictor variables were examined in terms of differences in "raw" usage rates and in terms of dependent variables computed as odds ratios (changes in the odds of being buckled, relative to the odds of being buckled in a baseline period for the same State). It should be pointed out that, in this context, the odds ratios can be conceptualized as 600 separate outcomes, one for each State-year cell in each of two 6-year study periods; each cell represents the odds of being buckled in that year, divided by the odds of being buckled in a designated baseline period. To avoid confusion with traditional use of odds ratios (i.e., for summarizing the

effect of a predictor variables on outcomes), these measures can be viewed as "changes in the odds of usage" for any State at any point in time.

Because some States already had higher usage rates during baseline periods (due to prior enforcement efforts, primary law upgrades, differences in State "cultures," etc.), it was desirable to know which States continued to improve over time, expressed in terms relative to the remaining "room for improvement" that was specific to each State's baseline (i.e., adjusting for previous progress already made). The concept behind this (odds ratio) dependent variable is that initial gains are easier to obtain than after substantial progress has been made. A State that begins with a 90% usage rate will have very little room to improve in terms of absolute (percentage-point) gain. A "ceiling effect" almost certainly produces diminishing marginal returns, with less net gain from equal or even greater levels of effort. An odds ratio (i.e., the odds of being buckled during a post-period divided by the odds of being buckled at baseline) is more sensitive to relative change for those high-use States. This measure of change is similar in principle to the conversion rate measure used by NHTSA and by Tison and Williams.

Results

Descriptive Analyses of High-, Medium-, and Low-Belt-Use States

Independent of the panel regression analyses, basic descriptive analyses were conducted on high-, middle-, and low-belt-use States regarding differences in law type and fine amounts. States were ranked by their observed seat belt use in 2007 and 2008, the two most recent years for which data were available. Both years of data were averaged to produce a more stable estimate of use. States and the District of Columbia were grouped into the "Top 10," the "Middle 31," and the "Bottom 10" States (see Table 4). Nine of the "Top 10" group had a primary law; almost half (15 of 31 States) of the "Middle 31" group had such a law; and only three States in the "Bottom 10" had a primary law. One State in the lowest use group (New Hampshire) had no adult seat belt law at all.

Table 4. Seat Belt Usage Rankings by Observed Use

	Observed (2007-08)		FARS (2006-07)	
	Percent	Rank	Percent	Rank
TOP 10:				
Hawaii	97.3	1	60.0	7
Washington	96.5	2	58.8	9
Oregon	95.8	3	65.9	2
Michigan	95.6	4	65.4	3
California	95.2	5	66.7	1
Maryland	93.2	6	61.4	4
Iowa	92.1	7	55.9	13
New Jersey	91.6	8	49.6	18
Nevada	91.6	9	50.7	17
Texas	91.5	10	57.7	10
MIDDLE 31:				
New Mexico	91.3	11	49.5	19
Illinois	90.3	12	47.9	21
Indiana	89.6	13.5	48.9	20
West Virginia	89.6	13.5	40.1	34
Georgia	89.3	15.5	44.2	24
North Carolina	89.3	15.5	53.7	15
Delaware	89.0	17	57.1	11
District of Columbia	88.6	18	60.7	5

	Observed (2007-08)		FARS (2006-07)	
	Percent	Rank	Percent	Rank
Minnesota	87.3	19	46.5	22
Vermont	87.2	20	53.7	16
Connecticut	86.9	21	55.7	14
Utah	86.4	22	59.6	8
New York	86.3	23	60.2	6
Pennsylvania	85.9	24	37.9	37
Alabama	83.8	25	40.6	32
Oklahoma	83.7	26	42.6	27
Alaska	83.7	27	56.8	12
Ohio	82.2	28	43.0	25
North Dakota	81.9	29	34.6	44
Colorado	81.4	30	42.9	26
Maine	81.4	31	42.1	29
Tennessee	80.9	32	39.5	35
Nebraska	80.7	33	35.9	43
Arizona	80.4	34.5	40.8	31
Florida	80.4	34.5	42.3	28
Virginia	80.3	36	38.3	36
Montana	79.5	37	30.9	48
Idaho	77.7	38	44.5	23
South Carolina	76.8	39	36.1	42
Missouri	76.5	40	32.3	47
Kansas	76.2	41	41.8	30
BOTTOM 10:				
Rhode Island	75.6	42	37.1	40
Louisiana	75.4	43	37.9	38
Wisconsin	74.8	44	40.4	33
Kentucky	72.6	45	36.8	41
South Dakota	72.4	46	22.2	51
Mississippi	71.6	47	29.6	49
Wyoming	70.4	48	37.4	39
Arkansas	70.2	49	33.9	46
Massachusetts	67.8	50	34.6	45
New Hampshire	66.5	51	25.4	50

For each of the three usage groups, Table 5 shows the averages for FARS and observed use, as well as medians and inter-quartile ranges (25th to 75th percentiles) for measures of fines, enforcement, and media. Medians are provided because of skewed distributions. The inter-quartile range of fines was from $25 to $80 in the 10 States with the highest observed usage rates (median = $25); from $15 to $25 in the middle group of States (median = $25); and from $20 to $25 in the bottom group (median = $25). Aggregating fines with fees and other charges, the inter-quartile range was from $56 to $111 in the Top 10 group (median = $75.50); from $20 to $69 in the Middle 31 group (median = $30), and from $18 to $26 in the Bottom 10 group (median = $25).

