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The Impact of Legislation, Enforcement, and Sanctions on Safety Belt Use

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The Impact of Legislation, Enforcement, and Sanctions on Safety Belt Use

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Subject Areas
Safety and Human Performance

TRANSPORTATION RESEARCH BOARD

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration, U.S. Department of Transportation.

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COOPERATIVE RESEARCH PROGRAMS

FOREWORD

By Charles W. Niessner
Staff Officer
Transportation Research Board

This report summarizes the effectiveness of mandatory approaches to increase safety belt usage. The report will be of particular interest to safety practitioners with responsibility for developing and implementing safety belt usage programs.

Efforts to increase safety belt usage in the United States began with the introduction of lap belts in a small percentage of vehicles in the 1950s. By 1968, such devices were required in the front seats of all new passenger vehicles. In the 1970s, initial efforts to enact safety belt use (SBU) laws were unsuccessful. In 1978, the National Highway Traffic Safety Administration (NHTSA) initiated a behavioral approach. However, increasing safety belt usage proved to be a difficult task as it took more than 25 years to reach the current national usage rate of just over 80%.

However, even at the relatively high rates in recent years (such as, observed daytime rates of 80% or greater), many high-risk motorists, including drinking drivers, motorists on the road during late-night hours, young males, drivers with violations and crashes on their record, and occupants involved in fatal crashes still do not buckle up. Future efforts to reduce fatalities and injuries involving unrestrained occupants will need to focus on such high-risk motorists.

Under NCHRP Project 17-33, "Effectiveness of Behavioral Highway Safety Countermeasures," Preusser Research Group summarized the effectiveness of mandatory approaches to increase safety belt usage consisting primarily of SBU use laws, enforcement efforts, and sanctions, from the perspective of what combinations of such actions might work best in today's environment to increase usage among high risk motorists.

The report summarizes the actions to increase safety belt usage in three broad categories: legislative activity, enforcement efforts, and sanctions. The first SBU law in the United States was enacted in New York in 1984. SBU legislation has provided consistent evidence of increases in safety belt usage and of reductions in fatalities and injuries associated with motor vehicle crashes.

During the 1980s, several studies were conducted in Canada that showed significant increases in observed usage associated with enforcement. Highly visible enforcement efforts have been shown to have a significant impact on safety belt usage. The intensity of current efforts of paid media and enforcement has resulted in increases in national usage from about 71% in 2000 to 81% in 2006.

Sanctions for safety belt violations have typically been minimal in comparison with penalties for other violations. In general, stop sign violations carry greater fine levels than nonuse of safety belts. There is relatively little research on the impact penalties for nonuse of safety belts, but there is consistent circumstantial evidence to suggest that increased penalties in the form of increased fines and points would result in increased safety belt usage.

CONTENTS

SUMMARY

The Impact of Legislation, Enforcement, and Sanctions on Safety Belt Use

This review focuses on the impact of legislation, enforcement, and sanctions in increasing safety belt usage (SBU). It finds strong and consistent evidence of past and current legislative and enforcement efforts, as well as consistent evidence suggesting the importance of sanctions. All three measures must be publicized to maximize their potential for impact.

The earliest SBU laws were associated with a median 32 percentage point increase in observed usage, from baselines of 16% to 18%. Increases were greater in states that allowed for standard (primary) enforcement procedures and, in those states, they were greatest when enforcement and/or sanctions were present. In general, these early laws affected lower-risk groups (e.g., females, adults, urban and late-night motorists, etc.) to a greater extent than higher-risk groups (e.g. males, teens, rural and daytime motorists, etc.), thus increasing the usage gap between such groups. These laws resulted in median 7% to 9% reductions in fatalities and 13% reductions in injuries. These reductions were lower than expected, based on the magnitude of increases and the known effectiveness of safety belts against deaths.

From January 1993 through February 2007, 18 jurisdictions upgraded their secondary enforcement laws to allow for primary enforcement. These upgrades were associated with a median 13 to 16 percentage point increase in observed SBU, from a median baseline of about 65% (range: 52% to 83%). Recent upgrades, those implemented since 1999, were associated with somewhat smaller gains (median = 11 points), compared with pre-2000 upgrades (median = 16 points). With regard to usage among occupants killed in crashes, these upgrades were associated with a median increase of 8 percentage points (range: −1 to +21), with recent upgrades associated with gains that were slightly larger than those of earlier upgrades (+10 versus +7 points, respectively). In contrast to results concerning initial laws, studies of primary law upgrades suggest that they affect higher risk groups to the same (or greater) extent as they affect lower risk groups, thus decreasing the usage gap between these two risk groups. There also is recent evidence that upgrades affect usage among drinking drivers and among occupants killed in late-night crashes. In some cases these increases have been greater than among nondrinking drivers and occupants killed in daytime crashes.

Studies of the impact of primary law upgrades on fatalities have shown a median 7% to 8% decline in fatalities, greater than would be predicted based on the measured change in usage (observed or among crash victims). This finding is consistent with a relatively greater impact on high-risk occupants. Using changes in usage among crash victims (median = 9.7 points in recent upgrades), it is estimated that future upgrades would be associated with 4% to 5% fewer deaths and 6% fewer moderate-to-serious injuries. The average annual savings (per state) would be about $138 million. Of course, there is a large range associated with this estimate, with large and populous states experiencing greater savings than smaller, less populous, and usually rural states.

Most recent upgrades have been implemented in conjunction with high visibility enforcement (HVE) efforts, usually as part of national *Click It or Ticket (CIOT)* mobilizations. Thus, reported impact is often associated with a combination of legislative, enforcement, and publicity efforts. This combination of law upgrades and repeated HVE has provided some of the largest impacts in observed use and use among crash victims.

Highly visible enforcement, usually in the form of periodic waves of intensified enforcement and publicity (*blitzes*), also has been consistently associated with large and significant increases in observed usage. *At the local level,* a review of more than 25 HVE programs resulted in a median increase of about 13 percentage points (range: –7 points to 41 points), usually from low-to-modest baseline rates. Benchmark programs provided increases as high as 41 points, from a median baseline of about 54% usage (range: 25% to 72%). The impact associated with HVE generally followed a *ratcheting* or *saw-blade* pattern, with large initial increases followed by modest declines, followed by additional increases and modest declines with each subsequent HVE effort. Generally, usage rates stabilized following repeated waves of HVE (e.g., in North Carolina).

Based upon these studies of local HVE efforts, it appears that: a) *sustained* enforcement was as effective as *blitz* enforcement and it was usually associated with less abrupt decay in both enforcement and usage following program completion; b) publicity was essential for program impact, with paid ads associated with greater increases than other forms of media activity, but with earned media (i.e., efforts to generate local news stories) also essential for maximum impact; c) daytime enforcement generally affected daytime usage more than late-night usage, while nighttime enforcement affected late-night usage (sometimes among bar patrons) more than daytime usage; d) nonsanction approaches, where police attempted to increase usage by means of positive messages and gestures rather than with warnings or citations, were generally ineffective; e) checkpoints and/or roadblocks were nearly always associated with large observed impacts; f) median intensity of enforcement was 54 citations per 10,000 residents (range: 20 to 140); g) median intensity of paid media efforts (where reported) was 36¢ per capita (range: 26¢ to 38¢); and h) median awareness of enforcement efforts (where reported) was 49% (range: 10% to 90%).[1]

At the state, regional, and national levels, a 1993 benchmark program implemented in North Carolina was associated with a 16 point increase in observed usage from a baseline of about 63%. Over two waves (7 weeks) of enforcement, this effort included more than 6,000 checkpoints, nearly 60,000 citations (81 per 10,000 residents), and about $600,000 for paid advertising (8¢ per capita). Telephone surveys indicated that 85% of the public were made aware of the enforcement effort. Associated with this program, an estimated 45 deaths and 320 serious injuries were avoided in the first 6 months. Based on this reported impact on deaths and injuries, the total cost savings associated with the program was as high as $115 million during that 6-month period.

Few, if any, state or regional programs have been implemented with the intensity or coordination of this benchmark program, where checkpoints were coordinated and implemented in every county. However, several reasonably intense programs have achieved increases averaging 7 to 9 percentage points. States with higher baseline usage rates generally, but not always, experienced smaller impacts than those with lower baseline rates. This negative relationship between baseline rates and impact partially explains why repeated program implementations successively result in smaller increases in observed usage. Public adaptation to ongoing activity is likely another factor.

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[1]These indices of enforcement and media intensity represent activity levels over the duration of the program, rather than per week or per wave of activity.

A longitudinal examination of observed and Fatality Analysis Reporting System (FARS) rates shows that it is important to view the impact of HVE (and upgrades) over the longer term. Most states that participated in early Selective Traffic Enforcement Program (STEP) demonstrations (i.e., from 2000 to 2002) continued to participate in national Operation ABC and CIOT mobilizations. As a result, these states experienced 5-to 6-year increases that averaged about 15 percentage points. Increases were generally greater in states that also upgraded their laws during this period (median increase of 19 points) than in secondary law states that did not upgrade their laws (median increase of 14 points).

Longer-term trends in usage among crash victims (FARS use) suggest that outcomes in these STEP states resulted in substantial reductions in fatalities, injuries, and costs. A comparison of pre-upgrade and post-upgrade FARS use in three Great Lakes Region states showed increases ranging from 8 points to 13 points. Each of these states implemented multiple waves of HVE and upgraded their SBU laws. These increases in FARS use translated to an estimated *average* annual impact of 70 fewer deaths, 1,000 fewer moderate-to-serious injuries, and cost savings of more than $200 million per year, per state. Each of these states is now focusing on higher-risk occupants.

The effectiveness of sanctions is not as well documented as the effectiveness of laws and HVE. Clearly, initial laws were more effective when sanctions were in effect than when they were not in effect. In addition, early research showed a positive relationship between the magnitude of a fine and usage among crash victims. There is consistent evidence that these relationships between sanctions and impact were greater in primary law states than in secondary law states. Impaired driving studies also suggest a positive relationship between sanctions and impact on fatalities. Thus, while insufficient research has been conducted with regard to the impact of sanctions on SBU, it is likely that *publicized increases in sanctions* would increase the impact of upgrades and HVE efforts.

With current nationwide usage above 80% and with some states achieving observed rates above 90%, concern has been expressed about the potential for additional impact in such states. However, a comparison of *observed* and *FARS* rates suggests that there is capacity for additional gains in all states, particularly with regard to usage among high-risk occupants involved in potentially fatal crashes. These comparisons, along with documented low usage rates among high-risk groups (particularly in alcohol-related crashes), suggest that additional emphasis should be placed on enforcement of safety belt laws during late-night hours and, wherever feasible, in conjunction with enforcement of alcohol-impaired driving laws. This suggestion was offered as early as 1986.

CHAPTER 1

Background

Efforts to increase SBU in the United States began with the introduction of lap belts in a small percentage of vehicles in the 1950s. By 1968, such devices were required in the front seats of all new passenger vehicles. Beginning in the late 1960s and extending into the mid-1980s, however, efforts to increase manual SBU competed with automatic occupant protection efforts, in the form of air bags and automatic safety belts. As a result of these competing efforts, progress in persuading motorists to buckle up may have been curtailed to some extent.

Williams and Lund (1988) point out that rulemaking to require automobile manufacturers to install automatic crash protection was, to some extent, based upon a premise that motorists could not be convinced to buckle up. This approach sought to have automatic devices, such as air bags and/or automatic safety belts, installed that would require no action by occupants of vehicles to buckle up. This rulemaking began in the mid-1960s, with a Notice of Proposed Rulemaking issued in 1970 [Federal Motor Vehicle Safety Standard (FMVSS) 208]. Over the next 15 years, this standard caused substantial controversy. It was debated heavily and delayed or altered several times. In 1981, the rule was cancelled by the National Highway Traffic Safety Administration (NHTSA). The U.S. Supreme Court then ordered that it be reconsidered. The issue was finally resolved by a compromise rule issued by Secretary of Transportation Elizabeth Dole in 1984.

While initial efforts to obtain SBU laws in the 1970s were unsuccessful, a 1976 *Highway Safety Needs Report* found that increasing SBU was the single most effective (and cost-effective) countermeasure that could be deployed to forestall deaths and injuries associated with motor vehicle crashes (U.S. Department of Transportation, 1976).[2] This report was followed in

1977 by a NHTSA project to develop a compendium of known methods for increasing manual SBU[3] and by a series of NHTSA workshops with the states (and its regional offices) in 1979, 1980, and 1981. As a follow-up, a national conference was held in 1982 to consolidate the findings of the workshops and to provide additional impetus to efforts to increase SBU (and reduce alcohol-related deaths).[4]

Unfortunately, increasing SBU proved to be a difficult task, as it took more than 25 years to reach the current national usage rate of just over 80%. Reviews by J. L. Nichols (2002) and by J. H. Hedlund (2006) have suggested that the strongest evidence of impact resulted from a combination of mandatory SBU laws, primary law upgrades,[5] and highly visible enforcement. This combination of activity has been associated with most of the increases in SBU documented since 1983.

However, even at the relatively high rates of observed usage in recent years, many high-risk motorists, including drinking drivers, those on the road during late-night hours, young males, drivers with violations and crashes on their record, and occupants involved in serious crashes still do not buckle up. Future efforts to reduce fatalities and injuries involving

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[2]This study was based upon a combination of state-of-the art information regarding the effectiveness and costs associated with countermeasures along with a Delphi Panel of 103 safety managers, planners, evaluators, and researchers. It found large differences in the costs and potential for reducing deaths and injuries among 37 identified counter-

measures. For example, it reported that the top-ranking countermeasure (mandatory SBU) was 15,000 times more cost effective as the lowest ranking countermeasure (roadway alignment and gradient).

[3]*Safety Belts: The Uncollected Dividends* was a manual including methods for increasing SBU that was developed for NHTSA in 1977 and 1978 by the Highway Safety Research Center of the University of North Carolina. The information in this manual provided the basis for regional safety belt workshops held with the states in 1979.

[4]This conference, held in Detroit, Michigan, in 1982, became the first Lifesavers Conference.

[5]*Primary law upgrades* provide police officers with the authority to stop a vehicle and issue a citation solely on the basis of an observed safety belt violation. Such laws contrast with *secondary safety belt laws,* which require an officer to first observe some other traffic law violation before stopping a motorist for safety belt nonuse.
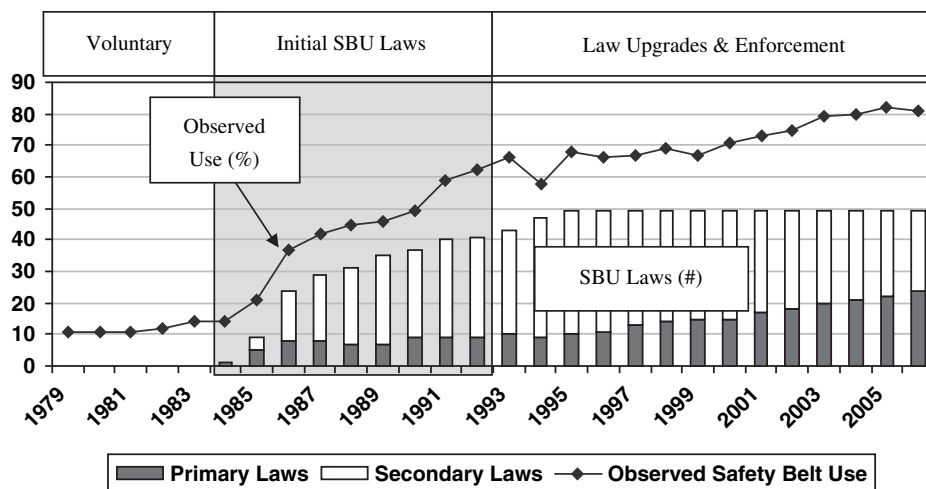
Figure 1. Observed SBU rates in the United States: 1979–2006.[6] Sources: 19 city surveys, aggregate of state surveys, National Occupant Protection Use Survey (NOPUS).

unrestrained occupants will need to focus on such high-risk motorists, particularly at night when many of these high-risk motorists are on the roadway.

Figure 1 shows national SBU in the United States from 1979 through 2006, along with the cumulative number of state SBU laws and the number of primary (standard) enforcement laws in effect during this period. Three time periods are identified, during which national usage increased from less than 15% to more than 80%. They include: 1) a pre-law period, when only voluntary approaches were being pursued; 2) an initial law period, during which most state SBU laws were implemented; and 3) a combined upgrade and enforcement period, during which 18 secondary laws were upgraded to allow for standard/primary enforcement and HVE was implemented to increase usage.[7] As this figure suggests,

legislation and enforcement have been closely associated with increases in observed SBU in the United States.[8]

One objective of this report is to summarize the characteristics and effectiveness of various mandatory approaches to increase SBU, both observed and among fatal crash-involved occupants. Another objective is to relate these findings to the current environment in which many states already have primary laws, most states have been conducting periodic waves of HVE, and some states have observed usage rates above 90%, all in an environment of relatively low penalties. This review begins with the impact of initial SBU laws.[9]

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[6] National usage is estimated using data from a variety of sources including NHTSA's 19-city surveys (1979–1991); a weighted aggregate of statewide survey results (1992–1993), and NHTSA's NOPUS (1994–2006). The number of states with SBU laws is derived from a review of SBU legislation by Nichols and Jones (under review). The number of laws and primary laws in effect excludes those in Puerto Rico (primary law in effect in 1975) and the District of Columbia (secondary law in effect in 1986, primary law in effect in 1997).

[7] Eighteen upgrades were implemented from January 1993 through January 2007. They included: California (1993), Louisiana (1995), Georgia (1996), District of Columbia (1997), Maryland (1997), Oklahoma (1997),

Indiana (1998), Alabama (1999), Michigan (2000), New Jersey (2000), Washington (2002), Delaware (2003), Illinois (2003), Tennessee (2004), South Carolina (2005), Mississippi (2006), Alaska (2006), and Kentucky (2007).

[8] The greater effectiveness of mandatory approaches over voluntary approaches is consistent with the documented experiences of Australia, European nations, and Canada as well.

[9] Hardware approaches, such as safety belt interlock devices; visual and auditory reminder systems; and the improved comfort and convenience of safety belt systems have also played an important role in terms of increasing SBU.

CHAPTER 2

Legislation

As Figure 1 shows, there have been two important phases of safety belt legislative activity in the United States: 1) a period of *initial laws,* occurring primarily from 1984 through 1992, and 2) a period of *primary law upgrades,* beginning in 1993 and continuing to the present time.

Initial Laws (1984–1992)

The first SBU law in the United States was enacted in New York in 1984 and, while nearly all subsequent laws were influenced by the efforts of an automobile industry-funded lobbying organization called Traffic Safety Now (TSN),[10] the New York law resulted from the lobbying efforts of a coalition led by the medical community. The New York law allowed for standard/primary enforcement procedures, whereby an officer could stop a vehicle upon observation of a safety belt violation. However, the second law, enacted in New Jersey in 1985, required that a police officer must first observe another law violation before stopping and/or issuing a ticket for safety belt nonuse. This requirement established a new variable in efforts to increase SBU: the issue of *primary (standard) enforcement laws versus secondary enforcement laws.*

There have been scores of studies of the impact of early SBU laws in terms of increasing SBU among motorists and crash victims and reducing deaths and injuries. Most studies examined laws implemented from 1984 through 1987. Studies of observed usage included several series of statewide probability surveys, such as those conducted in New York (Rood, McCartt, Kraichy and Carman, 1987); in Michigan (Wagenaar and Wiviott, 1986); and in North Carolina (Reinfurt, Campbell, Stewart, and Stutts, 1990). They also included independently conducted, large-scale *convenience surveys*[11] in New York, Illinois, Texas, and New Jersey (Williams, Wells, and Lund, 1987) and a large multistate study of statewide survey results (e.g., Campbell, Stewart, and Campbell, 1987). In addition to these mostly state-based surveys, NHTSA conducted a comprehensive series of observational surveys in 19 U.S. cities from the late 1970s through 1991, to monitor the impact of safety belt laws across the nation.[12]

Overall, these studies indicated that *early* SBU laws were associated with a median increase in usage of about 32 percentage points, from a baseline of 16% to 18% to a post-law rate of just under 50%. Some laws resulted in larger initial increases, to rates above 60%, followed by declines to just under 50%. On the other hand, usage in some states increased more gradually, such as when the implementation of penalties was delayed.

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[10] This action was in response to a compromise solution to the automatic restraint-SBU controversy that had continued in the United States for about 15 years (1969 through 1984). This compromise was issued in a revised FMVSS (FMVSS 208) that required automobile manufacturers to install automatic restraints in all new passenger cars by the 1990 model year, unless two-thirds of the nation's population was covered by mandatory SBU laws by 1989. Such laws had to conform with certain criteria, such as requiring use among drivers and front seat passengers, providing for a minimum fine ($25) and few waivers, providing for prevention and education programs, and requiring that violations could be used to mitigate damages sought by a nonuser injured in a crash.

[11] A *convenience* survey is a survey that is not based upon a probability sample of travel in the jurisdiction examined. Although not probability based, many convenience surveys were extensive and comprehensive in nature, involving several thousand observations at hundreds of sites chosen to represent different driving conditions.

[12] The 19-cities data were collected in a series of studies. Data collected prior to 1983 were from surveys conducted by Opinion Research Corp. and reported by Phillips (1980, 1983). Data collected from 1983 through 1991 were from surveys conducted by Goodell Grivas, Inc. They included the following years of data and reports: 1983 use rates (Perkins, Cynecki, and Goryl, 1984); 1984 use rates (Goryl and Cynecki, 1985); 1985 use rates (Goryl, 1986); 1986 use rates (Goryl and Bowman, 1987); 1987–88 use rates (Bowman and Rounds, 1988 and 1989); and 1989–91 use rates (Datta and Guzek; 1990, 1991, and 1992).

SBU legislative activity appears to have initiated a *time-related effect* that resulted in increased SBU in nonlaw states as well as in law states. This suggestion is based upon an examination of statewide survey data and data from 19 cities, which indicated that the trend was not evident prior to legislation, was greatest during the period of the most intense legislative activity, and subsided when legislative activity declined (Nichols and Jones, under review).

Findings Relevant to Current Efforts to Increase Usage

Relevant to current efforts to increase SBU, early evaluations consistently showed that the impact of *primary (standard) enforcement laws* was greater than that of *secondary enforcement laws,* particularly when enforcement and/or sanctions were in place. Data from the 1987 Campbell report showed a 38-point increase in primary-law states when enforcement and/or sanctions were in place and an increase of just over 20 points under all other conditions (in primary law states *without* a penalty in effect and in secondary law states, *with or without* a penalty in effect). Post-law usage in primary law states was generally 10 to 15 points higher than in secondary law states.

In addition, there is consistent evidence that *initial safety belt laws impacted low-risk motorists* (women, adults, occupants of newer vehicles, daytime motorists, nondrinking drivers, and nonspeeders) to a greater extent than it affected *high-risk* motorists (men, young drivers, occupants of older vehicles, nighttime motorists, drinking drivers, and speeders.) Nearly all studies found post-law usage to be greater among lower-risk groups than among higher-risk groups. In New York, for example, three successive studies found that while bar patrons, young males, and speeding drivers (respectively) increased their SBU following implementation of the state's SBU law, their increases were nearly always smaller than those observed among community controls and/or lower-risk groups (Preusser et al. 1986, 1987, 1988). Further, as a result of the bar patron study, it was suggested that nighttime enforcement of safety belt laws should be considered in order to affect higher-risk drivers. Such efforts would address two priority traffic safety issues, safety belt nonuse and alcohol-impaired driving. Because of greater impact on lower-risk groups than on higher-risk groups, initial laws generally resulted in increased differences (in usage) between these two groups.

Usage Among Crash-Involved Occupants

Similar changes were found among occupants involved in serious crashes. Pre-to-post law comparisons reported by Winnicki (1995) showed that the largest increases in *usage*
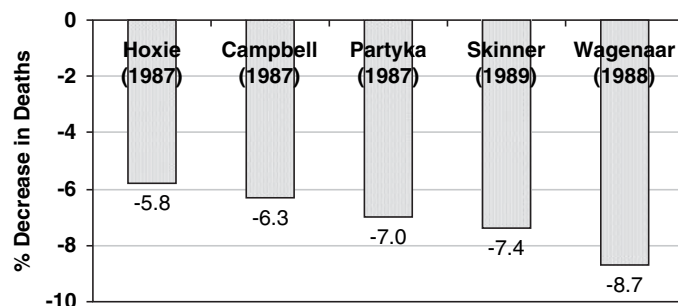
Figure 2. A summary of the impact of early safety belt laws on fatalities: Results of multi-state studies (adapted from Nichols and Jones, under review).

among persons in *potentially fatal crashes* (UPFC)[13] were in primary-law states where enforcement and/or sanctions were in effect within 4 months after law implementation (median increase = 21 points). Regression analyses found SBU laws to be associated with a 29% increase in UPFC, with an additional 13% increase associated with primary laws. As was the case in studies of observed usage, lower-risk groups experienced greater increases than high-risk groups.

Impact on Fatalities and Injuries

The results of individual and multi-state studies showed a median 9% reduction in fatalities and a median 13% reduction in serious injuries associated with initial SBU laws, generally confined to occupants covered by the laws. These findings are based on reviews by the U.S. General Accounting Office (1992) and the Centers for Disease Control and Prevention (CDC) (Dinh-Zarr, Sleet, and Shults, et al., 2001). Results from multistate studies are shown in Figure 2. The median fatality reduction in these larger studies was 7%.

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[13]*Occupants involved in potentially fatal crashes* constitute a hypothetical population that includes an estimated number of *restrained persons who were saved by SBU,* plus those restrained and unrestrained persons who were killed.

UPFC is based on usage among fatally injured occupants of passenger vehicles and the estimated effectiveness of safety belts in reducing fatalities. UPFC is calculated according to the following formula: UPFC = $[u_f / (1-e)]/[(u_f /(1-e) - (1-u_f)]$; where u_f = use among fatally injured occupants (unknowns excluded); and e = the effectiveness of safety belts in reducing fatalities. A second approach for estimating UPFC is to calculate *lives saved,* using the formula (number of restrained deaths × E (effectiveness))/(1 − E); and then calculating *UPFC* as follows: UPFC = (restrained occupants killed + restrained occupants saved)/total occupants involved in potentially fatal crashes (i.e. restrained occupants killed + restrained occupants saved + unrestrained occupants killed).

At the time of Winnicki's study, effectiveness (E) was estimated to be 0.45. Estimates now vary by vehicle type and seating position. Using the 2005 proportions of deaths involving various combinations of vehicle type and seating position, along with estimates of effectiveness for each combination (e.g., car/front = 0.45; car/rear = 0.44; LTV/front = 0.60; LTV rear = 0.73), the overall effectiveness of safety belts was estimated to be 0.52 (see Appendix A).
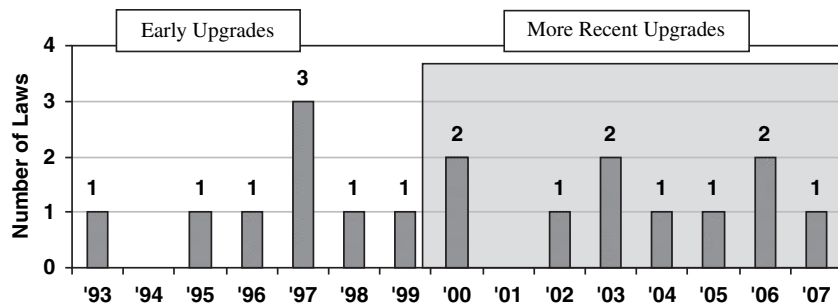
Figure 3. Primary law upgrades implemented by year, from January 1993 through January 2007.[17]

Reductions in deaths were smaller than expected, based upon the magnitude of changes in observed usage and the estimated effectiveness of safety belts in reducing deaths in potentially fatal crashes.[14] Williams and Lund (1988) estimated that, given the change in observed use and the estimated effectiveness of safety belts, reductions should have been about 15%. The smaller-than-expected impacts likely reflected the fact that observed (daytime) usage did not accurately reflect usage among occupants involved in serious crashes.

Several studies have reported that: a) decreases in fatalities were greater in primary law states than in secondary law states [U.S. Government Accounting Office (GAO), 1992, and Dinh-Zarr, Sleet, Shults, et al., 2001]; b) reductions were greater in the first few months following law implementation than in later months (e.g., Skinner and Hoxie, 1989; Skinner, 1989); and c) the impact on fatalities and injuries was greater among low-risk groups than among high-risk groups (Wagenaar and Wiviott, 1986; Williams, Wells, and Lund, 1987; Rood, McCartt, Kraichy, and Carmen, 1987; and Winnicki, 1995).

Primary Law Upgrades (1993–2006)

While informative, the outcomes associated with initial SBU laws are less important today than they were two decades ago. Recent efforts to enact primary-law upgrades are more relevant to current efforts to increase SBU and to reduce the fatalities, injuries, and costs associated with motor vehicle crashes. In spite of the fact that early research showed standard/primary enforcement laws to be more effective than secondary laws, only nine states (and Puerto Rico) had primary laws in effect by the end of 1992. Thirty-two states (and the District of Columbia) required secondary enforcement procedures. This

situation has changed in recent years as upgrades have been implemented in 17 states and the District of Columbia.

Eleven of these upgrades, implemented from January 1993 through January 2007 (see Figure 3),[15] have been evaluated. Table 1 summarizes the results of these evaluations. It shows a 16-point median increase in *observed* SBU. Using only the median outcome from three California studies (+18 points) and one of two identical outcomes for Michigan, the median increase is 15 points.[16] Smaller gains were associated with more recent upgrades (median = 11 points) than with earlier upgrades (median = 16 points), likely associated with higher baselines.

It is important to note that several primary-law upgrades were complemented by intensified enforcement and publicity. The upgrades in Maryland and Oklahoma were preceded and followed by participation in statewide *Chief's Challenge* incentive programs,[18] and nearly all of the recent upgrades were complemented by participation in national *Operation ABC* or CIOT enforcement mobilizations (in Michigan, New Jersey, Washington, Delaware, and Illinois).[19] Thus, in

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[14]Effectiveness at the time was estimated to be 45% (against deaths). Currently, effectiveness is estimated to be 45% among front seat occupants and 44% among rear seat occupants of passenger cars and 60% among front seat occupants and 73% among rear seat occupants of light trucks and vans (LTVs). The 2005 distribution of these vehicle type/seating combinations in potentially fatal crashes was approximately 52%, 5%, 38%, and 5%, respectively (see Appendix A).

[15]These upgrade jurisdictions include: California (1993); Louisiana (1995); Georgia (1996); Maryland, Oklahoma, and the District of Columbia (1997); Indiana (1998); Alabama (1999); Michigan and New Jersey (2000); Washington (2002); Delaware and Illinois (2003); Tennessee (2004); South Carolina (2005); Mississippi and Alaska (2006); and Kentucky (2007).

[16]A comparison of *state-reported observed usage* in the calendar year prior to implementation with usage in the calendar year after implementation for 14 upgrade states (for which such data were available resulted in a median 13-point increase, with pre-2000 upgrades associated with a larger increase than more recent upgrades (medians: 14 points and 11.5 points, respectively).

[17]Note that this figure includes the 1997 upgrade in the District of Columbia.

[18]*Chiefs Challenge* programs were incentive/reward programs to encourage police agencies to participate in intensified, coordinated, and publicized safety belt enforcement efforts.

[19]*Operation ABC* and CIOT mobilizations were coordinated enforcement and publicity programs organized by the Air Bag and Seat Belt Safety Campaign (ABSBSC), NHTSA, and State Offices of Highway Safety. These mobilizations, originally implemented in May and November of each year and more recently only in May of each year, resulted in increased citations for safety belt violations; significant increases in public awareness of SBU, laws, and enforcement; and increases in observed usage.

Table 1. Change in observed SBU rates associated with primary law upgrades: Outcomes from 10 studies and reports, ordered by magnitude of effect (from Nichols and Jones, under review).

Chg. Rank	Primary Author (Year)	State	Baseline (%)	Postlaw (%)	Change (Points)	Sample (Time Period)
1	Lange (1998)	CA ('93)	73	96	+23	2 cities (4 yr)
2	Solomon (2001)	MD ('97)	72	92	+20	3 counties (2 yr)
3	Chaudhary (under review)	AL ('99)	52	71	+19	Statewide (2 yr)
4	Ulmer (1994)	CA ('93)	58	76	+18	6 cities (1 yr)
5	IIHS (1993)	CA ('93)	53	70	+17	5 cities (1 yr)
6.5	Preusser (1997)	LA ('95)	52	68	+16	5 cities (21 mo)
6.5	Solomon (2001)	OK ('97)	53	69	+16	3 counties (2 yr)
8	Chaudhary (under review)	NJ ('00)	63	78	+15	Statewide (2 yr)
9.5	Eby (2001)	MI ('00)	65/70	82	+12/+17	Statewide (2 yr)[1]
9.5	Chaudhary (under review)	MI ('00)	65/70	82	+12+17	Statewide (2 yr)[1]
11	Solomon (2001)	DC ('97)	67	80	+13	Subsample (2 yr)
12	Salzberg (2004)	WA ('02)	83	95	+12	Statewide (2 yr)
13	Illinois DOT (2004)	IL ('03)	76	86	+10	Statewide (2 yr)
14	Ulmer (1997)	GA ('96)	64	72	+4/+8	5 cities (20 mo)
Median Change +16 points						

[1] Note: Data for both Michigan studies come from surveys conducted by Eby et al.; official rates for two pre-upgrade years were 70%, but a survey conducted just before the upgrade found a rate of 65%.

at least half of these jurisdictions, changes in usage were associated with the upgrades *in combination with* highly visible enforcement. However, increases in usage in years immediately preceding these law changes were nearly always smaller than in postupgrade years, suggesting that the law changes were important factors in the acceleration of usage gains.

Another important finding is that primary law upgrades frequently impacted high-risk groups as much as (or more than) lower-risk groups. The impact on young males, occupants of pickup trucks, rural motorists, minority groups, and drinking drivers was frequently as great as (and sometimes greater than) on less risky occupants. Thus, while initial laws nearly always increased the usage gap between low-risk and high-risk groups, upgrades often decreased that gap.[20]

Impact on UPFC

Consistent with the above findings, primary law upgrades have nearly always resulted in significant increases in usage

among occupants killed (FARS use) and UPFC. Table 2 shows an average 8-point increase (in both measures) associated with 14 upgrades.[21] Increases following more recent upgrades[22] were slightly greater (+10 points among victims) than those following earlier upgrades (+7 points among victims).[23] Average changes in UPFC for recent and early upgrades were 9 points (see Figure 4) and 8 points, respectively.

Impact on Deaths, Injuries, and Associated Costs (based on UPFC)

Based upon changes in UPFC and the estimated effectiveness of safety belts against deaths and injuries (by vehicle type and seating position), it is possible to estimate the impact of law upgrades on these outcomes. Further, based upon ratios of serious injuries to deaths, nationally and in individual

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[20]Following our initial review, a study of law upgrades found an impact on nighttime usage as well as on daytime usage. In Michigan and New Jersey, the impact was greatest on nighttime usage (Masten, 2007). A study by Voas et al. (in press) reports similar findings with regard to greater impact on usage among drinking drivers than among nondrinking drivers in some states (e.g., in California, Michigan, and Washington).

[21]It is not clear why Maryland and the District of Columbia did not experience larger immediate increases associated with their laws. However, Maryland had the highest baseline rate of any upgrade state and UPFC increased in subsequent years in both jurisdictions.

[22]"*More recent*" upgrades were implemented after November 1998 (from Alabama through Tennessee).

[23]The average increase for earlier upgrades was largely due to Maryland and the District of Columbia, which had either no increase or a very slight increase. Maryland had the highest baseline usage (among victims and among occupants involved in fatal crashes) of any of the early upgrade jurisdictions.

Table 2. Change in *usage* among occupants *killed* and *involved in potentially fatal crashes:* Calendar year before upgrade to calendar year after upgrade. Source: FARS, 1993–2005 (all numbers rounded to nearest full percentage point).

Jurisdiction	Year Law in Effect	FARS Use Prelaw Year (%)	FARS Use Postlaw Year (%)	Change in FARS Use (points)	UPFC Prelaw Year (%)	UPFC Postlaw Year (%)	Change in UPFC (points)
CA	1993	34	47	+14	51	65	+14
LA	1995	24	36	+12	40	55	+14
GA	1996	28	32	+5	44	50	+5
OK	1997	22	29	+6	37	46	+8
DC	1997	27	28	+1	41	42	+1
MD	1997	53	53	-1	69	69	-1
IN	1998	31	41	+10	48	59	+11
Early Upgrade Ave.	**FARS Use**			**+7**	**UPFC**		**+8**
AL	1999	30	36	+6	47	53	+7
MI	2000	45	53	+8	63	70	+7
NJ	2000	37	41	+5	53	58	+5
WA	2002	45	58	+14	62	74	+12
DE	2003	35	55	+21	51	71	+20
IL	2003	37	48	+11	54	65	+11
TN	2004	35	39	+4	52	57	+5
Recent Upgrade Ave.	**FARS Use**			**+10**	**UPFC**		**+9**
Overall Ave. Changes	**FARS Use**			**+8**	**UPFC**		**+8**

UPFC = (number victims belted + number saved)
(number victims belted + number saved + number victims unbelted
Number Saved = (number victims belted * Effectiveness)
(1-Effectiveness);
Both calculated by vehicle type and seating position (See Appendix A for example)
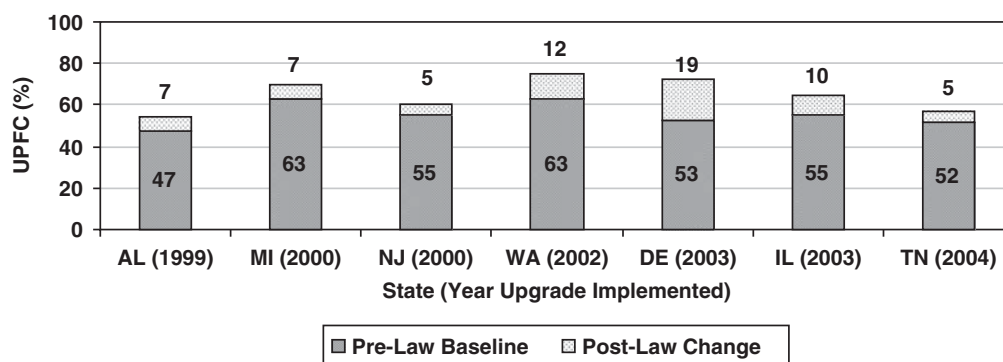
Figure 4. Baselines and changes in usage among UPFC: Seven upgrades implemented since 1999 (change from calendar year prior to upgrade to calendar year after upgrade, based on FARS).

states, and on the findings of studies of the economic costs of crashes,[24] it is possible to estimate the cost savings associated with such interventions.