Table 5. Observed Seat Belt Usage Rates, 2007–2008*

		Top 10 States	Middle 31 States	Bottom 10 States
Observed seat belt use (2007-08)	Average	94.0%	84.0%	71.7%
FARS seat belt use (2006-07)	Average	59.2%	45.2%	33.5%
Fines only (2003-08)	Average	$52.63	$23.58	$24.67
	Median	$25.00	$25.00	$25.00
	75th percentile	$80.00	$25.00	$25.00
	25th percentile	$25.00	$15.00	$20.00
Fines + fees (2008)	Average	$81.62	$43.79	$26.28
	Median	$75.50	$30.00	$25.00
	75th percentile	$110.50	$69.00	$26.40
	25th percentile	$55.00	$20.00	$17.50
Citations/10K pop. (2003-08)	Average	23.0	21.7	13.4
	Median	20.3	19.4	12.0
	75th percentile	27.0	27.6	16.4
	25th percentile	11.8	11.5	5.8
Media $ per capita (2003-08)	Average	$0.07	$0.08	$0.09
	Median	$0.07	$0.07	$0.09
	75th percentile	$0.09	$0.11	$0.13
	25th percentile	$0.02	$0.04	$0.06

* States were grouped relative to 2007 and 2008 observed use.

Correlations Between Outcome Measures

For the 12-year period for which both measures were available, the Pearson's correlation coefficient showed a reasonably high correlation between observed use and FARS use (r = .76). As Figure 4 shows, the relationship between the two measures was slightly different when broken out by States with primary enforcement laws and those with secondary enforcement laws or no law. The correlation was highest for the State-years during which a primary law was in effect (r = .71; n = 221), compared with the State-years when either a secondary law or no law was in effect (r = .60; n = 391). These differing relationships are illustrated by the two loess regression fit-lines in Figure 4.

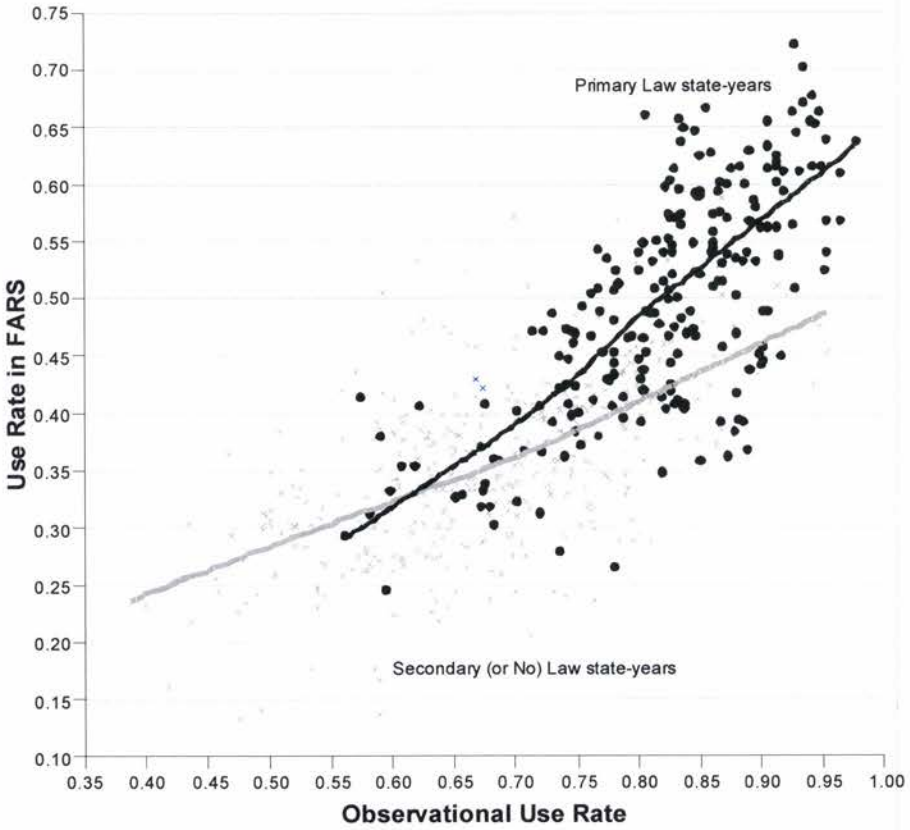


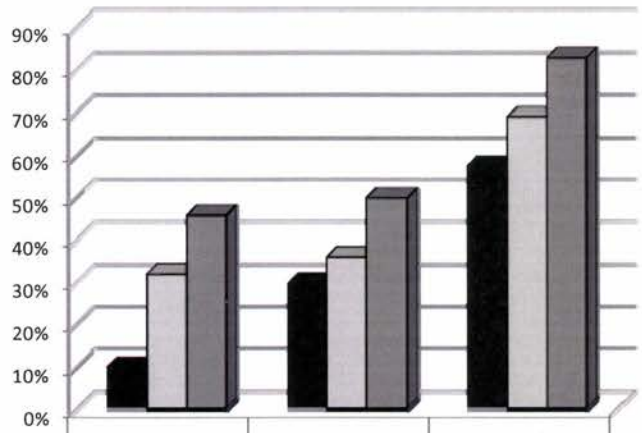
Figure 4. Correlation Between Observed Seat Belt Use and Usage Among Occupants Killed Under Primary and Secondary Enforcement Law Conditions

Seat Belt Use and Fine Amount by Law Type

Seat Belt Use by Law Type

As indicated, the presence or absence of legislation requiring seat belt use has long been shown to be the most significant correlate with seat belt usage rates, more than any other factor measured. This was illustrated by the preliminary results, which are shown in Figure 5. Without accounting for any other variables, the first three columns in this figure indicate that the average FARS usage rate during the 26-year period from 1982 through 2007 was 9.8% in those State-years when no law was in effect; 31.7% in those State-years when a secondary enforcement law was in effect; and 45.5% when a primary enforcement law was in effect.

The second and third 3-column clusters in Figure 5 show *FARS use* and *observed use* for the 12 years from 1996 through 2007. For this period, average FARS use was 29.6% under no-law conditions (i.e., in New Hampshire); 35.7% under secondary law conditions; and 49.5% under primary law conditions. Observed use rates were much higher under all conditions, averaging 57.3% during no-law years; 68.7% during secondary law years; and 82.7% during primary law years. On average, FARS use was about 33 points lower than observed use, under both primary and secondary laws.