[24]NHTSA has conducted several studies of the economic costs of crashes. Four such reports provide cost estimates for the following years: *1980* (NHTSA, 1983); *1990* (Blincoe and Faigin, 1992); *1994* (Blincoe, 1996); and *2000* (Blincoe, Seay, Zaloshnja, Miller, Romano, Luchter, and Spicer, 2002).

If changes in SBU are known (observed or among occupants killed), impact on fatalities, injuries, and costs can be estimated using NHTSA's *BELT USE* software, which is part of the agency's *Motor Vehicle Safety (MVS)* software package, available on its Web site (www.nhtsa.dot.gov.people/crash/MVS/). This program translates actual or projected changes in SBU into changes in UPFC (by combinations of vehicle type and seating position) and estimates impact on deaths, injuries, and

Table 3. Estimated impact of seven recent primary law upgrades based on actual changes in SBU among fatal crash victims and on estimates provided by NHTSA's BELT USE software.[25]

State	Baseline Usage Among Fatals (%)	Usage Among Fatals After Upgrade (%)	Deaths Avoided (#)	MAIS 2-5 Injuries Avoided (#)	Savings Assoc. with Deaths Avoided ($ million)	Savings Assoc. with Injuries Avoided MAIS 2-5 ($ million)	Savings Assoc. with Deaths & Injuries Avoided MAIS 2-5 ($ million)
AL	29.9	35.9	40	325	40	40	**80**
MI	45.1	53.3	56	897	69	137	**206**
NJ	36.5	41.3	16	508	24	95	**119**
WA	44.8	58.3	44	958	61	165	**226**
DE	34.8	55.2	12	206	15	33	**48**
IL	37.0	47.6	53	944	66	145	**210**
TN	34.6	39.0	31	354	31	45	**76**
Total	n/a	n/a	252	4,192	$306m	$660m	**$965m**
Ave.	37.5	47.2	36	599	$44m	$94m	**$138m**

costs. Economic savings are based on data from the most recent NHTSA *economic costs* reports.[26]

Table 3 shows that an estimated 252 deaths and 4,192 Maximum Abbreviated Injury Scale (MAIS) 2–5 injuries[27] were prevented in the first full calendar year after implementation in seven recent upgrade states. Based on this approach, there was an estimated 4.9% reduction in deaths and a 6.1% reduction in MAIS 2–5 injuries associated with these upgrades. Cost savings totaled about $965 million (expressed in 2007 dollars), for an average of about $138 million per state.[28] *The estimated savings per death prevented was about $3.8 million* (including the savings associated with about 17 MAIS 2–5 injuries prevented for each death prevented).

Impact Based on Study Results Regarding Upgrades

Studies that have examined the impact of standard/primary law upgrades using time series or other statistical analyses have reported outcomes that have been considerably larger

than those shown in Table 3. Farmer and Williams (2004), for example, found a 7% reduction in *passenger vehicle driver deaths* associated with 10 upgrades that were implemented from 1993 through 2003.[29] They estimated that these upgrades prevented 2,990 driver deaths over an 11-year post-law period. In addition, known ratios of injuries to deaths suggest that nearly 55,000 MAIS 2–5 injuries were prevented.[30]

On an annual basis, Farmer and Williams estimated that 421 *driver deaths* would be prevented annually in these jurisdictions (an average of about 42 per jurisdiction). Again, national injury-to-death ratios suggest that 7,631 serious injuries would also be avoided annually (about 760 per jurisdiction). Reductions of this magnitude translate to approximately $1.8 billion in annual cost savings, or about $180 million per jurisdiction, expressed in terms of 2007 dollars (just over $4 million per death prevented). These savings are roughly 30% greater than the average savings shown in Table 3.

In another study, Chaudhary and Solomon (under review) found a median 8% reduction in *passenger vehicle front-seat*

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[25]Total passenger vehicle fatalities for each baseline year were distributed by vehicle type and by seating position, using the 2003 proportions for each state.

[26]Currently, the data in BELT USE is from 2003 FARS files and economic costs are stated in terms of 2004 dollars. However, available data for any given year can be entered into the program and cost savings can be translated into data for such years (or for 2007) using economic indices such as the Consumer Product Index (CPI), which is available on the Bureau of Labor Statistics (BLS) Web site (www.bls.gov/cpi/).

[27]MAIS stands for Maximum Abbreviated Injury Scale. It classifies injuries on a scale of 1 to 5, with MAIS 1 being a minor injury and MAIS 5 being the most serious injury. Safety belts are most effective in reducing moderate-to-serious injuries and deaths.

[28]In addition to the cost savings associated with deaths and MAIS 2–5 injuries avoided, there was an additional 2.9% in savings associated with minor injuries avoided (MAIS 1), bringing total cost savings to just under $1 billion, or about $142 million per state expressed in 2007 dollars.

[29]The jurisdictions examined by Farmer and Williams included California, Louisiana, Georgia, the District of Columbia, Maryland, Oklahoma, Indiana, Michigan, New Jersey, and Washington.

[30]This estimate is based on data shown in Appendix E, which includes estimates of unit costs for deaths and MAIS 2–5 injuries, as well as the (nationwide) ratio of such injuries to deaths. These estimates are based on data derived from three NHTSA studies of the economic costs of crashes, which provide cost estimates for the following years: *1990* (Blincoe and Faigin, 1992); *1994* (Blincoe, 1996); and *2000* (Blincoe, Seay, Zaloshnja, Miller, Romano, Luchter, and Spicer, 2002). From these reports, estimates of costs and number of injuries per death were derived for the four *base* years and then interpolated for all other years. Given an estimate of deaths prevented (from a reviewed study), the number of MAIS 2–5 injuries and the unit costs for deaths and for MAIS 2–5 injuries were calculated (and adjusted for the greater effectiveness of safety belts against injuries than against deaths). The combined costs per death and associated injuries were then multiplied by the reported number of deaths prevented.

Table 4. Estimated impact of future standard/primary law upgrades based on an estimated 9.7 percentage point increase in usage among fatal crash victims and from outcomes from NHTSA's BELT USE software.[33]

State	Usage Among Fatals in 2005 (%)	Usage Among Fatals After Upgrade (%)	Deaths Avoided (#)	MAIS 2-5 Injuries Avoided (#)	Savings Assoc. with Deaths Avoided ($ m)	Savings Assoc. with Injuries Avoided MAIS 2-5 ($ m)	Savings Assoc. with Deaths & Injuries Avoided MAIS 2-5 ($ m)	Savings Assoc. with Deaths & Injuries Avoided MAIS 1-5 ($ m)
AZ	39.4	49.1	45	561	51.1	79.2	130.4	133.1
AR	32.2	41.9	37	404	33.6	46.0	79.5	81.5
CO	42.9	52.6	30	384	38.9	61.8	100.7	103.0
FL	40.6	50.3	145	2,083	166.8	298.2	465.0	477.1
ID	42.7	52.4	15	134	16.2	18.0	34.2	34.9
KS	32.8	42.5	24	261	26.8	36.3	63.1	64.6
ME*	42.9	52.6	8	122	9.1	17.2	26.3	27.0
MA	32.9	42.6	19	743	30.3	146.3	176.6	183.5
MN	46.6	56.3	27	325	35.2	50.0	87.2	89.2
MO	33.8	43.5	69	870	75.7	118.5	194.1	199.3
MT	26.7	36.4	15	128	15.3	16.0	31.3	32.0
NE	31.9	41.6	17	305	17.7	39.7	57.4	59.1
NV	46.7	56.4	18	253	24.5	41.6	66.1	67.6
NH	30.1	39.8	7	160	9.8	26.6	36.4	37.7
ND	25.0	34.7	7	64	7.4	8.2	15.7	16.0
OH	41.8	51.5	62	1,572	68.3	215.0	282.9	292.2
PA	36.7	46.4	75	1,180	86.1	169.0	254.8	262.3
RI	35.1	44.8	4	98	4.9	16.7	21.6	22.4
SD	26.2	35.9	11	98	11.3	12.8	24.1	24.7
UT	44.6	54.3	16	227	16.0	29.0	45.0	45.9
VT	48.0	57.7	3	16	3.6	2.3	5.9	6.0
VA	34.9	44.6	48	775	58.3	116.6	175.0	180.1
WV	37.8	47.5	19	217	17.3	24.8	42.2	43.2
WI	38.1	47.8	41	617	46.8	86.9	133.7	137.4
WY	34.1	43.8	10	65	11.2	8.9	20.2	20.5
Sum	n/a	n/a	772	11,662	$882 m	$1,687 m	$2,569 m	$2,640 m
Ave	37.0	46.7	31	466	$35 m	$67 m	$103 m	$106 m

* Maine has since enacted a primary law upgrade but no impact data are available.

occupant deaths in three upgrade states (Alabama, Michigan, and New Jersey) from 2000 through 2003. This translated to about 254 deaths prevented in these jurisdictions in 2003, an average of about 85 deaths per jurisdiction. Using state-specific injury-to-death ratios and economic cost estimates from NHTSA's *BELT USE* software, the researchers estimated that nearly 4,000 MAIS 2–5 injuries were also prevented, an average of about 1,350 per jurisdiction, and that the total cost savings was more than $800 million, about $302 million per jurisdiction (in terms of 2007 dollars). This is roughly twice the average annual savings shown in Table 3.[31] However, the average savings per death (and associated injuries) prevented was about $3.6 million, similar to the $3.8 million per death represented by the data shown in Table 3.

Finally, Salzberg and Moffat (2004) reported a 13.4% reduction in motor vehicle occupant deaths during a 12-month

postupgrade period in Washington state. This translated to the prevention of approximately 72 deaths over that period, compared with an estimated 44 deaths prevented using the BELT USE software. Based on a relatively high ratio of injuries to deaths in Washington (about 22:1), it was estimated that, if 72 deaths were prevented, more than 1,500 MAIS 2–5 injuries would also have been prevented during the 12-month period and that savings would have totaled nearly $350 million (in 2007 dollars). This estimate is about 60% greater than the estimated savings shown in Table 3 for the Washington upgrade.[32]

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[32]A fourth study (Voas, Fell, Tippets, and Blackman, et al., in press) reported a median 15% reduction in alcohol-related deaths and a median 5% reduction in non-alcohol-related deaths in five case study states that implemented primary law upgrades. This study found significant impact on usage (and deaths) among drinking drivers, which, in some cases, was greater than the impact on nondrinking drivers. This study supports suggestions in the literature that high-risk motorists are affected by standard/primary law upgrades and it is consistent with the findings of Eby et al. (2002) and Masten (2007).

[33]Total passenger vehicle fatalities in 2005, including unknowns, were distributed by vehicle type and by seating position for the *BELT USE* program.

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[31]These greater savings are due primarily to the larger number of (estimated) deaths prevented, using the time series procedure. However, some of the differences result from the larger average jurisdiction size in the Chaudhary study.

Unlike the situation with initial safety belt laws, where time series analyses generally found lower impact (median: −9%) than would be expected based on changes in usage (about −15%), the few studies of law upgrades have generally found a greater impact on deaths (median: −8%) than would be expected based on changes in usage (median: −4%). The factors associated with this difference are not clear and it could be that additional studies of upgrades will find smaller impacts on deaths.

Potential Impact of Future Upgrades

Of greatest current relevance is the potential impact of future upgrades. Using the median increase in usage among fatally injured occupants in seven recent upgrade states (+9.7 percentage points) and the *BELT USE* program, Table 4 provides estimates of reductions in deaths, injuries, and costs associated with future upgrades. These estimates use 2005 FARS data (disaggregated by vehicle type and seating position) for *baseline* or *current* year status.

These estimates suggest that 772 deaths and 11,662 MAIS 2–5 injuries would be prevented annually if the states included in this list of secondary-law (or no-law) states (as of February 2007) enacted and implemented primary enforcement law upgrades.[34,35]

The estimated savings associated with deaths and MAIS 2–5 injuries prevented would be approximately $2.6 billion per year, or just over $100 million per year, per state (in 2007 dollars). This translates to a savings of about $3.3 million for each death (and about 15 MAIS 2–5 injuries) prevented.

Summary of Legislation

- Studies of legislation have consistently shown increases in SBU and reductions in fatalities, injuries, and costs associated with motor vehicle crashes.

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[34]In all states but New Hampshire, which has no adult SBU law, these law changes would be upgrades from secondary enforcement laws. In New Hampshire, it would be a new law and would likely have an impact greater than the 9.7-point estimate, although there are secondary law states with usage among fatalities that is lower than that in New Hampshire.

[35]In addition to costs associated with deaths and *MAIS 2–5* injuries prevented, the last column of this table shows total estimated savings associated with deaths and *all* injuries prevented (including MAIS 1). Inclusion of minor injuries adds 2% to 3% to the estimated savings involving deaths and MAIS 2–5 injuries.

- Recent *primary law upgrades* appear to impact high-risk groups to a greater extent than did *initial SBU laws.* This may be due to a greater deterrent value of primary law upgrades or it may be due to the fact that upgrades have been implemented at higher baseline usage rates, thus affecting higher-risk occupants.

- On average, *recent* upgrades have been associated with an 11 percentage point increase in observed daytime SBU; a 9.7 point increase in *usage among occupants killed;* and a 9.3 point increase in *UPFC.*

- Based on changes in usage among fatally injured occupants, there was an average 4% to 5% reduction in deaths and a 6% reduction in MAIS 2–5 injuries associated with these law changes. Cost savings associated with such changes would average about $138 million per state, with an estimated savings of about $3.8 million per death (and 17 MAIS 2–5 injuries) prevented.

- Studies of upgrades have reported larger impacts, with a median 7% to 8% reduction in deaths. Annual savings associated with these larger impacts range from $175 million to $350 million per state per year, with savings per death prevented of $3.6 million to $4.2 million (in 2007 dollars).

- Using the more conservative approach, based upon past changes in usage among fatally injured occupants, a current secondary law state that upgraded to allow for primary enforcement would, on average, experience 6% fewer deaths and 7% fewer MAIS 2–5 injuries annually (among passenger vehicle occupants). The *average* estimated savings associated with these reductions would be approximately $2.6 billion per year, or just over $100 million per state per year (in 2007 dollars). These savings translate to about $3.3 million per death prevented (along with approximately 15 MAIS 2–5 injuries prevented).

- The presence of sanctions and enforcement affects the magnitude of impact, particularly in primary law states. With initial laws, there is greater impact when standard enforcement is permitted and when enforcement and/or penalties are in effect. Similarly, with law upgrades, the presence of HVE generally enhances the impact of the law change (*and vice versa*).

- Most studies of the effectiveness of standard/primary law upgrades include the impact of HVE associated with or following such upgrades. Thus, results are associated with the combination of activity.

CHAPTER 3

Enforcement

Canadian Influence

During the 1980s, several Canadian studies showed significant increases in observed usage associated with enforcement. Some of these programs were conducted locally, such as in Ottawa, Ontario (Jonah, Dawson, and Smith, 1982; Jonah and Grant, 1985; and Grant, 1991) and some were conducted at the provincial level, such as in Quebec (Dussault, 1990; Grant, 1991). Nearly all of the programs evaluated were STEPs, periodic waves of intensified enforcement accompanied by publicity to make the public aware of the enforcement. This approach, sometimes called HVE, would come to have an important influence on U.S. efforts to increase SBU.

Daytime STEPs in Ontario

Some of the earliest Canadian studies were conducted in the regional municipality of Ottawa-Carleton (RMOC), Ontario. A series of three studies examined the impact of enforcement waves of varying duration. In the first STEP (4 weeks), usage increased from 58% to 80% (+22 points), then declined to 70% after 6 months (Jonah, Dawson, and Smith, 1982). In a second study (see Figure 5), a series of three STEPS of varying length (1 month, 4 days, and 1 week) increased usage from 66% to 84% (+18 points). Usage declined to some extent between each wave, but then increased to slightly higher levels with each subsequent implementation.[36]

Figure 5 shows the cumulative impact of successive waves of activity. Longer periods of enforcement (4 weeks and 1 week) were reported to be more effective than the shorter period (two waves of 2 days each).

Based on their results, Jonah and Grant suggested that an optimal program might begin with a 4-week enforcement effort, followed by quarterly follow-ups, each involving 1 week of enforcement. They also suggested that higher fines and/or

demerit points may be needed to reach those motorists least likely to buckle up.

A third study, conducted in 1987, found that another 4-week STEP was associated with an 8-point increase in usage, from 79% to 87% (Grant, 1991). Usage increased during daylight hours and in the evening, *but, as Figure 6 shows, this daytime enforcement effort had no effect on drivers leaving drinking establishments late at night (10:00 p.m. to 1:30 a.m.).* Their use remained at about 61%, much lower than that of daytime and evening use.

Nighttime Enforcement in Nova Scotia

Another Canadian study was conducted in Nova Scotia and reported by Malenfant and Van Houten (1988). It involved nighttime enforcement designed to influence patrons leaving drinking establishments in two cities, Moncton and Halifax. Enforcement occurred on Thursday and Friday nights, between 9:00 p.m. and 2:00 a.m. Although checkpoints were conducted near the drinking establishments, only a small proportion of violators received citations.[37] The most prevalent

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[36] A control city, Kingston, was identified for comparison purposes. Usage changed very little in Kingston over the study period.

[37] *Checkpoints* (in this case, *sobriety checkpoints*) constitute an enforcement approach whereby vehicles pass through a designated segment of the roadway and vehicles are stopped according to some predetermined rate or pattern (e.g. every vehicle, every other vehicle, every fifth vehicle, etc.). Drivers of stopped vehicles are observed for evidence of alcohol use and/or impairment. If such evidence exists, a standardized field sobriety test (SFST) may be administered and a breath test may be requested. Failure of such tests would generally result in an arrest for Driving Under the Influence (DUI) of alcohol or other drugs or a violation of an administrative law such as Driving with an Illegal *(per se)* Blood/Breath Alcohol Concentration, or both. *Safety checkpoints* (or safety checks) are similar to sobriety checkpoints, except that stated purpose of the operation is to search for inoperative or malfunctioning safety equipment (e.g., horn, lights, etc.). Proper licensing and registration is also examined and, if there is probable cause, impaired driving laws may be enforced. The term *roadblock* is a more generic term that may refer to either form of checkpoint or to stops made for some other purpose.
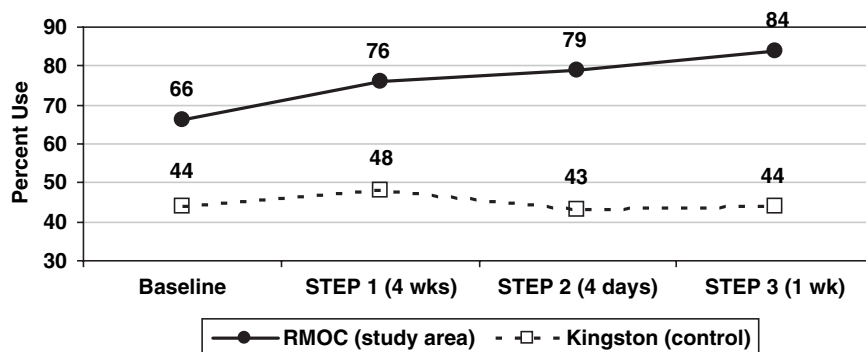
Figure 5. Changes in SBU rates in the regional municipality of Ottawa-Carleton (RMOC), following a series of STEP programs, and in a control city.
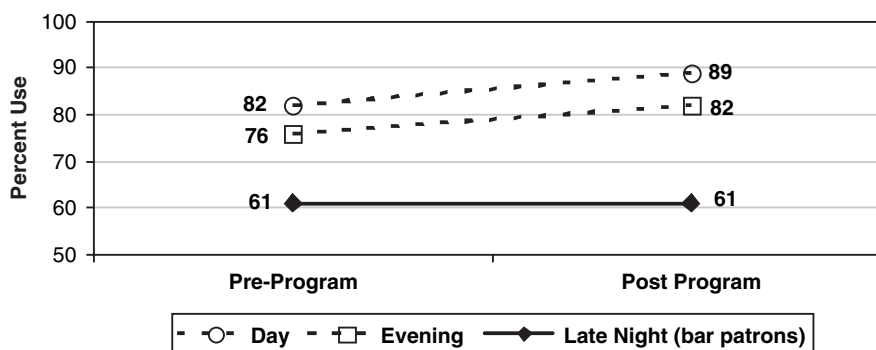
Figure 6. Percent driver daytime and nighttime SBU in RMOC following a 1-month STEP (Source: Grant, 1991).

enforcement action was a verbal warning. Thus, in spite of the use of checkpoints, this was *not* a "*zero tolerance*" enforcement effort. Further, public information was of modest intensity, involving a press release, 20 signs placed in each of the two cities, and posters placed at tavern exits and in shopping malls.

Figure 7 shows that baseline nighttime usage among bar patrons in Halifax (the larger city) was more than 30 points lower than among daytime motorists (54% late night versus 86% daytime). There was less difference in Moncton (58% late night versus 63% daytime).[38] Late-night usage among bar patrons increased substantially during this 4-week nighttime effort (+9 points in Halifax and +16 points in Moncton) and remained elevated after 1 month of follow-up (+8 points in both cities). Just as daytime enforcement in Ottawa did not impact late usage among bar patrons, nighttime enforcement in Halifax did not impact *daytime* usage. In Moncton, with a lower daytime rate, both day and night usage increased.

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[38] Actually, it may be more appropriate to say that baseline daytime usage was much higher in Halifax (86%) than in Moncton (63%) but nighttime usage was relatively low in both cities (54% to 58%). The high daytime rate in Halifax is likely why there was little change in that measure associated with the program.

A STEP and Incentive Program in Quebec

Another Canadian STEP evaluation examined a combined enforcement and incentive program. This month-long effort was implemented in Quebec in 1986 (Dussault, 1990). It involved extensive training of police in every sector of the province; increased ticketing to three to four times that of pre-STEP levels;[39] earned media; approximately $1 million (Canadian) in paid advertising (about 15¢ per capita); and a provincewide incentive program. Small, immediate rewards were given for observed SBU and larger, delayed rewards were provided in the form of entry into a lottery. Figure 8 shows usage increasing from 53% (in 1985) to 86% (in 1987), according to surveys conducted by Transport Canada (+33 points). Subsequent, semiannual STEPs resulted in a 94% usage rate by 1990 (Grant, 1991).

In summary, the early Canadian experience involved extensive use of STEP, "blitz," or "wave" enforcement. Evaluations of these efforts suggested that a) successive waves of enforcement would be needed to sustain usage gains; b) longer periods of blitz enforcement appeared to be more effective than

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[39] The number of citations increased to nearly 1,500 per day or about 67 citations per 10,000 population over a period of 1 month.
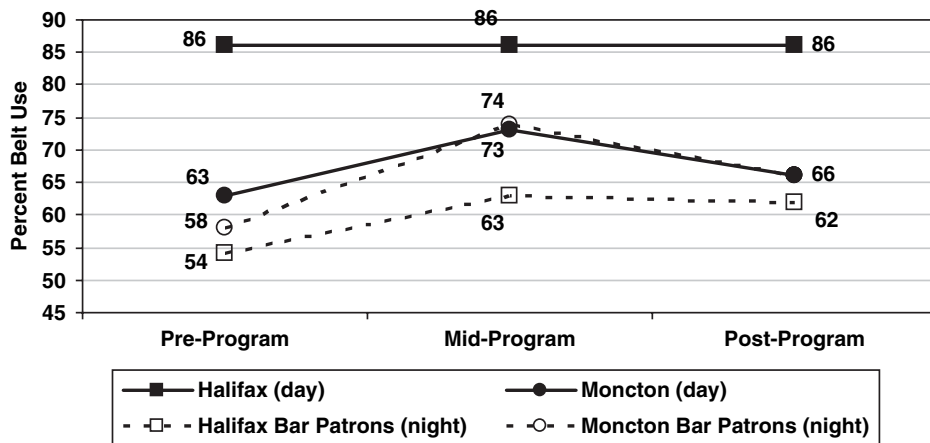
Figure 7. Daytime and nighttime SBU in Halifax and Moncton, Nova Scotia (Source: Malenfant and Van Houten, 1988).
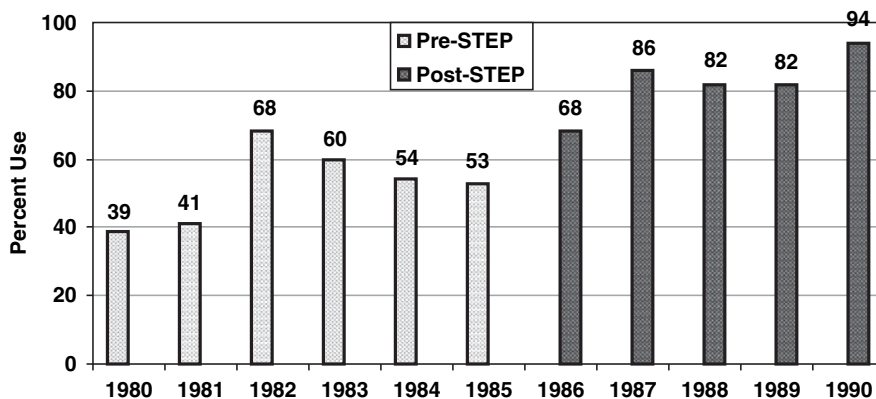
Figure 8. SBU in Quebec, before and after the implementation of STEPs (Sources: Dussault, 1990; Grant, 1991; Transport Canada, 1992).

shorter periods;[40] and c) nighttime enforcement impacted usage among late-night road users, including bar patrons. Based on these results, Canadian officials recommended that each province conduct two STEPs per year and complement such activities with a minimum of $300,000 in paid media per million residents (about 30¢ per capita per year).[41]

Background to U.S. Enforcement Efforts

Very soon after the first SBU laws were enacted in the United States, evidence of the need to enforce such laws began to accumulate. Many states experienced initial postlaw increases in

usage, followed by subsequent declines and stabilization in the absence of enforcement. Further, Campbell (1988) reported a positive relationship between enforcement levels and observed usage in both primary and secondary law states.[42]

In part due to the mix of primary and secondary enforcement laws, a variety of enforcement procedures have been implemented in this country. Such programs varied on dimensions such as periodic versus sustained efforts, use of primary versus secondary enforcement procedures, use of special patrols versus integration of SBU enforcement into regular patrols, issuance of citations versus warnings, extensive publicity versus little or no publicity, and "hard" enforcement messages versus "soft" nonenforcement messages, etc.

Another important variable has been the size and complexity of jurisdictions where the enforcement program was implemented. Early programs were nearly always confined to local areas, later expanding to statewide, regional, and nationwide

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[40]Less that 1 week of enforcement was associated with the smallest impact but there may have been some confounding with order effects (i.e., early waves were associated with greater impact than later waves).
[41]This was in 1992, just 2 years after NHTSA, recognizing a stabilization of usage rates at just below 50%, implemented STEP-like enforcement as part of its national *70% by 1992* program. The Canadian success with STEPs was an important stimulus for this U.S. initiative.

[42]Annual citation rates, as reported in the Campbell report, ranged from 1 to 88 per 10,000 residents.
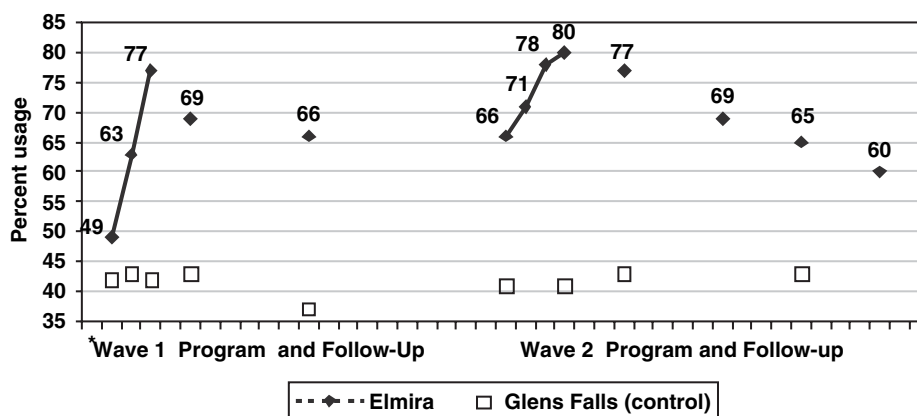
Figure 9. Changes in observed usage in Elmira, New York, following a benchmark local STEP involving two waves of activity (Sources: Williams, Lund, Preusser, and Blomberg, 1987; Williams, Preusser, Blomberg, and Lund, 1987).

efforts. Because of increasing difficulty involved in implementing enforcement and publicity programs in larger and more complex jurisdictions, state and national programs were nearly always implemented with less intensity than local programs.

Local Enforcement

Benchmark: Elmira, New York (1985–1986)

One of the earliest evaluations of a local enforcement program was conducted in Elmira, New York, about 1 year after this first state law was implemented. Influenced by Canadian efforts, the Elmira program quickly became a local *benchmark* for program intensity and impact. The enforcement and media effort constituted two campaigns. The first (Elmira I) was a 3-week effort implemented in November 1985 (Williams, Lund, Preusser, and Blomberg, 1987). It included 1 week of publicity, 1 week of publicity and warnings, and 1 week of publicity and ticketing. The second wave (Elmira II) was implemented as a *reminder* campaign in April 1986 (Williams, Preusser, Blomberg, and Lund, 1987). It consisted of 3 weeks of publicity, combined with checkpoints and extensive warnings, particularly in the final week. Overall, there were many more warnings than citations,[43] and the rate of warnings increased from 140 per 10,000 residents in the first week of enforcement (Elmira I) to 600 per 10,000 residents in the final week (Elmira II). During the first week in which tickets were issued (week 3 of the first campaign), the citation rate was about 143 per 10,000 residents.

About 26¢ to 31¢ per resident (per wave) was spent on paid advertising, which was supplemented by earned (news) media

and extensive distribution of printed materials directly to households. At least 250 ads per 10,000 residents were aired during the first campaign and about twice as many were aired during the second campaign (514 per 10,000 residents). Following the second wave, telephone surveys found that about 40% of Elmira's residents were aware of the program.

The results of these two campaigns are shown in Figure 9. There were large increases in observed usage associated with the intense publicity and enforcement (consisting mostly of warnings). Driver belt use increased by 28 points by the end of the first campaign (+57%), then declined by 8 points after 2 weeks and by 11 points after 2 months, losing nearly 40% of its gain. In spite of this decline, usage remained 17 points (35%) above its baseline. Following the reminder campaign, usage increased by 14 points, reaching 80%, and then declined by 20 points over a period of 8 months. The net gain was 11 points (22%) over the original 49% baseline. Thus, while the gains were substantial, subsequent declines clearly pointed to a need for repeated implementations.[44]

Subsequent Local Programs and Evaluations (1985–1999)

Since the Elmira (I and II) benchmark campaigns, at least 12 studies of local enforcement efforts have examined programs implemented in the following locations:

- **Albany and Greece, New York (1986),** where blitz enforcement was compared with sustained and integrated enforcement. Both cities had modest levels of earned and public service media that appeared to decline over the 5– to

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[43] In fact, over the two waves of the Elmira program, only warnings were issued in 4 of the 5 weeks of enforcement activity.

[44] Both campaigns included a control community that experienced very little change in usage during either campaign.

6–month project period. Baselines: 49%–52%; peak increases: 13 points in Albany (blitz); 17 points in Greece (sustained/integrated) (Rood, Kraichy, and Carmen, 1987).

- **Modesto, California (1986),** where blitz enforcement was adapted to a secondary law state, along with paid, earned, and public service media over a 2-month program, ending with a publicity-only wave. *Baseline: 32%; peak increases: 24 points (daytime), 17 points (nighttime)* (Lund, Stutser, and Fleming, 1989).
- **Austin, Beaumont, Brownsville, Dallas, Laredo, and Tyler, Texas (1988–1990),** where sustained/integrated enforcement was implemented in five cities over a period of about two years. Three, 2-week blitzes were implemented over a period of 8 months in Dallas.[45] Public information consisted primarily of earned and public service media, which declined over time. *Baselines: from 32% in Laredo to 61% in Dallas and 71% in Austin; peak increases: from 7 points in Dallas to 41 points in Laredo* (Mounce, Brackett, and Womack, 1990).
- **Binghamton, New York (1988–1990),** where blitz safety belt enforcement was combined with impaired-driving enforcement. Safety belt checkpoints were conducted during the day and impaired driving checkpoints were conducted at night over a period of about 2 years. Over time, safety belt enforcement changed from mostly warnings to mostly citations and was accompanied by extensive earned and public service media. *Baseline: 46%; peak increases: 16 points (daytime); 24 points (late-night)*[46] (Wells, Preusser, and Williams, 1992).
- **Rantoul and Galesburg, Illinois (1988),** where periodic waves of secondary/integrated enforcement were combined with modest publicity in both cities and with incentives (in Galesburg). *Baselines: 42% in Rantoul, 25% in Galesburg; peak increases: 8 points in Rantoul (enforcement only); 6 points in Galesburg (enforcement and incentives)* (Mortimer, Goldsteen, Armstrong, and Macrina, 1990).
- **Galesburg, Rock Falls/Sterling, and Danville, Illinois (1989),** where 4 months of continuous or sustained safety belt enforcement was integrated into ongoing traffic enforcement activities over a period of 4 months, with apparently modest earned and public service media. *Baselines: 31% in Galesburg, 28% in Rock Falls, 38% in Danville; peak increases: 19 points in Galesburg; 11 points in Danville; 9 points in Rock Falls/Sterling* (Mortimer, 1992).
- **Allegan, Muskegon, and Ottawa Counties in western Michigan (1989–1990),** where continuous safety belt enforcement was integrated into an ongoing traffic law enforcement campaign over a period of about 1 year, with apparently modest public information activity. *Baseline: about 56%; peak increase: 13 points* (Streff, Molnar, and Christoff, 1992).
- **High Point, Elizabeth City, and Haywood County, North Carolina (1993),** where intensive blitzes involving checkpoints, extensive ticketing, and intensive media (public service, earned, and paid) were implemented over a period of 2 months. *Baselines: 78%–79% in Elizabeth City and High Point, 43% in Haywood County; peak increases: 38 points in Haywood County; 13 points in High Point; 10 points in Elizabeth City* (Williams, Hall, Tolbert, and Wells, 1994).
- **Elmira, New York (1999),** where an intensive blitz program involving checkpoints, extensive ticketing, and intensive public service, earned, and paid media, were implemented over a period of 3 weeks. *Baseline: 72%; peak increase: 21 points* (Williams, Wells, McCartt, and Preusser, 2000).
- **Reading, Pennsylvania (2004),** where enforcement included a combination of safety checkpoints and roving patrols conducted at night, using night-vision equipment. In addition, police cars with flashing lights were positioned near signs encouraging seat belt use ("mini-cades"). Although described as "zero tolerance" enforcement, more warnings (225) than citations (42) were given. However, more than 5,500 motorists were contacted via the various enforcement approaches. Publicity was via earned media only with no paid media, but the night-vision equipment generated much media interest. *Baseline: 56% day, 50% night; peak increases: +3 points daytime; +6 points nighttime* (Chaudhary, Alonge, and Preusser, 2005).

Key characteristics of these programs are summarized in Table 5. Following is a general description of results relative to such characteristics.

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[45] The following combinations of enforcement procedures and law type were evaluated:

Elmira (I and II), Albany, Dallas, and Binghamton were examples of *periodic, primary enforcement procedures* used *in primary law states,* with reasonably frequent use of *warnings,* whereas the programs in Elizabeth City, High Point, Haywood County, and Elmira (III) were examples of *primary law enforcement procedures, in primary law states, with a near total focus on issuing citations.*

The programs in *Greece, New York,* and in *five of the six Texas cities* involved *sustained, secondary enforcement procedures,* integrated with other traffic law enforcement, in *primary law states.*

The program in *Modesto, California,* and the initial programs in small *Illinois cities* were *periodic or blitz efforts* implemented in *secondary law states.* The *second group of Illinois demonstrations* and the *Western Michigan* program involved *sustained secondary enforcement procedures (integrated with other traffic law enforcement)* in *secondary law states.*

Of the four jurisdictions where *nonsanction approaches* were implemented, *two were in a secondary law state* (Florida) *and two were in a primary law state (*North Carolina).

[46] In Binghamton, in addition to eight daytime checkpoints for safety belt nonuse, warnings were also issued during 54 nighttime checkpoints focused on impaired driving.

Table 5. Key characteristics of local blitz and integrated enforcement programs.