	FARS, 26 years (1982-2007)	FARS, 12 years (1996-2007)	Observed (1996-2008)
No Law	9.8%	29.6%	57.3%
Secondary	31.7%	35.7%	68.7%
Primary	45.5%	49.5%	82.7%

Figure 5. Seat Belt Usage, Observed and Among Occupants Killed (FARS Use), by Law Type

These overall analyses further suggested that the increase in FARS use (from no-law to secondary law) was roughly 13.5 percentage points in the first year that a secondary law was in effect ($t = 14.69$, $p<.001$), and the effect of a primary law (relative to a secondary law) was 10.6 percentage points in the first year after an upgrade was in effect ($t = 8.48$; $p<.001$).

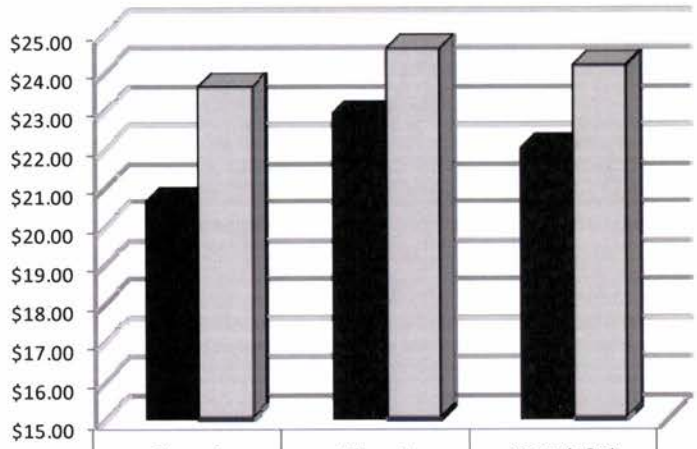
During the 1980s and early 1990s, most States were moving from no-law to at least a secondary seat belt law, but from 1996 through 2007, all States except New Hampshire already had at least

a secondary law. During this period, the analyses showed an 11.8-percentage-point increase (t = 9.66) in use associated with moving from a secondary law to a primary law, similar to the effect size found in the overall analysis (10.6 points).

From these preliminary results, it is clear that any analysis of the effectiveness of sanctions or enforcement must first take law status into account. Furthermore, it is possible that enforcement and sanction factors might be differentially associated with increases in seat belt use in primary law States than in secondary law States. The panel analyses examined these interactions.

Fine Amount by Law Type

Other than law type, the only reliable predictor variable available for analysis during both the *Operation ABC* period and the *CIOT* period was fine amount. Measures of central tendency are shown in Figure 6.



	Phase 4	Phase 5	BOTH (4&5)
Secondary	$20.60	$22.86	$22.00
Primary	$23.58	$24.55	$24.13

Figure 6. Median Fine Amount, by Law Type, by Phase

As indicated previously, the distribution of the fines variable was skewed, with most values at $25 or less (but averages changed more than medians in recent years with a few States increasing their fines substantially). The frequency of State-years with higher fines diminished with increasing fine amounts, with only a smattering of values at $100 or higher. Thus, the data table included within Figure 6 shows grouped median values (essentially highly trimmed means) rather than averages. These grouped medians are more robust estimators than averages with skewed data such as these.

Figure 6 shows that there were higher fine amounts in place during the *CIOT* period (Phase 5) than in the *Operation ABC* period (Phase 4), and that fine amounts were modestly higher in those State-years when a primary law was in effect than when a secondary law was in effect. This difference was greater during the *Operation ABC* period than during the *CIOT* period, although the difference between primary and secondary law conditions was modest ($24.13 versus $22 across both phases).

Panel Regression Analyses

Combining the No-Law and Secondary Law Categories

The longitudinal panel-regression models have difficulty accounting for a law factor (e.g., no-law versus any law) that is almost entirely confounded with a subject unit (i.e., New Hampshire is the only State remaining in the no-law category). Thus, it was not desirable to have a separate factor representing only New Hampshire.[3] [4] To remedy this situation, the regression analyses examined the effect of primary laws versus a collapsed category that included New Hampshire with the secondary law States.

Any change in law status (i.e., moving from secondary to primary enforcement) that occurred within a particular year was represented by a proportional value (portion of the year) for the dummy law status variable.

Results of the Panel Regression Analyses

The final regression models are shown in Appendix C. Only two predictors, law type and fine amount, were available predictors across both time periods. No significant associations were found for media expenditures and seat belt use; therefore, this variable was not included in any of the final models. The enforcement measures were statistically significant in some analyses, but were deemed too unreliable. Therefore, the enforcement results are not shown in the following sections. The enforcement variables were retained in the final regression models where they were statistically significant, in order to statistically control for enforcement.

Operation ABC Mobilizations, 1997–2002

Impact on FARS Use, 1997–2002

The panel regression analyses of seat belt use for the *Operation ABC* period examined the effect of fine amount and law type as predictors of FARS use. This dependent variable showed a 9.1-percentage-point higher usage rate when a primary law was in effect, compared with when a secondary law was in effect ($t= 7.14$; $p<.001$). Significant effects were also associated with fine amount ($t=3.61$; $p<.001$). Each variable was tested while controlling for the other.

No significant interaction effects were found. Thus, based on this analysis, the effects of fine level were of similar magnitude for both law categories. Further, because the parameters for each factor were calculated while controlling for the other factors, all effects are additive. The parameter estimates for this analysis are shown in Appendix C.

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[3] Fortunately, the other sanction and enforcement factors coincide with the no-law/law distinction (i.e., with no law, there are no fines, no participating law enforcement agencies, and no citations) and the effect of moving from no-law to a secondary law after 1996 is largely captured by the other predictors in the model.

[4] This overlap in predictors accounting for New Hampshire was demonstrated when fine amount was added into the model after 1995. This virtually wiped out the significance of the no-law-to-secondary-law parameter ($t = 5.75$; $p=.121$) as it captured most of the same variance for New Hampshire, while leaving the secondary- to-primary law change highly significant.

Throughout this section, information is provided for various levels of change (e.g., a fine increase from \$5 to \$25 or from \$25 to \$60. However, estimates are also provided for "maximal effects" even though some of the conditions may not be realistic at this time (e.g., a fine increase from \$0 to \$100). Such numbers are provided simply to show the relative effect of a maximal change in that variable in comparison with a primary law upgrade, which is the benchmark action.

The relationship between fine amount and FARS use was curvilinear, with decreasing marginal returns associated with increasing fines. An increase in fine amount from \$5 to \$25 ($(\sqrt{25} - \sqrt{5}) * .0121 = 3.34$) was associated with approximately the same effect as an increase from \$25 to \$60 ($(\sqrt{60} - \sqrt{25}) * .0121 = 3.32$). Each was associated with approximately a 3.3-percentage-point increase in FARS use. Thus, an increase in fine amount from \$5 to \$60 was associated with a 6.7-point increase in FARS use (rounded). The effect of increasing the fine from \$60 to \$100 (2.7 points) was less than increasing the fine from \$25 to \$60 (3.3 points). Compared with no fine at all, a \$100 fine was associated with a 12.1-percentage-point increase. Little improvement was associated with fines higher than \$100, but there were only a few fines higher than this level. An increase in fine amount from the median value of \$25 to \$100 was associated with a 6.1-point increase in FARS use. Because there was no significant interaction effect, this would be the case in either a primary or a secondary law State. Similarly, moving from a secondary law to a primary law, at any given fine level, was associated with a 9.1-percentage-point increase.

Impact on Observed Seat Belt Use, 1997–2002

Compared with the effects on FARS use during the *Operation ABC* period, there was a slightly larger effect on observed use associated with primary seat belt laws (+11.9 percentage points; $t = 8.45$; $p<.001$). There was an almost identical effect of fine amount on observed use as on FARS use, with about a 3.1-percentage-point increase in observed use associated with a fine increase from \$5 to \$25 or from \$25 to \$60.

Once again, no interaction terms were found to be significant. Thus, the regression model showed that the effect of a primary law was similar in States with differing fine levels, and the effects associated with differing fine levels were similar under both primary and secondary law conditions.

Impact on the Odds of Being Buckled

Each of the estimates of change described in the previous two sections was based on levels of "raw" observed or FARS use over all State-years within the *Operation ABC* period. Comparing average usage levels from one combination of predictors to another provides the basis for estimating the effect. Using the odds of being buckled in any given year, divided by the odds of being buckled in the baseline year provides a more direct measure of actual change from baseline. For example, if the usage rate during the baseline year was 60%, the odds of being buckled during that year would be 6:4 (buckled:unbuckled). If use increased to 70% in a subsequent year, the odds of being buckled would increase to 7:3. In this subsequent year, the odds ratio would be the odds of being buckled (7:3) divided by the odds of being buckled in the baseline year (6:4), or 1.56. Thus, the odds of being buckled would have increased by 56%. Implementing a change from 70 to 80% use would result in an odds ratio of 1.71 (i.e., 8:2/7:3 =

12:3/7:3 =12/7 = 1.71). Thus, the odds ratio provided a greater relative gain for the 10-point increase from a 70% baseline than for the same gain from a 60% baseline.

Odds of FARS Seat Belt Use, 1997–2002

Note that with this analysis using FARS data 2 years of data were used for the baseline (1995-1996) to provide a more stable/reliable estimate. This is particularly important in States with smaller populations and thus smaller numbers of occupants killed in crashes.

Primary seat belt laws accounted for a 17.9% (not percentage-point) increase in the odds of being buckled, relative to the baseline period. The maximal effect of raising the fine amount (from $0 to $100) was a 35.7% increase in the odds of being buckled ($t = 2.42$; $p = .017$), about twice the relative gain associated with a primary law. However, as indicated, there were very few States with no fine during any portion of this phase. Thus, a more relevant comparison would be provided by an increase from $5 to $100, which would be about 27.7%, and perhaps the most realistic increase would be from the median $25 fine to a maximum of $100, which would be associated with a 17.9% effect – identical to the effect of a primary law.

Some of the greater potential effect of fines relative to a primary law may have been because some States already had a primary law or implemented an upgrade early in the *Operation ABC* period, when baseline seat belt use was lower (than later in the period). The unbelted margins were likely greater at that point and any given increase in use (e.g., a 10-point increase) would have resulted in a relatively smaller change in the odds ratio than if the same absolute change was from a higher baseline. Again, this is the same general concept on which the use of a *conversion rate* is based. Both approaches provide a greater "reward" (in terms of percent change) for increases from higher baselines than for increases of the same magnitude from lower baselines.

Odds of Observed Seat Belt Use, 1997–2002

Regarding changes in the odds of being buckled, primary laws were associated with a much larger effect on observed use than on FARS use. Relative to baseline, primary laws were associated with a 26.2% increase in the odds of (observed) use ($t=4.26$; $p<.001$), compared with the 17.9% increase in the odds of FARS use. However, for the *Operation ABC* period, the change in the odds of observed use associated with a maximal increase in fine amount ($0 to $100) was nonsignificant ($t = 1.49$; $p = .139$).

Summary of Results for the Operation ABC *Period, 1997-2002*

Table 6 summarizes the results of the analyses examining the *Operation ABC* period (1997-2002). Both primary laws and fine amount had relatively substantial associations with seat belt use.