Location	Year (Prog. Length)	Enf. Type	Program/ Enf. Duration	Tickets/ Warnings	Enf. Weeks	Enf. Rate /10K	Media Type	Media $	Media Rate/ Capita
Elmira, NY I (35,000)	1985 3 wks	Blitz/ Primary[c]	1 wk warn 1 wk tckt	500 warn 189 tckt	1 wk 1 wk	143 warn 54 tckt	Earned + Ads	$9K	26¢ 9¢/wk
Elmira, NY II (35,000)	1986 3 wks	Blitz/ Primary[c]	3 wks of warnings	2,800 warn	3 wks	800 w 267 w/wk	Earned + Ads	$11K	31¢ 10¢/wk
Albany, NY 102,000	1986 (6 mo)	Blitz/ Primary[c]	4 blitzes + integrated	1,440 tckt	6 mo 4 blitz	141 40/wk	Earned + Ads	$0	$0
Greece, NY 98,000	1986 (5.5 mo)	Sustained/ Integrated	5.5 mo. routine patrol	163 tckt	5.5 mo.	17 .7/wk	Earned + Ads	$0	$0
Modesto, CA 160,000 (Co)	1986 (8 wks)	Blitz/ Secondary	1 wk warnings 1 wk tckts	530 warn 209 tckt	1 wk 1 wk	33 warn 13 tckt	Earned + Ads	$52K	33¢ 8¢/wk
Austin, TX 508,000	1988-90 (2+ yrs)	Sustained/ Integrated	2+ yrs (25 hrs/wk)	11,500 t/yr	52/yr (25 hrs)	226/yr 4/wk	Earned + Ads	$0	$0
Beaumont, TX 117,000	1988-89 (19 mo)	Sustained/ Integrated	19 mo (28 hrs/wk)	6,000 t/yr	52/yr (28 hrs)	513/yr 10/wk	Earned + Ads	$0	$0
Brownsville, TX 107,000	1988-89 (21 mo)	Sustained/ Integrated	19 mo (24 hrs/wk)	6,000 t/yr	52/yr (24 hrs)	561/yr 11/wk	Earned + Ads	$0	$0
Dallas, TX 1,060,000	1988-89 (12 mo)	Blitz/ Primary[c]	(3 blitzes) 2 wks each	6,600 tckt	6 wks	62/6 wks 10/wk	Earned + Ads	$0	$0
Laredo, TX 117,000	1988-90 (2+ yrs)	Sustained/ Integrated	(3 yrs) (39 hrs/wk)	6,000 t/yr	52/yr (39 hrs)	513/yr 10/wk	Earned + Ads	$0	$0
Tyler, TX 82,000	1988-90 (2+ yrs)	Sustained/ Integrated	(3 yrs) (36 hrs/wk)	n/a	52/yr (36 hrs)	n/a	Earned + Ads	$0	$0
Binghamton, NY 56,000	1988-90 (2 yrs)	Blitz/ Primary[c]	(2 yrs) 6 sets (waves)	5000 warn 864 tckt	6 sets (waves)	893 wrn 154 tckt 26/set	Earned + Ads	"small" amount	n/a
Rantoul, IL 18,000	1988? (8 wks)	Blitz/ Secondary	2 x 2 wks = 4 wks	35% of all violations	4 wks	35% of all viol.	Earned + Ads	?	?
Galesburg, IL 34,000	1988? (8 wks)	Blitz/ Secondary	2 x 2 wks = 4 wks	33% of all violations	4 wks	33% of all viol.	Earned + Ads	?	?
Rock Falls, IL 25,000	1989 (4 mo)	Sustained/ Integrated	4 mo (40 hrs/wk)	30% of all violations	4 mo (40 hrs/wk)	30% of all viol.	Earned + Ads	?	?
Galesburg, IL 30,000	1989 (4 mo)	Sustained/ Integrated	4 mo (40 hrs/wk)	30% of all violations	4 mo (40 hrs/wk)	30% of all viol.	Earned + Ads	$0	$0
Danville, IL 35,000	1989 (4 mo)	Sustained/ Integrated	4 mo (40hrs/wk)	22% of all violations	4 mo (40 hrs/wk)	22% of all viol.	Earned + Ads	$0	$0
Western MI 500,000 (3 Co)	1989 (11 mo)	Sustained/ Integrated	11 mo (140 hrs/ mo)	2,635 t+w (60 tckts/ 100 speed tckts)	11 mo (140 hrs/ month)	53 (t+w) 1 (t+w) per wk	Earned No ads?	$0	$0
Escambia/ Santa Rosa, FL 240,000	1989 (3 mo)	Sustained/ Integrated/ no sanction	3 mo (no sanction)	39 tckts per mo	3 mo	2/mo 0.4/wk	Earned + Ads	$0	$0
Hernando/ Pasco Co, FL 380,000	1989 (3 mo)	Sustained/ Integrated/ no sanction	3 mo (no sanction)	148 tckt per mo	3 mo	n/a 4/mo 1/wk	Earned + Ads	$0	$0
Albemarle, NC 16,000	1989 (7 mo)	Sustained/ Integrated/ no sanction	7 mo (no sanction)	n/a Mostly Warnings	7 mo	n/a mostly warn	Earned + Ads	$0	$0
Gastonia, NC 60,000	1989 (7 mo)	Sustained/ Integrated/ no sanction	7 mo (no sanction)	Mostly Warnings	7 mo	mostly warn	Earned + Ads	$0	$0
Eliz. City, NC 14,000	1993 (8 wks)	Blitz/ Primary[c]	(4 wks)	450 tckt	(4 wks)	315/4 wk 79/wk	Earned + Ads	$5K	38¢ 8¢/wk
High Point, NC 71,000	1993 (8 wks)	Blitz/ Primary[c]	(4 wks)	650 tckt	(4 wks)	92/4 wk 23/wk	Earned + Ads	$27K	38¢ 8¢/wk
Haywood Co, NC 48,000	1993 (8 wks)	Blitz/ Primary[c]	(4 wks)	1459 tckt	(4 wks)	304/4 wk 76/wk	Earned + Ads	$18K	38¢ 8¢/wk
Elmira, NY 91,000 (Co)	1999 (3 wks)	Blitz/ Primary[c]	(3 wks) (12 da)	474 tckt	12 da	52/12 da 30/wk	Earned + Ads	n/a	n/a
Reading, PA 81,000	2004 (30 da)	Blitz/ Secondry[c]	30 da	42	30 da	5.2/4 wk 1.3/wk	Earned no ads	$0	$0

"K" = 000; "t" or "tckt" = ticket(s); "w" or "warn" = warning(s); "da" = day(s); "viol" = violation(s); "c" superscript = check points
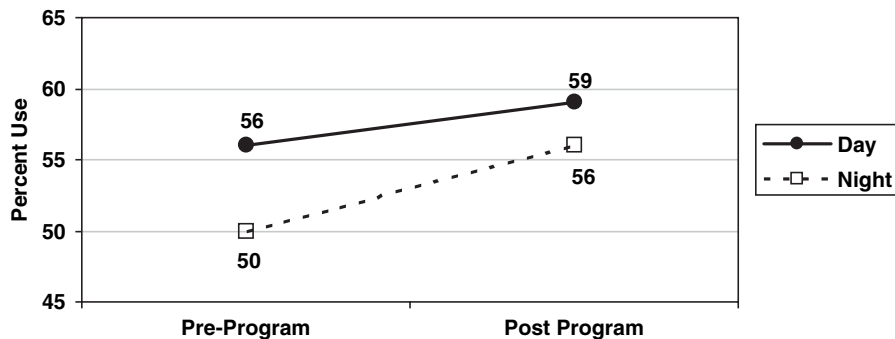
Figure 10. Percent daytime and nighttime SBU in Reading, Pennsylvania, following nighttime enforcement (Source: Chaudhary, Alonge, and Preusser, 2005).

Findings Regarding Various Program Characteristics[47]

Peak Increases.   The *median peak increase* of the 27 outcomes provided by the above studies was about *13 points* (range: −7 points to +41 points). The 31-point gain, from baseline through wave 2 of the benchmark *Elmira* program, was the third largest increase among these outcomes. The largest gain was 41 points, which was associated with the 2-year, sustained and integrated enforcement effort in *Laredo, Texas,* implemented from a very low baseline usage rate of 32%. The second highest increase was a 38-point gain associated with the pilot program implemented in *Haywood County, North Carolina.*

Blitz Versus Sustained Enforcement.   At the local level, sustained or continuous enforcement efforts received as much evaluative attention as blitz efforts. Sustained enforcement, implemented as part of special patrols or as an integrated component of regular patrols, was generally associated with impacts that were comparable to those associated with blitz programs.[48] Comparing 12 blitz outcomes and 14 sustained-program outcomes, *the median peak increase was 13 to 14 points for both approaches.* However, in each of *three comparisons* from similar baselines, *sustained and integrated enforcement programs were associated with modestly higher increases.* These included a Dallas blitz (+6 points), compared with a sustained effort in Austin (+9 points); a Galesburg, Illinois, blitz (+6 points), compared with a subsequent sustained and integrated enforcement in that city (+19 points); and an Albany,

New York, blitz (+13 points), compared with a sustained and integrated effort in Greece, New York (+17 points).

Daytime Versus Nighttime Enforcement.   Most safety belt enforcement programs have been implemented during the day. Such enforcement often impacts daytime and "early evening" usage but it has less often been shown to impact "late-night" usage, particularly among high-risk drivers such as drinking drivers. Daytime STEPs in Ontario, for example, failed to affect late-night usage among bar patrons (Grant, 1991). A combined alcohol and safety belt enforcement program was conducted in Binghamton, New York, that did impact late-night usage (Wells et al., 1992). It consisted of daytime checkpoints to enforce safety belt laws and nighttime checkpoints to enforce impaired driving laws. However, *as part of the nighttime checkpoints, warnings were issued to unbuckled motorists.* Thus, part of the nighttime effort was focused on SBU.

At least two nighttime enforcement programs that were specific to SBU resulted in significant impacts on high-risk, late-night motorists. The Nova Scotia study already described (Malenfant and Van Houten, 1988) affected late-night bar patrons in two cities and a program in Reading, Pennsylvania (Chaudhary et al., 2005) increased usage among late-night motorists in that city. Both programs affected nighttime usage more than daytime usage (see Figures 7 and 10).

Postprogram Decay in Usage and Enforcement.   Generally, there has been evidence of less decay in usage following cessation of sustained/integrated programs than following blitz efforts. Results from eight sustained programs found little or no decay in usage after 2 months, whereas results from six blitz efforts showed a decline of about 30% during similar periods of time. There also have been indications of less abrupt decreases in enforcement following cessation of sustained programs, compared with blitz efforts.[49] These results have come

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[47]These summaries describe the relative magnitude of reported impact of various efforts and categories of efforts. Unless the term "significant" is used to describe a comparison or results, the comparison or result is not the result of a statistical test.

[48]Some caution is advised in interpreting these results as sustained efforts generally involved programs implemented at low baselines and they were generally implemented over longer periods of time than blitz programs.

[49]Evidence of abrupt decreases in enforcement following blitz programs were found in Dallas, Texas, and Albany, New York.

from several locations, including Albany and Greece, New York, six cities of varying size in Texas, and small-to-modest size cities in Illinois. Following their evaluations in Albany and Greece, New York, Rood et al. recommended that programs *begin with blitz procedures* and *then integrate safety belt enforcement into regular patrol activities.* Alternatively, advocates of blitz programs have recommended repeated blitz efforts to sustain and increase gains in usage.[50]

Nonsanction Enforcement. Some enforcement programs have focused on *nonsanction* approaches, employing positive reminders by police officers to buckle up and little or no issuance of warnings or citations. Examples of such programs were found in four Florida counties (Kaye et al., 1995) and two North Carolina cities (Hunter et al., 1993). The key enforcement activity in each of these programs involved police officers giving a "*thumbs up*" gesture to motorists to remind them to buckle up.[51] Although some programs were accompanied by substantial amounts of earned and public service media, they generally were not associated with significant increases in usage. The median change associated with these four nonsanction programs was +3 points (range: −7 points to +8 points, from similar baselines of about 50% usage). Although their impact was small in every case, there were indications in both Florida and North Carolina that such approaches *may* have more potential in smaller, less complex media markets than in larger and more complex markets.[52]

The issuance of *warnings* versus *citations* is another aspect of the *nonsanction* issue. Several programs, including the benchmark Elmira (I and II) programs focused more on warnings than on the issuance of citations. While adequate comparisons of impact have not been documented, most programs that began with an emphasis on warnings eventually shifted to a focus on citations. Examples include Modesto, California, Binghamton, New York, and Elmira III (compared with Elmira I and II).

Paid Media. Paid media was generally associated with substantial increases in observed usage (median gain = 16 points).

Examples of such increases were found in the Elmira blitzes, in the combined driving under the influence (DUI)/safety belt effort in Binghamton, New York, and in the three North Carolina pilot programs. Where information was provided, spending on paid media ranged from 26¢ per capita (in Elmira) to 37¢ per capita (in the North Carolina pilot studies), or about 8¢ to 10¢ per capita *per week* of paid media.

Earned and Public Service Media. Publicity efforts involving earned media, public service ads, or both were part of nearly every program evaluated, albeit to varying degrees. In several studies, including those conducted in New York (Rood et al., 1987) and Texas (Mounce et al., 1990), evaluators reported that programs relying on earned (i.e., news) media experienced initial interest that declined rapidly as the program continued.[53] In the Florida and North Carolina nonsanction programs, earned and public service media, along with the distribution of educational materials, were more visible in smaller, less complex media markets than in larger, more complex markets. The median increase for programs that depended *solely* on earned and public service media (i.e., those with no paid media) was about nine points (range: −7 to +41).

In spite of limitations when used alone, earned media has proven to be an important component of HVE efforts. Evidence of *intensive earned media coverage* was found in all three Elmira blitz programs and in the three North Carolina pilot blitzes. All six programs were among the most effective implemented.

Enforcement accompanied by little or no media was generally associated with smaller increases in usage than programs with intense publicity. Two examples included the nonsanction programs conducted in larger jurisdictions in Florida and North Carolina. However, perhaps the best example was reported for the comparison city (Tonawanda) in the New York demonstrations. There was a substantial increase in ticketing in Tonawanda both during and after the study period. In fact, citation rates were greater in Tonawanda than in one of the study communities. Without publicity, however, there was no measured increase in usage (Rood et al., 1987).

Feedback Signs. One unique form of public information involves the use of feedback signs to inform motorists of levels and changes in SBU and enforcement efforts. Feedback signs were evaluated in two North Carolina cities in 1985 (Asheboro: population 18,000, and Greensboro: population 180,000) and reported by Malenfant, Wells, Van Houten, and Williams (1996). Results suggest that these signs were associated with increases in usage from 75% to 89% in Asheboro, the smaller city (+11 points). However, impact was more modest in

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[50]It should be remembered that the above results come from evaluations of *local* programs, most of which were implemented in *small jurisdictions* and from relatively *low baselines,* compared with current rates of usage. Also, it should be noted that it is more difficult to implement a statewide, rather than a local, *sustained* enforcement effort that is of sufficient intensity to impact usage. As a result, there are few examples of sustained/integrated enforcement programs implemented at the statewide level. One exception may be provided by California, which historically reported relatively high levels of sustained enforcement activity.

[51]The "thumbs up" gesture involved a police officer tugging on his safety belt with his thumb to remind unbuckled motorists to buckle up.

[52]This finding of greater potential for impact in smaller, less complex environments likely holds for the use of incentives (Hunter et al., 1993) and feedback signs (Malenfant et al., 1996) in conjunction with enforcement programs as well.

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[53]This decline in interest on the part of the news media is a key reason why a paid media component is currently considered to be critical to the success of enforcement efforts.

Greensboro, the larger city, where usage increased from 80% to 86% (+6 points). Feedback signs were also used in the 1999 Elmira "Buckle Up Now!" program, where usage increased from 69% to 90% (+21 points), but these signs constituted only one of several components of an intense enforcement and publicity program. As with earned media, incentives, and nonsanction approaches, the use of feedback signs appears to be most effectively implemented in smaller, less complex media markets and jurisdictions.

Checkpoints and Roadblocks. As was the case with paid media, *checkpoints and roadblocks*[54] were generally associated with greater impact than other enforcement approaches. The median increase among programs using checkpoints or similar programs (excluding nonsanction programs) was 15 points, with a range of +8 points to +38 points.[55] By comparison, programs that did not use such techniques had a median increase of about nine points (range: −7 to +41 points). Williams et al. (1994) pointed out that checkpoints were a key factor in the 38-point increase in Haywood County, North Carolina, one of the largest impacts found in this review.

Intensity Measures. It is difficult to compare enforcement levels from one project to another, particularly with regard to blitz and sustained efforts. Rates of ticketing in STEPs are usually reported only for the period during which the enforcement is intensified (usually 2 to 4 weeks). Rates of ticketing for sustained programs, on the other hand, are usually reported for the entire program period (ranging from 4 to 5 months to 2+ years). Overall, the weekly rate of ticketing per 10,000 residents varied from near zero (in nonsanction sites) to 79 in Elizabeth City, North Carolina, with a median of about 10 tickets per 10,000 residents per week. Looking only at blitz efforts, the median rate during the blitz periods was the benchmark rate of 54 tickets per 10,000 residents (1 week) issued during the Elmira I program (range: 20 to 140).[56]

Summary of Local Program Results

Overall, local program findings are summarized as follows:

- The largest peak effect size was 41 points, with a median increase of 13 points.
- Sustained programs had impacts that were at least comparable to those of blitz programs and they were associated with less postprogram decay.
- In spite of postprogram decay, it is possible to sustain impact over long periods of time by repeated program implementations.
- Checkpoints, roadblocks, and other HVE efforts were generally associated with some of the larger increases in observed use.
- Enforcement accompanied by high levels of publicity was most effective.
- Paid media helps to counter waning media interest over time and, as such, was generally associated with larger impacts on usage.
- The use of feedback signs facilitated enforcement and publicity efforts, particularly in smaller, less complex jurisdictions.
- Nonsanction enforcement approaches generally were not effective.
- Incentive programs were shown to have some potential for sustaining (and possibly adding to) the impact of enforcement efforts (at low usage rates).
- Median levels for various indices of media and enforcement were as follows:[57]
    a. The median *citation rate in blitz programs* was about 30 citations per 10,000 residents per week (Elmira III),

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[54] In this category, the researchers also include the practice of officers stationed at signalized intersections for the purpose of issuing warnings or citations for safety belt violations.

[55] Checkpoints or roadblocks were used in Elmira, New York; in the three North Carolina pilots; and in blitz efforts conducted in Albany and Binghamton, New York. The approach used in Dallas, Texas (police situated at intersections and observing for violations) was also included in this category because of its visibility.

[56] This weekly rate of ticketing is just one way of looking at intensity. In Elmira this rate was achieved in a program where there was only 1 week of ticketing; other programs may have issued tickets at a slightly lower rate over a period of several weeks. The total number of persons cited (per 10,000) *may* be a more relevant index of intensity when enforcement efforts are contiguous.

[57] Median values vary, depending on how waves of activity are counted and how warnings are viewed. In Elmira, New York, one could consider the two waves of activity as a single activity or as two separate activities. Because these two waves were separated by nearly 5 months, they were viewed as separate activities. It may be most relevant to view contiguous enforcement efforts as a single activity and to view noncontiguous efforts that are separated by time as separate activities. In spite of these definitional issues, median values were *relatively* robust as indicators of intensity. One exception is found in the Elmira I and II projects where *road checks, combined with warnings,* constituted the main enforcement activity. Because of their visibility (i.e., road checks plus 3,000 warnings in Elmira II), the intensity of this effort is underestimated by the zero citation rate assigned to it. While warnings are not as effective as citations, they do not have zero deterrence value, particularly when used in conjunction with road checks. If a warning had been assigned the same value as a citation, Elmira II would have had the highest intensity (286 actions per 10,000 residents per week) and Elmira I would have the third highest rate (98 actions per 10,000 residents per week). The median level of intensity would then be 76 citations per 10,000 residents per week.

ranging from zero (Elmira II—with warnings only) to 79 (Elizabeth City, North Carolina).

b. *Enforcement in secondary law states* was sometimes measured in terms of the safety belt proportion of total citations. The median of this index was 32%, with a range of 22% (Danville, Illinois) to 35% (Galesburg, Illinois).

c. The median *expenditure for paid media* was about 36¢ per resident (overall program), with a range of 26¢ (Elmira I) to 38¢ (North Carolina pilots).[58] Expressed as per capita, per week, the median rate was 8¢.

d. The median *awareness of enforcement* level was 49% (Albany, New York), ranging from 10% (Greece, New York) to 90% (Elmira III).

Statewide, Regional, and National Enforcement Programs

Local demonstrations provide an opportunity to implement relatively intense enforcement and media efforts, using different combinations, intensities, and patterns of enforcement and publicity. However, the most relevant results for states attempting to increase usage likely come from studies of programs that have been implemented statewide. It is here that the greatest potential exists for affecting usage among large populations, even though local programs are likely to be more *fully implemented*. Following are descriptions of an initial benchmark program, followed by subsequent statewide, regional, and national efforts. Most of the recent examples of statewide STEP programs come from participation in Operation ABC and national CIOT mobilizations implemented since 1997.

Benchmark: North Carolina (1993–1994)

Background. Beginning in 1993, the State of North Carolina initiated a series of statewide efforts to increase SBU. This program, called CIOT, was implemented about 8 years after North Carolina enacted its primary SBU law (1985) and experienced increases in usage that eventually stabilized at 60% to 65%. Early enforcement efforts had been implemented in 1987 and those efforts resulted in significant increases in usage (Reinfurt, Campbell, Stewart, and Stutts, 1990). In addition, nonsanction approaches had been implemented in Albemarle and Gastonia in 1989, with little measured impact (Hunter, Stewart, Stutts, and Marchetti, 1993). In 1993, just prior to the statewide CIOT program, three intensive pilot blitzes were conducted in Elizabeth City, Haywood

County, and High Point. These pilot programs were accompanied by large and significant increases in observed usage, with gains ranging from 10 to 38 percentage points (Williams, Hall, Tolbert, and Wells, 1994).