Table 6. A Summary of Outcomes for the Period of *Operation ABC* Mobilizations, 1997-2002

FARS seat belt use				
	Raw use rates		Odds ratios	
Factor	Maximal effect (% pts.)	Change relative to primary	Maximal effect (% chg.)	Change relative to primary
Primary law (vs. secondary law)	9.2	n/a	17.9	n/a
Fine amount ($0 to $100)*	12.1	1.33	35.7	1.99
Fine amount ($5 to $100)	9.4	1.03	27.7	1.55
Fine amount ($25 to $100)	6.1	0.67	17.9	1.00
Fine amount ($25 to $60)	3.3	0.36	9.8	0.55
Observed seat belt use				
	Raw use rates		Odds ratios	
Factor	Maximal effect (% pts.)	Change relative to primary	Maximal effect (% chg.)	Change relative to primary
Primary law (vs. secondary law)	11.9	n/a	26.2	n/a
Fine amount ($0 to $100)*	11.2	0.94	25.1**	0.96
Fine amount ($5 to $100)	8.7	0.73	19.5**	0.74
Fine amount ($25 to $100)	5.6	0.47	12.6**	0.48
Fine amount ($25 to $60)	3.1	0.26	6.9**	0.26

* Only three States had no fine for any period within the *Operation ABC* phase.

**These increases in the odds of being buckled (observed use) were the only results that did not reach statistical significance.

Click It or Ticket Mobilizations, 2003–2008

Analyses of seat belt use for the *CIOT* campaign years incorporated the same predictor variables used in the analysis of the *Operation ABC* period, plus two additional variables, seat belt citation rate and per capita media expenditures during May *CIOT* mobilizations. Even more than amount of fines, these two measures were highly skewed. However, a log transformation of each measure resulted in normal distributions that were more suitable for meeting parametric assumptions. Essentially the same methods as those described for the analyses of effects during the *Operation ABC* period were used. Markedly nonsignificant parameters were removed in order not to produce spurious relationships that may have resulted from an overfit model.

Impact on FARS Use, 2003–2007

Analysis of FARS seat belt use data showed a 9.0-percentage-point increase associated with primary laws ($t = 6.02$; $p<.001$), remarkably consistent in magnitude to the effect found for the *Operation ABC* period. The effect associated with fine amount was also significant ($t = 2.76$; $p = .007$). Again, the effects on raw FARS use associated with both of these factors in the *CIOT* period were similar to their effects in the *Operation ABC* period. The slightly larger effect associated with fine amount in the *CIOT* period (compared to the *Operation ABC* period) was

accompanied by somewhat *greater* variability than during the previous phase, as more States increased their fines.

As in the *Operation ABC* period, the *CIOT* analyses found no significant interaction effects, suggesting that fine effects were similar under primary and secondary law conditions and that primary law effects were similar at various fine levels. There was no significant autocorrelation within State over time over the years of this analysis, as illustrated by the nonsignificant AR(1) parameter. Further, as in the *Operation ABC* period, the effects associated with fine amount were curvilinear, with decreasing gains in use associated with higher fine levels.

The consistency of these results with those using FARS data in the *Operation ABC* period serves as a form of replication that lends confidence to the conclusion that the statistical findings for either phase were not merely overfit to a particular sample.

Impact on Observed Usage, 2003–2008

Analysis of the *CIOT* period observational data showed similar effects on observed use as in the *Operation ABC* period. The primary seat belt laws accounted for a 10.4-point higher use rate in terms of raw observed seat belt use ($t = 6.08$, $p < .001$), just slightly greater than the effect of primary laws on FARS use (9.0 points) and slightly smaller than the effect of primary laws on observed use during the *Operation ABC* period (11.9 points). Thus, there was relative consistency in the effect associated with primary laws, ranging from a 9-point effect on FARS use in the *CIOT* period to an 11.9-point effect on observed use during the *Operation ABC* period, making it an important benchmark by which to assess the influence of other factors.

During these *CIOT* mobilization years, each incremental increase in fine amount at low-to-moderate levels (i.e., from $5 to $25 and from $25 to $60) was associated with a 3.7- to 3.8-percentage-point increase in observed use, and a fine increase from $60 to $100 was associated with slightly smaller increase of 3.1 points. Overall, this resulted in about a 13.9-point maximal increase associated with fine amount ($t = 3.36$; $p = .001$), greater than the effect associated with a primary law (10.4 points). An increase in fine amount from $5 to $100 was associated with a 10.8-point gain (about 1.03 times the gain associated with a primary law) and an increase from $25 to $100 would have been associated with a 7-point gain (about two-thirds being the effects associated with a primary law).

Impact on the Odds of Being Buckled

Using the odds-ratio measure of improvement (i.e., comparing the odds of being buckled in each State-year during *CIOT* time period with the odds of being buckled in the baseline period 2000–2002), both fine amount and the presence of a primary law were related to increases in the odds of being buckled using both FARS and observed data.

Odds of FARS Use, 2003–2007

A primary law was associated with a 7.9% increase relative to baseline. An increase in fine amount from $5 to $100 was associated with a usage increase of 17.5%, relative to baseline. This was more than twice the effect associated with a primary law. A fine increase from $25 to $100 was associated with an 11.3% increase in the odds of FARS use, about 43% greater than the effect associated with a primary law; and an increase in fine level from $25 to $60, was

associated with a 6.2% increase in the odds of FARS use, slightly less than the influence of a primary law.

The effect sizes for fine amount and primary law during this time period were significant only when assuming directionality of change and using a one-tail test ($p = .045$ for fine amount and $p = .050$ for primary law). Based on previous findings, the expectation was that both would be associated with increases (rather than decreases) in use. Still, these were marginally significant effects, compared with effects during the *Operation ABC* period.

Odds of Observed Seat Belt Use, 2003–2008

Having a primary seat belt law or upgrading to a primary law from a secondary law accounted for a relative increase of 20.0% in the observed odds of being belted ($t = 2.36$; $p = .020$), slightly smaller than the 26.2% effect found in the *Operation ABC* period.

An increase in fine amount from $0 to $100 would have been associated with a 59.1% increase in the odds of observed belt use during this phase ($t = 2.41$; $p = .018$), much larger than the effect associated with the other predictor variables during this phase and larger than the estimated 25.1% increase on the odds of *observed* use in the *Operation ABC* period. An increase from $25 to $100 was associated with a slightly greater effect (29.6%) than that associated with a primary law (20%), and a more moderate fine increase from $25 to $60 was associated with a slightly smaller effect (16.2%) than that associated with a primary law (20%).

Thus, in terms of increasing the odds of observed seat belt use, fine amount appears to have been the more powerful factor during this recent and ongoing *CIOT* period. Primary laws had the next largest potential. This suggests that several States with relatively high baseline usage rates (i.e., with a small residual proportion of nonusers) increased their fines during this period and achieved even higher usage rates, resulting in a high rate of conversion from seat belt nonusers to seat belt users.

Summary of Results for the CIOT *Period, 2003–2008*

In general, there was less change in seat belt use during the *CIOT* period than during the *Operation ABC* period. Table 7 summarizes the change associated with various predictor variables during this phase of activity. Once again, both primary laws and fines had significant associations with seat belt use.

Table 7. A Summary of Outcomes for a Period of National *CIOT* Mobilizations

FARS seat belt use (2003-2007)				
	Raw use rates		Odds ratios	
Factor	**Maximal effect (% pts.)**	**Change relative to primary**	**Maximal effect (% chg.)**	**Change relative to primary**
Primary law (vs. secondary law)	9.0	n/a	7.9**	n/a
Fine amount* ($0 to $100)	13.6	1.51	22.5	2.85
Fine amount* ($5 to $100)	10.6	1.18	17.5	2.22
Fine amount* ($25 to $100)	6.8	0.76	11.3	1.43
Fine amount* ($25 to $60)	3.7	0.41	6.2	0.78
Observed seat belt use (2003-2008)				
	Raw use rates		Odds ratios	
Factor	**Maximal effect (% pts.)**	**Change relative to primary**	**Maximal effect (% chg.)**	**Change relative to primary**
Primary law (vs. secondary law)	10.4	n/a	20.0	n/a
Fine amount* ($0 to $100)	13.9	1.34	59.1	2.95
Fine amount* ($5 to $100)	10.8	1.03	45.9	2.30
Fine amount* ($25 to $100)	7.0	0.67	29.6	1.48
Fine amount* ($25 to $60)	3.9	0.38	16.2	0.81

* The amounts cited provide comparisons with the effect of a primary law upgrade. They represent several levels of effect: $0 to $100—no longer attainable; $5 to $100—most States now have a higher fine; $25 to $100—the maximum change possible for most States; and $25 to $60 a more moderate change.

** Effect is significant with directionality assumed (i.e., one-tailed test).

A Period of National Mobilizations, 1997–2008

Looking across the entire timeframe from 1997 through 2007, the broader influence of fines and laws on seat belt use was examined. As mentioned, the results for each time period were remarkably comparable to each other, and by combining them, there is a larger sample pool of cases (State-years) and a wider variation across outcome measures for fines. The "dummy" variable for primary laws, of course, remains dichotomous.

Across the combined 11-year period during which FARS data were available (1997-2007), primary seat belt laws were associated with a 10-percentage-point increase in raw FARS use ($t = 9.20$; $p < .001$). This estimate is independent of the effects of fines. Across the 12-year period for which observed usage data were available, primary laws were associated with a 10.8-percentage-point increase in observed seat belt use ($t = 8.48$; $p < .001$), after adjusting for other factors.

A maximal change in fine amount ($0 to $100) would have been associated with a 13.4-percentage-point increase in FARS use through 2007 ($t = 5.88$; $p < .001$) and up to an 11.1-percentage-point increase in observed use through 2008 ($t = 4.09$; $p < .001$). A fine increase from the current median value of $25 to a level of $100 was associated with an 8.6-point increase in

FARS use and a 7.2-point increase in observed use, both of which are less than the effect of a primary law. The association of fine amount with FARS use and observed use stratified by law status are shown in Figures 7 and 8, respectively.