Program Characteristics. The statewide CIOT program was planned as a 5-year effort that began with two waves of enforcement and media activity in November 1993 and July 1994 (Williams, Reinfurt, and Wells, 1996). This was one of the first statewide applications of the STEP model in the United States and it was implemented with great intensity. The waves of activity were 8 weeks and 7 weeks in duration, respectively. The first included four phases: 1) an initial 2 weeks of public information; 2) 3 weeks of blitz enforcement using both checkpoints and roving patrols; 3) 2 weeks with no enforcement; and 4) intensified enforcement in the final week. Throughout this period there was extensive paid, earned, and public service media, featuring local police officers and the CIOT slogan. As in Elmira, the second wave was intended as a "booster." It was similar in design to the first wave except that it entailed only 3 weeks of enforcement, rather than 4.

Intensity. Over the two waves, more than 6,300 checkpoints were implemented and nearly 59,000 citations were issued for safety belt violations, about 81 citations per 10,000 residents over 7 weeks. A total of $600,000 was spent on paid advertising, about 8¢ per resident over the 15 weeks covered by the two waves. This expenditure resulted in just over 7,100 ads placed during the 15 weeks, about 10 per 10,000 residents. The spring 1994 wave, which was intended as a reminder, was somewhat less intense in terms of citations, paid media, and ads.

Impact. As a result of this statewide effort, combined driver and passenger usage increased from 63% to 79% during the first wave (+16 points), then declined by 7 points to 72%, losing about 40% of its gain. Following the second wave, usage increased by 7 points, reaching its previous peak of 79% (see Figure 11).

One often-missed aspect of this program is that *it was periodically repeated over a 5-year* period. As a result, statewide usage rates in North Carolina, which increased by 15 percentage points within a period of several weeks, stabilized at about 80%, 15 points above its preprogram baseline. Statewide usage remained at about that level through 2000, after which it began to increase again, likely associated with North Carolina's participation in national *Operation ABC* and CIOT mobilizations. As of 2006, the North Carolina usage rate was 89%.

Statewide Demonstration Programs (1993–1999)

Following the benchmark CIOT program implemented in North Carolina and prior to 2000, when paid media efforts

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[58] The amount spent on paid media in the three North Carolina pilots ($50,000) was distributed across sites by population. It is not known if that is the exact proportion spent in each site.
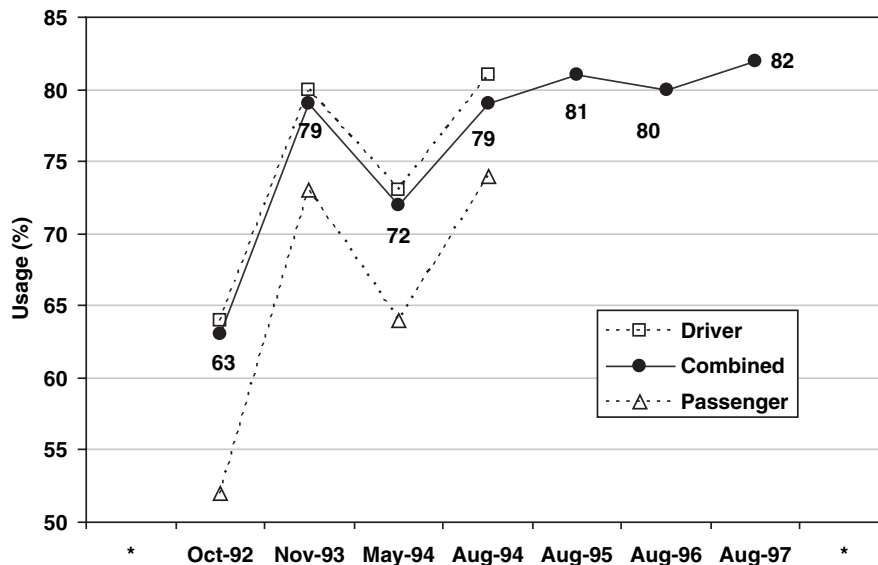
Figure 11. SBU in North Carolina: Before and after implementation of a 5-year CIOT enforcement program [Sources: Williams, Reinfurt, and Wells, 1996 (1992–1994) and annual usage rates reported to NHTSA (1995–1997)].

were introduced to Operation ABC mobilization efforts, there were a number of demonstrations funded to emulate the North Carolina program. These efforts, called Occupant Protection Special Traffic Enforcement Programs (OP-sTEP) were implemented with relatively modest levels of funding. They included:

- *Five statewide* OP-sTEPs[59] funded by NHTSA in 1993 and 1994, and
- *An expanded series of 20 OP-sTEPs* implemented from 1995 through 1998 and funded by NHTSA, with supplemental funding from the private sector.

OP-sTEP Demonstrations in Five States (1993–1995). An initial series of OP-sTEP programs were funded by NHTSA, beginning in 1993. Approximately $1.5 million in federal funds, $125,000 in private sector funds,[60] and $1.03 million in state funds were identified to conduct two to three sTEP waves per year. These were conducted initially in New Mexico, Oregon, South Carolina, Washington, and Vermont.[61] Each wave was to consist of 10 to 14 days of intensified enforcement accompanied by public service and earned media efforts. No

funds were provided for paid media. Police agency participation was obtained by providing overtime and/or officer and agency incentives. Former police officers, known as Operation BuckleDown (OBD) Spokespersons, were used as liaisons to contact agencies within their state and persuade them to participate. These funds, incentives, and liaison activities resulted in programs of modest intensity in comparison with the intense North Carolina program.

Results. On average, two to three waves of enforcement were conducted in each state, with a median rate of about four citations per 10,000 residents per week (range: 2 to 21 citations). No estimates of the intensity of public information activities were provided and no paid media was involved. About 45% of the police agencies in each state participated in these sTEPs (range: 30% to 71%). Usage increased by an average of about four percentage points from 1993 to 1994 (range: 3 to 5 points).[62] (NHTSA, 1995).

Expanded OP-sTEP Demonstrations (1996–1999). In conjunction with a new initiative called *Campaign Safe and Sober,* NHTSA expanded the OP-sTEP grant program to about 20 states from 1995 through 1998. Approximately $5.5 million in federal (Section 403)[63] funding was provided, along with

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[59]The acronym STEP, which originally referenced *Selective* Traffic Enforcement Programs used in several areas of traffic safety (e.g., speed, impaired driving, etc.), was modified to OP-sTEP to refer to *Special Traffic Enforcement Programs* focused on *Occupant Protection.*

[60]The Automotive Coalition for Traffic Safety, an auto industry-funded organization, provided $125,000 to these states to spend on the development and distribution of materials to support their enforcement efforts.

[61]Indiana was later included as a sixth state funded under this program.

[62]In Vermont, the increase was 14 points but a portion of that increase (9 points) was attributed to implementation of its safety belt law (from a baseline rate of 54%).

[63]Section 403 refers to that section of the Highway Safety Authorization (U.S.C. 23) that provides for funding for research and demonstration efforts. Another section of the Highway Safety Act, Section 402, provides funding for state and local programs.
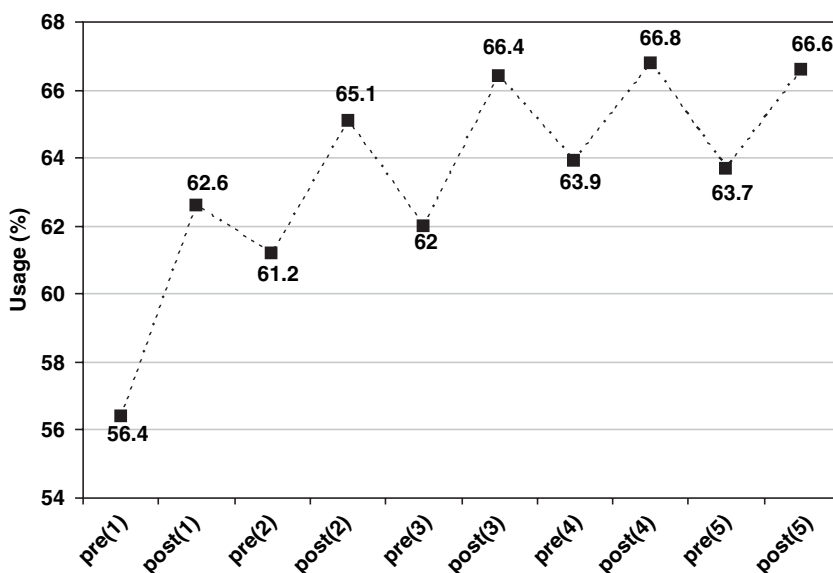
Figure 12. Changes in SBU in States Participating in OP-sTEP Demonstration Programs (Solomon, Nissen, and Preusser, 1999).

approximately $6 million in private sector funds.[64] Section 402 funding provided by states *may have* approximated the Section 403 funds. As with the initial OP-sTEPs, states were required to conduct waves of intensified enforcement, accompanied by earned and public service media.

An evaluation of this program was conducted by Solomon, Nissen, and Preusser (1999), using quarterly reports provided by grantee states.[65] Based upon this state-reported information, the median citation rate per 3-month period was about five citations per 10,000 residents (range: <1 to 43).[66] Another measure of enforcement intensity was *the safety belt proportion of total citations issued,* a measure frequently used in secondary law states. Safety belt violations accounted for about *22% of total citations,* compared with 32% for speeding and 3% for alcohol-impaired driving, somewhat lower than the 33% median rate reported for local programs where this measure was used. Only qualitative data were provided regarding the level and type of public information activity, which typically consisted of a combination of public service and earned media activities.

Results. Figure 12 shows results from preprogram and postprogram observations. It suggests a *step-like* or *ratcheting*

effect associated with successive waves of activity, with usage increasing with enforcement and publicity and then declining prior to the start of the next wave. There was an average gain of about 7 points after two waves of activity and a peak gain of about 10 points after three or more waves. Gains diminished after three to four waves. Solomon suggested that the states may have reached a "ceiling" at this point. It also is possible that the intensity of enforcement and media declined over time or that, following repeated implementations, greater intensity was needed to retain public awareness. Several local studies of blitz and sustained enforcement efforts have mentioned *burnout* among participating enforcement agencies and in media attention. The Canadian STEPs also showed declining gains with repeated applications.[67]

Operation ABC Mobilizations (1997–2003)

Background.   At about the same time as the OP-sTEP programs and Campaign Safe and Sober were being implemented, a crisis was emerging with regard to injuries and deaths occurring among young children and short-stature adults riding in the front seat of passenger vehicles. These injuries and deaths were associated with the deployment of passenger-side air bags in low speed crashes and frequently involved unrestrained and "out-of-position" occupants who were positioned directly

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[64]The private sector funding came from General Motors Corporation as part of a settlement agreement with NHTSA.

[65]Twenty states participated, but there was considerable variation in the level of reporting.

[66]It is not known exactly how many days of enforcement were included in these rates but it is likely that they refer to just over one wave of activity or about 15 days of enforcement. Thus, the rate of five citations per 10,000 residents most likely translates to about 2.5 citations per 10,000 residents per week. This can be compared with the rate of 12 citations per 10,000 per week in the North Carolina benchmark.

[67]This is an interesting dilemma. Even at relatively low levels of usage, repeated efforts often result in declining gains over time. Yet, over the longer term, nearly all states that have implemented blitz efforts have achieved usage rates above 70% to 80%. Frequently, "breakthrough" gains (associated with blitzes) have occurred in secondary law states after a primary law upgrade has been enacted and implemented.

within the deployment area of the air bag. As part of the response to this problem, a national "Call to Action" in early 1996 resulted in the formation of a public-private partnership involving NHTSA, the National Safety Council (NSC), the National Transportation Safety Board (NTSB), the CDC, automobile manufacturers, insurance companies, air bag suppliers, advocacy groups, public health and medical groups, and others. Out of that initial partnership evolved an organization called the Air Bag and Seat Belt Safety Campaign (known as the Air Bag Campaign or ABSBSC)[68] and a three-point program to increase SBU that included: a) intensive public information, b) upgraded legislation, and c) intensified enforcement.[69]

Operation ABC Mobilizations.　In 1997, the Air Bag Campaign implemented what became a decade-long series of safety belt enforcement mobilizations. The first, implemented in November of 1997, reportedly included 1,000 participating enforcement agencies. Such mobilizations were then implemented in the spring and fall of each year. By 2002, more than 12,000 enforcement agencies reported participating in these efforts. The media component of each campaign included extensive publicity generated by a combination of public service ads, earned media, and paid advertising, usually initiated by the ABSBSC. Individual state participation in the mobilizations prior to 2000 is not well documented. However, there was evidence of considerable activity among state and local police agencies. Further, based on NOPUS,[70] there was an increase in *national* usage, from 62% in May 1997 to 70% in December 1998 (Glassbrenner and Utter, 2001). A substantial portion of this increase appeared to be associated with greatly intensified mobilizations in 1998.

Innovative Grants and Expanded Use of Paid Media. Beginning in 2000, there was a substantial increase in emphasis placed on paid advertising and on the use of "hard" enforcement messages (e.g. CIOT). This increased use of paid media began with the May 2001 Operation ABC mobilization in the southeast region and was enabled by funding provided by Section 157 of the Transportation Equity Act for the 21st Century (TEA-21).[71] Effective allocation of these funds became a priority for NHTSA and the funds were increasingly used to support state participation in Operation ABC mobilizations. These funds enabled states to reach levels of media intensity that were comparable to those of the 1993 North Carolina CIOT benchmark.

State, Regional, and National CIOT Programs (2000–2006)

Several key enforcement programs and evaluations resulted from the national Operation ABC mobilizations implemented by ABSBSC in cooperation with NHTSA and its Buckle Up America program. They included: a) the South Carolina CIOT mobilization implemented in 2000; b) the regionwide expansion of the CIOT program to eight southeastern states in 2001; c) the funding of *fully-implemented* STEPs in 10 states across the United States in 2002; and d) the national CIOT mobilizations conducted in May 2003 and 2004. They also included several targeted mobilizations directed at pickup truck occupants (in the Southeast and South central regions), rural motorists (in the Great Lakes region) and, more recently, nighttime occupants (currently being implemented in North Carolina and West Virginia). Following are brief descriptions of these efforts.

South Carolina CIOT Program (Fall 2000).　Characteristics. As part of the Operation ABC mobilization conducted in November 2000, the Air Bag Campaign provided the State of South Carolina with a $500,000 grant for paid media using the CIOT slogan. NHTSA provided additional Section 157 funds and the South Carolina Highway Patrol committed to conducting more than 3,000 checkpoints throughout the state. As in the North Carolina benchmark, publicity involved a combination of paid, earned, and public service media.

Intensity. Based on the expenditure of $500,000 for paid media, the State spent approximately 12¢ per capita over a 4-week advertising period (about 3¢ per capita per week).

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[68] The ABSBSC was initially called the *National Automotive Occupant Protection Campaign* (NAOPC).

[69] A key objective of the three-point program was to increase adult SBU as several studies had shown that one of the surest ways to get children restrained was to get the adults in the vehicle restrained.

[70] NOPUS are national-probability-sample, observational surveys conducted annually to monitor usage across the United States. Beginning in 1998, several smaller-sample (mini-NOPUS) surveys were conducted before and after the May and November mobilizations to estimate changes associated with these enforcement efforts.

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[71] Section 157(f) *innovative* grant funds were part of a larger Section 157 program that authorized approximately $100 million per year as *incentive* grants. Such grants were provided to states based on having higher than average usage rates (compared with the national average) or increases in their rates over a 2-year period, after 1996. Funds not allocated under the incentive grant provision of this section were allocated under Section 157(f) for innovative (enforcement) efforts to increase statewide usage rates (*Federal Register,* Vol. 64, No. 4, pp. 1062–1067, Jan. 7, 1999). In Fiscal Year (FY) 2000, about $25.5 million was allocated to states under Section 157(f), and in FY 2001, approximately $38.2 million was allocated to states under this provision. The *Air Bag Campaign* supplemented these efforts by coordinating the nationwide mobilizations, purchasing national advertising, and generating news events (i.e., earned media).
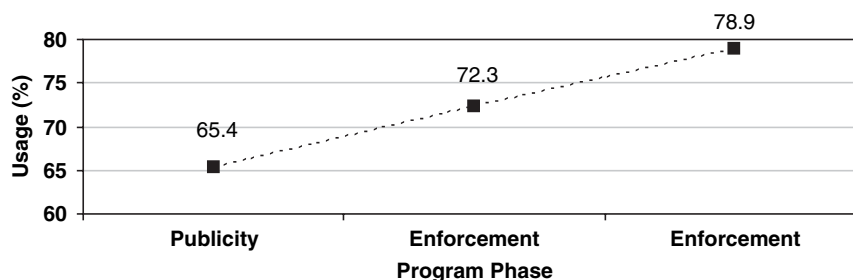
Figure 13. Changes in SBU in six South Carolina counties: Before and after the 2000 CIOT mobilization (from Solomon and Preusser, under review).

Two weeks of enforcement yielded 3,300 checkpoints[72] and 21,321 citations for safety belt and child restraint violations, more than three times as many citations as in past mobilizations in the state. This level of enforcement translated to 53 citations per 10,000 residents over 2 weeks, compared with 81 citations per 10,000 residents over 7 weeks in the 1993 North Carolina benchmark program.

Awareness of the CIOT program increased significantly over time. Surveys conducted at licensing centers across South Carolina found that: a) awareness of *recent safety belt messages* increased from 67% to 95% (+28 points); b) awareness of the CIOT slogan increased from 18% to 80% (+62 points); and c) messages were received primarily from television, both before and after the program (followed by newspapers and radio).

Awareness of enforcement increased as well. Statewide telephone surveys conducted before and after the mobilization found that awareness of enforcement efforts increased from 22% to 73% (+51 points) and awareness of *checkpoints* increased from 28% to 86% (+58 points). These results suggested that publicity regarding the program had reached the majority of the residents of the state. With regard to the source of information, most residents became aware of safety belt messages via television (67%), compared with radio (38%) and newspapers (42%).

Impact on SBU. According to South Carolina's statewide survey, usage increased from 66.5% to 73.9% (+7.4 points). Figure 13 shows the results of a smaller, subsample survey, conducted in six counties across the state. It found that usage in these counties increased from 65.4% to 78.9% (+13.5 points). In the latter survey, all categories of gender and race, as well as both urban and rural counties, experienced significant increases. In fact, usage increased among rural motorists, males,

and blacks to a greater extent than among urban motorists, females, and whites.

The South Carolina CIOT program provided a second example of an intense statewide enforcement program. Further, this effort was implemented at a time when the availability of resources for such programs was increasing in the form of Section 157 *Innovative Grants.*[73, 74] Thus, it became a model for similar program in other states.

Southeast Regional CIOT Mobilization (May 2001). Following the South Carolina program, an eight-state CIOT mobilization was implemented in the southeast region of the United States (Solomon, 2002). States included in this effort were: Alabama (newly upgraded primary law), Florida (secondary law), Georgia (upgraded primary law), Kentucky (secondary law), Mississippi (secondary law), North Carolina (original primary law), South Carolina (secondary law/primary law),[75] and Tennessee (secondary law).

This program, summarized in Table 6, and most subsequent statewide mobilizations had essentially the same program design, which called for: a) four weeks of program activity; b) earned media throughout the program; c) two weeks of paid media (weeks 2 and 3); and d) two weeks of enforcement (weeks 3 and 4). Observational and awareness surveys were conducted at the baseline; during earned media (week 1); during earned and paid media (week 2); at peak media and enforcement (between weeks 3 and 4); and postprogram.

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[72]Thirty-three hundred checkpoints, in this state with just over 4 million residents, constituted a rate of eight checkpoints per 10,000 residents (over a period of 2 weeks), compared with a rate of nine checkpoints per 10,000 residents in the North Carolina benchmark (over a period of 7 weeks).

[73]Section 157(f) innovative grant funds were not the only sources of funding for these programs but they were funds that were specifically used to support these enforcement efforts.

[74]Unfortunately, the South Carolina program was followed by a political controversy that greatly reduced subsequent enforcement efforts in the state and, as a result, much of the increase in usage diminished quite rapidly. This is in stark contrast with the North Carolina program, where waves of enforcement were repeated over a 5-year program period and usage stabilized at around 80%.

[75]South Carolina's safety belt law allowed for primary enforcement as part of safety checkpoints.

Table 6. A summary of key characteristics of the southeast regional CIOT program implemented in 2001 (Solomon, 2002).

State	Law Type	Min. Fine	Pop. (m)	Media Costs (K)	Media per Capita 2 wks/1wk	Number Tickets Issued	Tickets per 10K 2 wks/1wk	Pre-Use (%)	Post-Use (%)	Pct. Pt. Chg.
AL	P	$25	4.5	$500	11¢ / 6¢	12,257	27 / 14	68	76	+8
FL	S	$30	16.3	$708	4¢ / 2¢	29,724	18 / 9	61	70	+9
GA	P	$15	8.4	$500	6¢ / 3¢	33,208	40 / 20	72	82	+10
KY	S	$25	4.1	$600	15¢ / 7¢	5,806	14 / 7	60	70	+10
MS	S	$25	2.9	$250	9¢ / 4¢	2,450	8 / 4	49	62	+13
NC	P	$25	8.2	$250	3¢ / 2¢	20,055	25 / 12	80	84	+4
SC	S/P	$10	4.1	$250	6¢ / 3¢	7,115	17 / 9	65	70	+5
TN	S	$10	8.2	$500	6¢ / 3¢	9,190	11 / 6	53	73	+20
Region			56.5	$3,558	6¢ / 3¢	119,805	21 / 11	65	74	+9
					Regional rate		Regional rate			wt. ave.

"P" = primary law; "S" = secondary law; "Min." = minimum; "Pop" = population; "m" = million; "K" = thousand; "wk(s)" = week(s); "Pct. Pt." = Percentage points; "Chg." = Change; "wt" = weighted

Expenditures for paid media averaged about 6¢ per capita for the 2-week effort. This was about half the per capita expenditure in the 2000 South Carolina mobilization (12¢ per capita over 2 weeks). By comparison, the expenditure for Wave 1 of the 1993 North Carolina program was about 6¢ per capita for an 8-week effort and the expenditures in the early Elmira programs were 26¢ to 31¢ per resident over 3 weeks. Still, *awareness of enforcement efforts* reached higher levels in these more recent statewide programs than that measured in Elmira. Some of this elevated awareness may have resulted from repeated participation in STEPs and/or national mobilizations.

The average *citation rate* in this regional effort was 21 citations per 10,000 residents over 2 weeks of enforcement. This was lower than in North Carolina, where 51 citations (per 10,000) were issued over 4 weeks in Wave 1 and 30 citations (per 10,000) over 3 weeks in Wave 2. It is also lower than in the South Carolina program, where 52 citations were issued (per 10,000) over 2 weeks of enforcement. Looking back to the more effective local blitz programs, the median citation rate (in Elmira, Modesto, and the three North Carolina pilots) was 92 (per 10,000) over enforcement periods ranging from 1 to 4 weeks.

These comparisons suggest that *enforcement intensity may have declined with expansion of the STEP model from the local level to statewide and regional applications.* Per capita media spending was also less than in the local programs that used paid media. This expansion from statewide implementation in South Carolina to a regional effort generally resulted in a smaller average per capita expenditure for media (compared with South Carolina). Perhaps more significant is the fact that the median *awareness of enforcement* (checkpoints) in the southeast regional program reached only 62%, compared with 73% to 82% in South Carolina and 85% in North Carolina.[76]

Impact on Observed Usage. In spite of lower awareness of enforcement, Figure 14 shows a *substantial increases in observed usage in all eight states,* ranging from 4 points in North Carolina (which had the highest baseline rate) to 20 points in Tennessee (which had nearly the lowest baseline rates). Regionwide, there was an average increase of about nine percentage points. Among the states with comparable baseline rates (60% to 68%), there was a modest positive correlation between media intensity (as measured by per capita expenditure) and usage rate increase (r = .50).

Model CIOT Programs (2002)

In 2002, *full implementation* of the CIOT model was attempted in 10 states located in various regions of the United States. These states were Alabama, Florida, Illinois, Indiana, Mississippi, Nevada, Texas, Vermont, Washington, and West Virginia.[77] In addition, *more limited paid media and enforcement* efforts were implemented in four states: Colorado, Michigan, Ohio, and Rhode Island. By comparison, *little or no paid advertising* was included in four state programs: Iowa, New York, Oregon, and western Massachusetts.[78] It should be noted that the intensity of enforcement in these four states was comparable to that of the 10 *fully implemented* states (Solomon, Ulmer, and Preusser, 2002).

Paid Media. The *full implementation states* spent an average of 14¢ per capita on paid media (over 2 weeks), comparable to the 12¢ per capita spent in the 2000 South Carolina

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[76] Slightly different awareness levels were found in telephone surveys and driver licensing center surveys.

[77] The term *fully implemented* refers to the fact that, in addition to *intensified enforcement,* each of these states also invested heavily in *paid media* and they used the *CIOT slogan* or a similar "hard enforcement" slogan.
[78] It should be noted that, while these latter states are used for comparison purposes, three of the four (all except western Massachusetts) had very high baseline rates, thus limiting the potential for large gains to some extent.
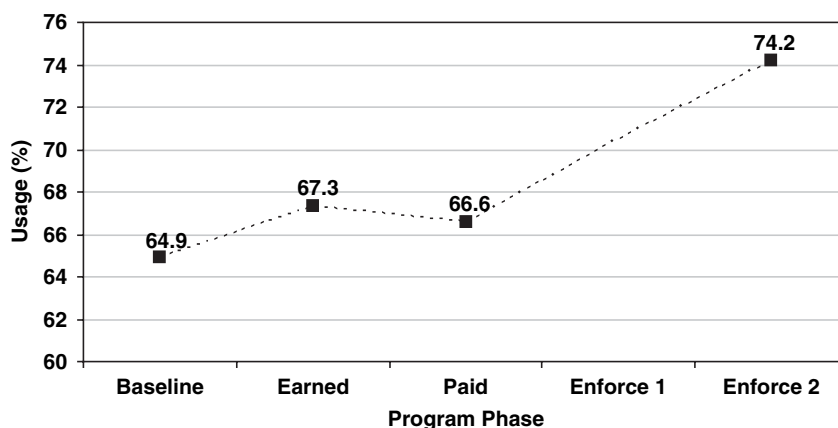
Figure 14. Changes in SBU, by phase, in the 2001 CIOT program implemented in eight southeastern states in 2001 (Solomon, 2002).

CIOT (2 weeks), and considerably more than the 6¢ per capita spent during Wave 1 of the 1993 North Carolina benchmark (8 weeks). The four *partial implementation states* spent only about 4¢ per capita on paid media (2 weeks).

Awareness. Postprogram *awareness of recent safety belt messages,* as measured by telephone and licensing center surveys, was higher in the 10 *fully implemented* states (86%) than in the 4 states with *lower expenditures for paid media* (81%) and the 4 states with *no paid media* (71%).[79] There were even greater differences with regard to *awareness of enforcement.* By the end of the program, 59% of residents in the *fully implemented* states were aware of special safety belt enforcement efforts, compared with only 34% in the states with *less paid media* and 25% in the four states with *no paid media.* The only previous programs with higher levels of enforcement awareness, compared with these *fully implemented* states, were the North Carolina benchmark (85%) and the 2000 South Carolina program (73%). Both had very high citation rates.

Enforcement intensity, as measured by citations per 10,000 residents, was similar in the *fully-implemented* states and in the states with *no paid media.* Both groups had an average of about 22 citations per 10,000 residents (2 weeks). States with *modest levels of paid media* also had *modest citation rates* (about 11 per 10,000).

The fact that the citation rates in the *fully implemented* and *no paid media* states were comparable suggests that the lower level of enforcement awareness in the latter group was due to the absence of paid media, since enforcement intensity was comparable. Publicity in the four *non-paid-media* states apparently resulted in less public awareness of the enforcement effort, possibly due to less control of when and where messages were aired and possibly due to the use of "softer" enforcement messages.

Table 7 provides a summary of key characteristics of each group of states. Compared with previous efforts, the 2-week *citation rates* in the *fully-implemented* states and in the states with *no paid media* were nearly identical to those found in the southeast regional program (i.e., 21 to 22 citations per 10,000 residents), but not as high as in the 2000 South Carolina CIOT (52 per 10,000 over 2 weeks) or in the 1993 North Carolina CIOT (51 per 10,000 over 4 weeks during Wave 1).

Impact on Observed Usage. Figure 15 shows that the average *increase in usage* in the *fully implemented* states was 8.6 points, nearly three times as great as in the *partially implemented* states (3 points) and about nine times as great as in the states with *no paid media* (less than 1 point).[80] This is consistent with a hypothesized positive relationship between paid media and level of impact. In fact, looking only at the 14 states with reasonably similar baseline levels (±10 percentage points of the overall mean baseline of 71%), there was a reasonably strong correlation between media intensity and postprogram change in usage (r = .77).

In comparison with past benchmark programs, the 9-point average increase in the *fully implemented* states was comparable to the 9-point increase found in the 2001 *southeast regional program* and the 7-point increase in *South Carolina.* As with levels of media intensity and awareness, these increases in usage were smaller than the increases observed following Wave 1 of the North Carolina benchmark (+16 points).

National CIOT Mobilizations

Beginning in 2003, the CIOT model was implemented on a nationwide basis, using essentially the same phasing of earned

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[79]By comparison, awareness of safety belt messages was 86% in the 2001 southeast regional program and 92% in the 2000 South Carolina CIOT program.

[80]Again, this comparison with the states with no paid media has to be tempered due to the very high baseline in three of the four states that did not purchase media time.

Table 7. A summary of key characteristics of states included in an evaluation of model *CIOT* programs conducted during the May 2002 mobilization.

State and Characteristics				Media Costs		Enforcement Levels			Usage Rates		
State	Law	Min. Fine	Pop. (m)	Media Costs $ (000)	Per capita 2 wks	Cites	Tckts/ 10K 2 wks	Tckts/ 10K 1 wk	Base Use (%)	Peak Use (%)	Chg. Pct. Pts.
Full Implementation States (Paid Media)											
AL	P	$25	4.50	$252	6¢	13,664	31	15	70.3	78.7	+8.4
FL	S	$30	17.02	$2,112	12¢	37,063	23	11	66.5	75.1	+8.6
IL	S	$25	12.65	$1,000	8¢	22,073	18	9	70.6	74.3	+3.7
IN	P	$25	6.20	$963	16¢	24,697	40	20	69.2	72.2	+3.0
MS	S	$25	2.88	$330	12¢	2,486	9	4	53.8	61.5	+7.7
NV	S	$25	2.24	$290	14¢	3,570	17	8	70.6	76.4	+5.8
TXa	P	$25+	6.54	$1,046	16¢	27,260	40	21	80.5	86.4	+5.9
VT	S	$10	0.62	$200	33¢	1,304	21	1	66.2	84.9	+18.7
WA	S/P	$86	6.13	$500	8¢	5,505	9	5	80.8	89.5	+8.7
WV	S	$25	1.81	$250	14¢	3,104	17	9	56.5	71.6	+15.1
Totals			**60.59**	**$7,718**		**140,726**					
Averages					**14¢**		**22**	**11**	**68.5**	**77.1**	**+8.6**
Partial Implementation States (Less Paid Media)											
CO	S	$15	4.55	$100	2¢	3,026	7	3	72.1	73.2	+1.1
MI	P	$25	10.08	$650	6¢	5,463	5	3	82.3	80.0	-2.3
OH	S	$25	11.44	$433	4¢	21,790	19	10	64.2	70.3	+6.1
RI	S	$75	1.08	$27	3¢	1,301	12	6	62.6	68.6	+6.0
Totals			**27.15**	**$1,210**							
Averages					**4¢**	**31,580**	**11**	**6**	**70.3**	**73.0**	**+2.7**
Comparison States (No Paid Media)											
IA	P	$25	2.94	$0	0¢	3,033	10	5	81.4	83.0	+1.6
NY	P	$50+	19.19	$0	0¢	69,034	36	18	78.3	82.8	+4.5
OR	P	$94	3.56	$0	0¢	5,745	16	8	88.5	87.8	-0.7
West MA	S	$25	0.34	$0	0¢	818	24	12	60.6	57.2	-3.4
Totals			**26.03**	**$0**		**78,630**					
Averages					**0¢**		**22**	**11**	**77.2**	**77.7**	**+0.5**
a)	The 10 largest cities in Texas participated										
b)	Legend: P = primary law; S = secondary law; Tckts = Tickets; m = million; K = thousand										
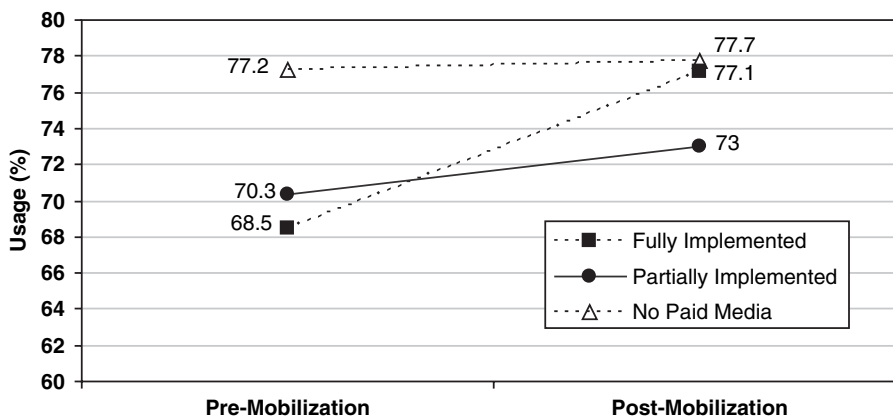
Figure 15. Changes in SBU in 10 states with fully implemented media and enforcement efforts, compared with changes in four states with less paid media and four states with no paid media: May 2002 Operation ABC mobilization (Solomon, Ulmer, and Preusser, 2002).

and paid media to publicize enforcement activity as in the statewide and regional applications already described.

1) The 2003 National CIOT Mobilization (May 2003). The May 2003 mobilization was the first national mobilization to be called CIOT, signifying that most states were now using either the CIOT slogan or some other "hard enforcement" slogan (Solomon, Chaudhary, and Cosgrove, 2004). Key characteristics of this nationwide effort are summarized in Table 8.

Paid Media. In conjunction with the 2003 effort, there was an $8 million *national* media purchase, in addition to approximately $15.7 million spent on paid media by 45 reporting states. This paid media was supplemented by extensive earned media, including national network coverage, more than 1,000 local television news stories, an audio news release that was aired on several thousand radio stations, and articles and editorials in nearly 100 publications.

Citations. About 7,125 law enforcement agencies participated in the 2003 national program in the 44 states that provided enforcement data. These agencies reported issuing about 508,492 citations for safety belt violations (about 20 per 10,000 residents over 2 weeks). The citation rate was 70% higher in primary law states (about 24 per 10,000 residents) than in secondary law states (about 14 per 10,000 residents).

Awareness. Nationwide telephone surveys measured 82% awareness of *recent safety belt messages* (an increase of 9 points from preprogram levels) and 40% awareness of *safety belt enforcement efforts* (an increase of 24 points). The 82% *awareness of safety belt messages* was generally somewhat lower than levels found in previous statewide and regional benchmarks (ranging from 84% in the southeast region mobilization to 95% in the South Carolina mobilization), but these were the highest levels and the greatest increase documented at the national level.

Awareness of enforcement, as indicated, was measured at about 40% in national telephone surveys. This was considerably lower than in prior programs, which ranged from 53% in the southeast (2001) to 85% in North Carolina (1993). As with media and enforcement indices, these results may reflect the difficulty of maintaining intensity as programs are expanded to larger and more complex geographical areas.

On the positive side, the 40% awareness of enforcement was greater than the 35% awareness measured in the 2002 *partial implementation states* and much greater than the 28% awareness found in the 2002 *no-paid-media* states. Further, this increase in enforcement awareness was 24 points (50%) greater than the 16-point increase measured in the fall 2002 national mobilization and 33% greater than the 18-point gain measured in the May 2002 national mobilization. Thus, there is evidence that a substantial effort was initiated nationwide in May 2003.

Impact on Observed Usage. The national SBU rate, as measured by the NOPUS, increased from 75% to 79%, a significant 4 percentage point increase. This was the largest nationwide increase measured by NOPUS since 1998, when two intensive *Operation ABC* mobilizations were implemented in the same year.

Figure 16 shows that the *average statewide usage rate,* as measured by mini-surveys conducted in 28 states just prior to the May 2003 mobilization, had declined to 72.8%, from its 2002 postmobilization level of 75.2% (−2.4 points). These declines were found in both primary law states (−3.2 points, from 82.6% to 79.4%) and in secondary law states (−1.8 points, from 71.0% to 69.2%). However, usage in these 28 states increased by an average of 5.7 points by the end of the 2003 mobilization, about 5 points in primary law states and about 7 points in secondary law states. Thus, the gain associated with the May 2003 mobilization may have been greater than the 4 points measured by NOPUS (which did not measure immediate preprogram rates).

2) The 2004 National CIOT Mobilization. An even greater level of media and enforcement intensity was implemented during the May 2004 national CIOT mobilization (Solomon and Chaffe, under review). The characteristics of this second national effort are summarized in Table 9.

Paid Media. The 2004 effort included approximately $32 million for paid advertising (about 11¢ per resident over 2 weeks), including a $12 million national media purchase and approximately $20 million expended by the states. As in the previous year, paid media was supplemented by extensive earned media, including national network coverage, local radio and television news stories, articles and editorials, and press events.

Table 8. A summary of key characteristics of the 2003 national CIOT program (Solomon, Chaudhary, and Cosgrove, 2004).

# States	Law	Min. Fine	Media Cost	Cost per Capita	# SBU Citations	Cites/ 10K 2 wks	Cites/ 10K 1 wk	Base Usage (%)	Peak Usage (%)	Chg Pct. Pts.
44	17 P 27 S	varies	$25 m	8¢ / 2 wks	508 K	20	10	75	79	+4

Media rates include both state and national expenditures.
Citation rates are based on rates in reporting states; these rates ranged from 14 per 10,000 residents in secondary law states to 24 per 10,000 residents in primary law states.
Legend: P = primary law; S = secondary law; Cites = citations; m = million; K = thousand
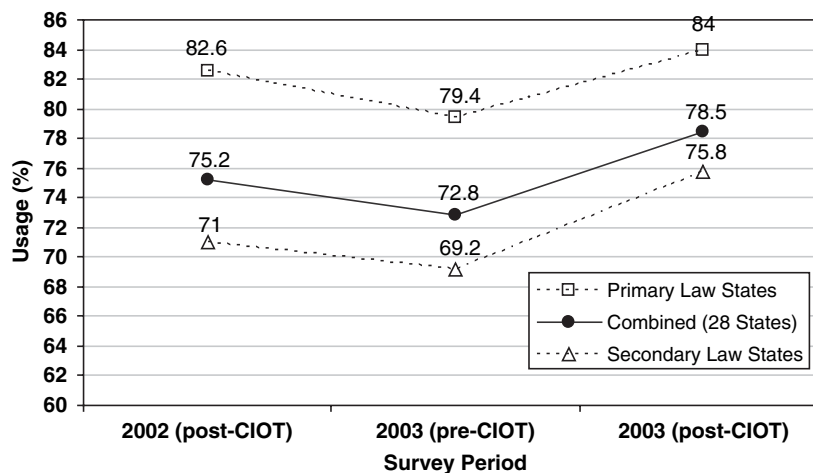
Figure 16. Observed change in SBU in 28 states: Postmobilization 2002 to postmobilization 2003 (from Solomon, Chaudhary, and Cosgrove, 2004).