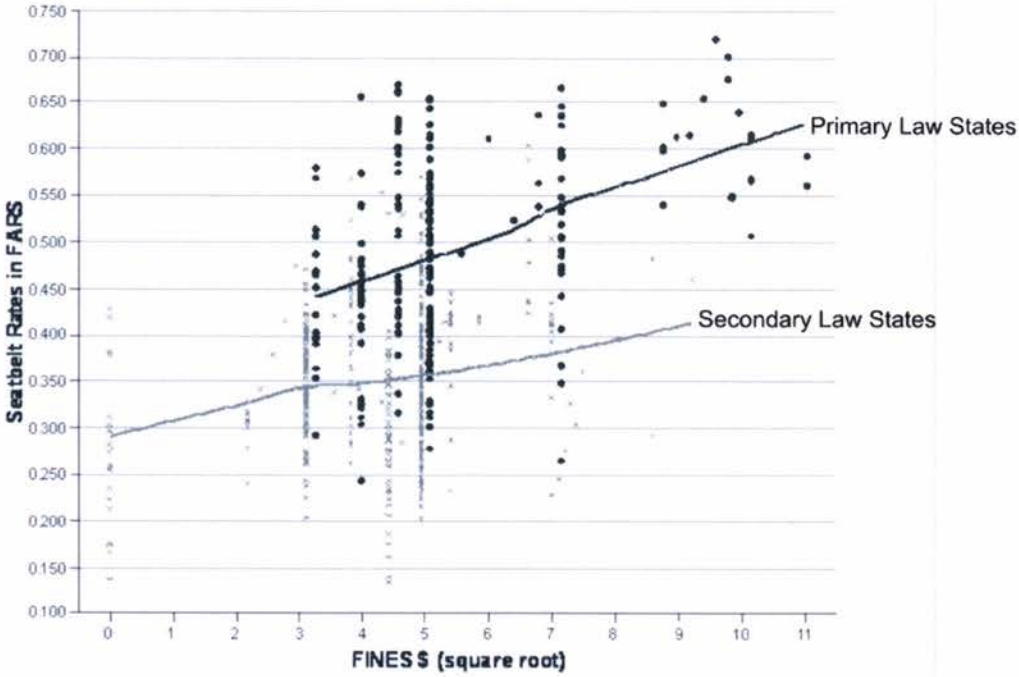

Figure 7. FARS Seat Belt Usage in Relation to Fine Amount

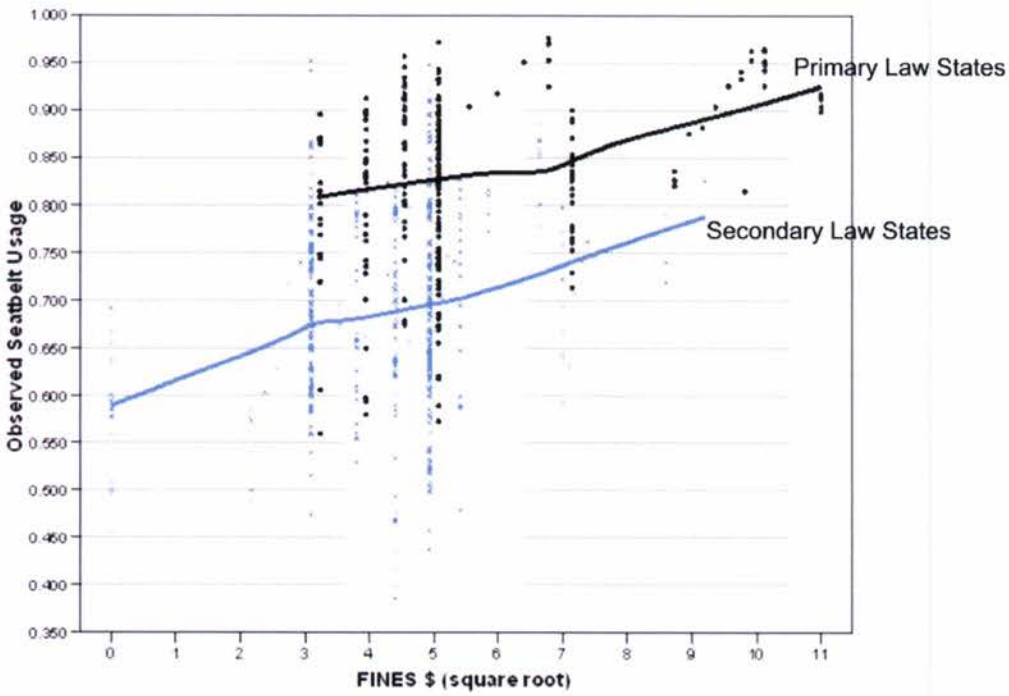

Figure 8. Observed Seat Belt Usage in Relation to Fine Amount

Summary, Discussion, and Conclusions

There were substantial increases in seat belt use during the *Operation ABC* and the *CIOT* years, a period during which national enforcement mobilizations were the most visible form of activity being implemented to increase seat belt use. Based upon results from the National Occupant Protection Use Survey (NOPUS), conducted annually in June, there was a 14-point increase in observed use during the *Operation ABC* period and an 8-point increase during The *CIOT* period, for an overall gain of 22 percentage points. Use among occupants killed increased by about 5 percentage points during each of the two time periods for an overall gain of about 10 percentage points. Following a period of relatively little gain from 1992 through 1996, it certainly appears that mobilization activity was a factor associated with the change seen during this period. Also present, however, were the effects of 16 primary law upgrades that were implemented after 1996 and before 2009, as well as numerous increases in seat belt fines among States. This study examined the relative effects of these primary law upgrades and seat belt fine levels on seat belt use, while statistically controlling for enforcement levels.

Primary Law Upgrades

As Nichols and Ledingham (2008) pointed out, primary law upgrades were consistently associated with increases in use, not only among daytime road users, but also among crash victims and nighttime road users. Further, these researchers pointed out that some of the greatest gains in use documented during this period were in States that enacted upgrades and participated heavily in the national enforcement mobilizations. To date, primary law upgrades have been associated with the strongest and most consistent evidence of increases in use among high-risk groups, such as drinking drivers, drivers using the roadways late at night, and occupants involved or killed in fatal crashes.

There was much consistency in the results of this study and the results of other recent studies and reviews. Across the 12-year period examined in this study, primary seat belt laws were associated with 9- to 10-percentage-point increases in seat belt use among occupants killed in crashes and 10- to 12-point increases in observed use, with a slightly greater effect on observed use during the *Operation ABC* period than during the *CIOT* period and relatively equal effects on FARS use during both time periods. Primary laws were associated with 18% increases in the odds of FARS use during the *Operation ABC* period and 8% during the *CIOT* period. Regarding the odds of observed use, primary laws were associated with a 26% increase during the *Operation ABC* period and a 20% increase during the *CIOT* period.

Fines

Somewhat less visible and possibly overlooked was the fact that about half of the States increased their fines and penalties in recent years. A comparison of penalty data in from 2000 to 2008 indicated that there were 50% greater increases in FARS use among States that increased their fines and/or fees than among States that did not. The results of this study suggest that there

is more potential associated with fine increases (up to about $100) than was previously recognized. In a similar study using data from an earlier time period (1991-2001), Houston and Richardson (2005) suggested that States impose fines of at least $50. Many States have increased their fine levels since this earlier study, providing an additional opportunity to examine the potential for fine increases to affect seat belt use.

The results demonstrated that increasing seat belt fines was associated with gains in seat belt use among crash victims (FARS use) and among daytime road users (observed use). The relationship between fine amount and seat belt was curvilinear, with decreasing marginal returns associated with increasing fines. Thus, an increase in fine amount from $5 to $25 was associated with approximately the same effect as an increase from $25 to $60; both were associated with about 3- to 4-percentage-point gains in belt use. This effect was similar in magnitude to that found in the Houston and Richardson study, which found that a $5 to $25 increase was associated with a 3-percentage-point increase. The effect of increasing the fine from $60 to $100 was just under 3-percentage points (less than an increase of $25 to $60). Little improvement was associated with fines higher than $100, but there were only a few fines higher than this level.

One inconsistent finding was the lack of interaction between fine amount and law type. Several studies reviewed by Nichols and Ledingham suggested that fines have had a greater effect in conjunction with primary laws than in conjunction with secondary laws. The results of this study did not show a significant interaction, although there was some suggestion of a greater effect of fines associated with primary laws (see Figures 7 and 8).

Enforcement

Enforcement, measured during only two weeks of the year, was related to higher seat belt use in terms of both FARS and observed use. However, the enforcement indicators involved imperfect indices of enforcement that were limited to May mobilization periods. Although the enforcement measures were statistically significant predictors, these measures were deemed too unreliable to estimate potential gains in seat belt use.

The variability or inaccuracies involved in documenting and reporting seat belt citations or agencies participating in mobilizations limited the ability of the regression analysis to assign an effect to enforcement activity. In comparison to indices of enforcement, law status and fine amount are objectively defined, they are documented by statute, and they are more permanent than seasonal enforcement actions. If there were a direct effect associated with either of these two variables (law status and fines), it is likely that the regression model would recognize such an effect and attribute it to those factors, leaving less to be accounted for by the less accurate measures of enforcement.

In addition, the relatively small association of enforcement with changes in use during the two-week *CIOT* period was consistent with the results reported by Tison and Williams (2010) in their study of seat belt laws, enforcement, and publicity during the CIOT period.

Media Expenditures

The lack of any direct association of media expenditures during May *CIOT* mobilizations with seat belt use is unexpected in the sense that it was not until States and local jurisdictions began using paid media in to support intensified enforcement mobilizations that large and significant

increases in observed use were documented. Many examples support this claim, including the original 1985 Elmira, New York, demonstration; the 1993 North Carolina *CIOT* program; the 2000 South Carolina *CIOT* mobilization; and the 2001 8-State *CIOT* demonstration in the Southeast. In 2002 across 18 States there was consistent evidence that State mobilizations characterized by low media expenditures and low citation rates were associated with smaller increases in belt use than States with higher media expenditures and higher citation rates. Without paid media, much of the observed increases in seat belt use that have been documented in conjunction with enforcement demonstrations and mobilizations would not have occurred.

It is only in conjunction with other, more powerful events such as an enforcement mobilization, the implementation of a primary law upgrade, or a fine increase that one would expect paid media to be effective. Second, in line with that assumption, nearly all paid media efforts have been implemented in conjunction with such more powerful events, thus enabling the effectiveness of these events. Third, there is the suggestion that some low-use States may emphasize the use of paid media on a per capita expenditure basis in lieu of intensified enforcement; in such cases, media expenditures would be expected to be associated with lower, rather than higher use. Finally, there is the issue of measurement. It is possible that per capita media expenditures do not accurately reflect media intensity or focus. Other measures, such as gross rating points or public awareness of seat belt or enforcement messages, provide a more valid index of the effect of media. Unfortunately, such data are available in only a handful of States. Media expenditures, however, are some of the few measures of media activity that have been documented State-by-State over several years of activity.

The finding that media expenditures were not associated with a significant seat belt effect after accounting for the influence of other factors was consistent with conclusions of Hedlund et al. (2008) and with Tison and Williams (2010). Similar to the findings of low-use States having larger per capita media expenditures in this study, Hedlund found that low-use States tended to spend more on media and less on enforcement-related activity.

Conclusions

The results of this study confirmed that primary seat belt laws were associated with higher use rates and with increases in the odds of being buckled. Few studies have examined the relationship between the fine amount for a violation and compliance to occupant protection laws. Key findings from this study include the following:

1. The evidence regarding the potential for fine amounts to affect seat belt use was consistent across the two time periods under study and for both FARS and observed belt use. The results showed that an increase in fine level from $25 (the current median value in both primary and secondary law States) to $60 was associated with a 3- to 4-percentage-point increase in both FARS and observed seat belt use. Increasing a State's fine level from $25 to $100 was associated with a 6- to 7-point increase in both use rates.

2. An upgrade from secondary to primary enforcement was associated with a 10- to 12-percentage-point increases in observed use and 9-point increases in FARS use. Such an increase would be additive to that associated with the fine increase.

Current enforcement measures do not provide accurate and reliable estimates of activity or change in activity. The small effect of enforcement was likely due to imperfect measures used to

estimate enforcement activity. Past studies have provided many clear examples where highly publicized and intensified enforcement has resulted in large and significant increases in observed seat belt use. To the extent that any index is inaccurate, incomplete, or inconsistent, the regression analysis is less able to attribute change or effect to that factor.

Primary laws, fines, and enforcement are important factors in determining seat belt use, and none of these factors likely has maximum potential without the benefit of at least some paid media to support it. More effective means should be explored for combining these factors to reach high-risk, low-use groups. In addition, more effective means should be explored for expanding and documenting enforcement activity beyond *CIOT* mobilization periods.

In summary, the results suggested that increasing fine levels is another strategy that has potential to further raise seat belt use, in addition to primary law upgrades and high-visibility enforcement. Although the regression analyses did not find a statistically significant effect associated with media, the public, however, needs to be aware of laws and fine changes before compliance is likely. Publicizing fine increases would likely be essential for maximizing the effects of such actions.