Citations. Across the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands, about 7,500 law enforcement agencies participated in the 2004 program, slightly more than in 2003 (about 7,125). These agencies reported issuing 657,300 citations for safety belt violations (about 22 per 10,000 residents over 2 weeks), compared with 508,492 citations in 2003 (about 20 per 10,000 residents). As in the previous year, more citations were written in primary law states (74%) than in secondary law states (26%), resulting in a rate of about 30 citations per 10,000 residents in primary law states and 15 per 10,000 in secondary law states.

Awareness. Nationwide telephone surveys measured 83% awareness of *recent safety belt messages* (+ 13 points over baseline) and 41% awareness of *safety belt enforcement efforts* (+25 points over baseline). These were nearly identical to the postlaw rates and increases found in 2003. As in 2003, the awareness of recent safety belt messages (83%) was comparable to levels in benchmark programs, but awareness of enforcement efforts (41%) was considerably lower than in benchmark programs (ranging from 63% in the southeast to 73% in South Carolina and 85% in North Carolina).

Impact on Usage. The national SBU rate, as measured by the NOPUS, increased from 79% in 2003 to 80% in 2004, a non-significant change. As with the 2003 national effort, Solomon and Chaffe reported pre-to-post program changes based on statewide surveys. They suggested that usage had declined by about 2 points from its 2003 peak of 79%, and then increased by about 2.4 points with the 2004 mobilization.

These results suggested that, while the intensified paid media and enforcement efforts implemented as part of annual enforcement mobilizations have been associated with past increases in nationwide observed usage, further progress may be more difficult without some change in strategy. Subsequent mobilizations, conducted in 2005 and 2006, have reinforced that suggestion.

3) Efforts to Reach High-Risk, Low-Use Groups. Based on the fact that usage among high-risk, low-use target audiences remained lower than in the general population, several targeted media and enforcement efforts were planned and implemented as part of the 2004 and 2005 CIOT mobilizations. One of these was an effort to reach pickup truck drivers in the south central region of the United States. Another was an effort to reach rural motorists in the Great Lakes region.

a. South Central Regional Effort to Reach Occupants of Pickup Trucks. As part of the 2004 CIOT mobilization, a targeted program to increase use among pickup truck occupants was implemented in five states in the south central region of the United States (Solomon and Chaffe, under review).

Table 9. A summary of key characteristics of the 2004 national CIOT program (adapted from Solomon and Chaffe, under review).

# States	Law Type	Min. Fine	Paid Media ($)	Per Capita Cost 2 wks	# SBU Tickets Issued	Tckts /10K 2 wk	Tckts /10K 1 wk	Preprog. Usage (%)	Postprog. Usage (%)	Usage Chg. (Pct. Pts.)
44	23 P 30 S	Varies	$32 m	11–12¢	657,000	30 P 15 S	15 P 8 S	76.6	79	+2.4
Media costs include both state and national expenditures. Citation rates are based on 44 reporting states. Legend: P = primary law; S = secondary law; Tckts = Tickets; m = million; K = thousand; Prog. = Program										
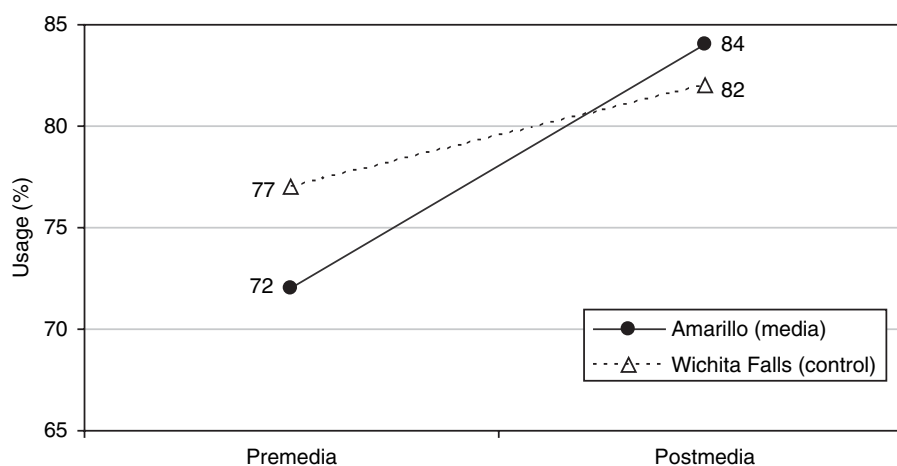
Figure 17. Observed change in usage among pickup truck occupants in Amarillo, Texas, and Wichita Falls, Texas (Solomon, Chaudhary, and Cosgrove, 2004).

Paid Media. This program, called "Buckle Up in Your Truck" (BUIYT), included an additional 2 weeks of paid media, implemented prior to the national CIOT mobilization. Approximately $688,000 was expended on BUIYT advertisements during this initial phase of the mobilization. This translated to about 2¢ per resident in these five states (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas). The messaging during this initial phase of the mobilization was not enforcement-related. However, an additional $2.9 million (8¢ per resident) was spent on ads during the CIOT phase of the mobilization that followed. This messaging, as in all CIOT mobilizations, was specifically designed to publicize enforcement efforts.

Awareness. As a result of these two media campaigns and the CIOT enforcement, awareness of messages *to buckle up in pickup trucks* among pickup truck drivers increased by 16 points, from 30% (preprogram) to 41% (post-BUIYT) to 46% (post-CIOT). Awareness of enforcement efforts increased by 23 points, from 55% (preprogram) to 58% (post-BUIYT) to 78% (post-CIOT). As these data show, most of the increase in awareness regarding *SBU and pickups* occurred during the BUIYT phase and most of the increase in awareness of *enforcement* occurred during the CIOT phase. This would be expected since the BUIYT advertising did not include an enforcement message and there was no enforcement during the BUIYT phase.[81]

Impact on Usage. Following 2 weeks of BUIYT media, there was a 2-point increase in observed usage among pickup truck

occupants (63.7% to 75.3%) and a 1-point increase among passenger car occupants (74.6% to 80.8%). Associated with the CIOT phase, there was a 6-point increase among pickup truck occupants (65.9% to 71.6%) and among passenger car occupants (75.3% to 80.8%). Overall, belt use in pickup trucks increased by 8 points and use in passenger cars increased by 6 points (rounded to nearest whole percent). The significance of these increases was not reported.

b. A Local Implementation Using Paid Media and the BUIYT Message. Using a local implementation to test the potential for target-specific messaging, BUIYT ads were purchased in Amarillo, Texas, during the November 2004 mobilization, with Wichita Falls serving as a control community. Solomon and Chaffe describe the results of this program as well. While the intensity of the media purchase was not described, they reported that awareness of the BUIYT *message* increased by 21 percentage points among Amarillo pickup truck drivers (from 43% to 64%) and awareness of *enforcement* increased by 5 points (from 69% to 74%). Interestingly, baseline and post-program awareness of *enforcement* was higher than the awareness of the *buckle up* message.

Most importantly, Figure 17 shows that observed usage among pickup truck occupants increased by 12 points in Amarillo (from 72% to 84%), compared with 5 points in Wichita Falls (from 77% to 82%), a net 7-point difference. Usage among passenger car occupants increased by 8 points in Amarillo (from 81% to 89%) and by 5 points in Wichita Falls (from 84% to 88%, rounded), a net 4-point difference. From these reported results, it appears that, while there may have been some statewide increase in usage that affected both Amarillo and Wichita Falls, the BUIYT program in Amarillo had a modest additional impact. No additional enforcement activity, beyond whatever was implemented during the Fall CIOT program, was reported for Amarillo.

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[81]A similar finding was reported by Nichols, Ledingham, and Preusser (2007) with regard to an RDP implemented in the Great Lakes Region. In this program, awareness of rural messages increased most during an initial RDP phase while awareness of enforcement increased most during the CIOT phase.

c. *Great Lakes Regional Effort to Reach Rural Motorists.* Several targeted demonstrations, such as the 2004 BUIYT program in the south central region, have been implemented to target higher-risk, lower-use target populations. Additional BUIYT demonstrations, for example, were implemented in the southeast region and south central regions in 2005. Another program, which targeted rural belt use, was implemented in the Great Lakes region in 2005 and 2006. Final results are available for the first year of this Rural Demonstration Program (RDP) and preliminary results are available for the second year.

Paid Media. The 2005 RDP was implemented in six states (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) and evaluated by Nichols, Ledingham, and Preusser (2007). Like the BUIYT program, the RDP included an additional 2 weeks of paid media, implemented prior to the national CIOT mobilizations conducted in May 2005 and May 2006. About $1.3 million was spent for paid media during the 2-week RDP (12¢ to 14¢ per capita). Following the RDP, an additional $4.4 million was spent on CIOT advertising (6¢ per capita) for the 2-week CIOT campaign. About two-thirds of this funding was spent on television. Although both the RDP and CIOT media campaigns were enforcement oriented, the CIOT campaign conveyed a "harder" message.

Enforcement. In 2005, only three of the six states intensified enforcement during the RDP, but all states did so during the CIOT phase that followed. In 2006, all states intensified enforcement during both phases of the mobilization. Citations were issued at the rate of about 18 per 10,000 residents (in the rural targeted areas) during the RDP and 28 per 10,000 residents (statewide) during the CIOT phase.

Awareness. In general, *awareness of safety belt messages* in the rural targeted areas increased most *during the* RDP and aware-

ness of *enforcement* activity increased most during CIOT. During the RDP phase, awareness increased more in the rural targeted areas than it did statewide, suggesting that the rural messaging was reaching its targeted audience. By the end of both phases, however, rural and statewide awareness levels were similar, with about 85% awareness of *safety belt messages* and 55% awareness of *enforcement* in 2005.

Impact on Usage. One of the key findings from the 2005 campaign was that only the three states that intensified enforcement during the RDP (Illinois, Indiana, and Ohio) experienced significant increases in usage in rural targeted areas during that phase. Further, only in these three states did the rural areas have larger overall gains, compared with statewide gains, after both phases of the program were completed (RDP + CIOT).

In 2005, there was a median 7-point increase in the rural targeted areas and a median 5-point increase statewide. Based on the results during this initial year, it appeared that the combination of 2 additional weeks of media (beyond that implemented as part of CIOT) and 1 additional week of enforcement were associated with greater impact in the rural targeted areas. However, *rural and statewide usage* increased significantly in most states and the differences between rural and statewide gains, while frequently greater in the rural areas, were not statistically significant.

Figures 18 and 19 show the 2005 trends for the six participating states. There are three measurement points for each state (pre-RDP, post-RDP, and post-CIOT). Figure 18 shows trends for the three primary law states (Illinois, Indiana, and Michigan, from left to right), and Figure 19 shows the trends for the three secondary law states (Minnesota, Ohio, and Wisconsin, from left to right). Again, key findings of this first-year effort were that these states generally experienced signif-
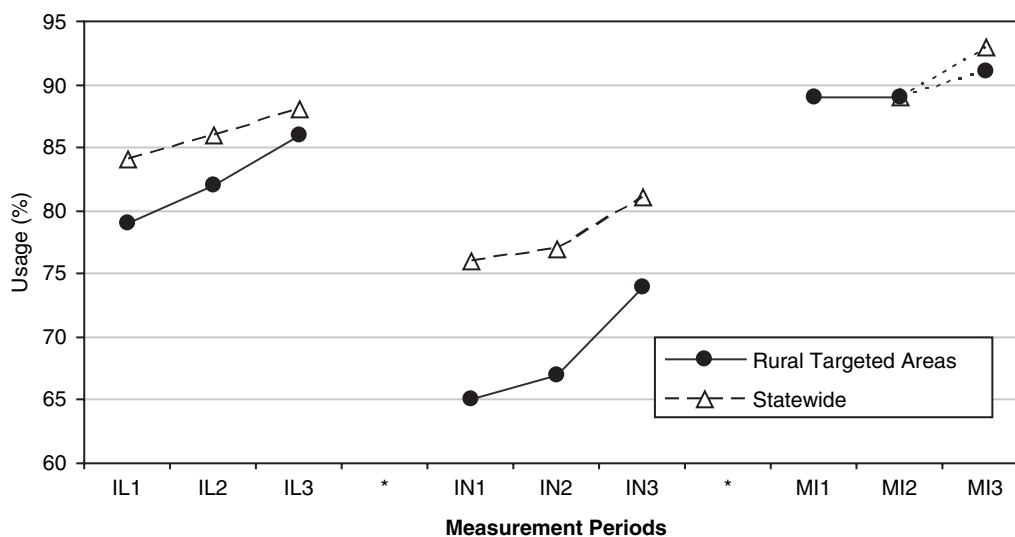
Figure 18. Changes in rural and statewide observed usage in three primary law states participating in a 2-year RDP. (First-year data from Nichols, Ledingham, and Preusser, 2007; second-year data preliminary).
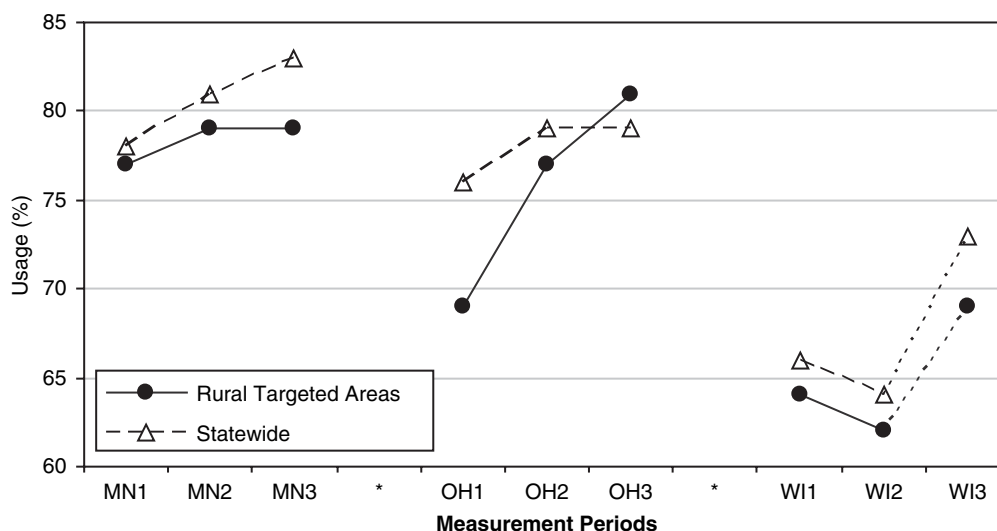
Figure 19. Changes in rural and statewide observed usage in three secondary law states participating in a 2-year RDP (First-year data from Nichols, Ledingham, and Preusser, 2007; second-year data preliminary).

icant overall gains in rural targeted areas (median = 7 points), as well as statewide (median = 5 points), but that increases were observed only when enforcement was present.

Cost Savings Estimates

North Carolina Benchmark

Impact on Fatalities. In order to meaningfully estimate cost savings associated with HVE efforts, these efforts must be implemented in a manner such that gains are sustained over time. This appears to have been the case with regard to the benchmark North Carolina program. Based on time-series analyses, Williams et al. (1996) reported a reduction of 45 deaths and 320 *serious injuries* during a 6-month period that followed implementation of the program, which was about a 7% decrease in driver deaths. These researchers also reported an estimated savings in *medical and EMS* costs of about $14.6 million.[82]

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[82] *Serious injuries* (reported by Williams et al.) are generally classified as MAIS 3–5 injuries. In order to estimate the impact on the broader category of *moderate-to-serious injuries* (i.e., MAIS 2–5), we multiplied the number of serious (MAIS 3–5) injuries by 3.5, resulting in an estimate of 1,100 MAIS 2–5 injuries prevented. This increased medical and emergency medical services (EMS) savings from $14.6 million to $23.4 million.

Medical and EMS savings generally account for about 20% of total savings (associated with deaths and injuries prevented). Based on this relationship, the estimated *total savings* was *$116.8 million.* Using the unit costs for deaths and the proportions of costs accounted for by various components (i.e., lost productivity, medical and EMS, and "other" costs) provided in Appendix E, we calculated values for the remaining cells in Table 12. Estimates in terms of current (2007) dollars were obtained by multiplying by a factor of 1.39, based on the inflation index available on the Bureau of Labor statistics Web site (www.bls.gov/cpi/).

Impact on Injuries and Total Savings. Based on these estimates, it was calculated that about 1,100 *moderate-to-serious* (MAIS 2–5) injuries and about $115 million in total costs were prevented over this 6-month period (about $160 million in 2007 dollars). Based on the number of injuries prevented, there was an estimated savings of about $23 million in medical and emergency services alone ($32 million in 2007 dollars). This component constitutes about 20% of total savings. Savings per death prevented (including the prevention of an estimated 25 MAIS 2–5 injuries per death) were about $2.6 million ($3.6 million in 2007 dollars). If impact was maintained over a full year, total savings would be about $320 million (in current dollars).[83]

Program Costs. All of the costs associated with the North Carolina CIOT program are not documented by Williams et al. However, based on data provided in their report and in various other project reports, and on personal communications with the principal investigator and regional and state representatives, an estimated $2 million was spent on the two waves of activity, including media and enforcement-related efforts in the fall of 1993 and summer of 1994.[84] Based on that estimate, Table 10 shows $117 million in (6-month) cost savings (just over $230 million in annual savings), a return of

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[83] There is evidence that usage increased and then declined following each wave of the CIOT program. On the other hand, subsequent annual statewide surveys seldom measured a use rate less than 80% after 1994. Thus, it appears that, over the long term, increases associated with this HVE program were sustained.

[84] This estimate was based upon personal communications with persons involved with the program, including the Director of the Governor's Highway Safety Program (GHSP) and the principal investigator.

Table 10. Estimated 6-month cost savings in North Carolina following the implementation of a CIOT enforcement and publicity program (based on time series analysis and on fatality, injury, and cost data from NHTSA crash cost reports, which are summarized in Appendix E).[a]

Type of Loss Prevented	Number of Prevented Incidents [b]	Unit Costs Per Fatality [c]	Lost Produc-tivity ($)	Medical & EMS ($)	Other Injury-Related ($)	Total Economic Cost Savings
Fatalities	45	$0.8 m	$32 m 86%	$1 m 2%	$5 m 12%	**$37 m**
(2007 dollars)		($1.1 m)	($44 m)	($1 m)	($6 m)	**($51 m)**
MAIS 2-5 Injuries	1,131	$1.8 m (per fatality)	$40 m 50%	$23 m 29%	$18 m 22%	**$80 m**
(2007 dollars)		($2.5 m)	($55 m)	($32 m)	($24 m)	**($111 m)**
Fatalities & Injuries	1,176	$2.6 m	$71 m 61%	$23 m 20%	$22 m 19%	**$117 m**
(2007 dollars)		($3.6 m)	($99 m)	($33 m)	($31 m)	**($162 m)**

Notes:
a) Cost estimates were derived from information provided in Appendix E. Information in Appendix E derived from Blincoe and Faigin, 1992; Blincoe, 1996; and Blincoe, Seay, and Zloshnja et al., 2002.
b) Fatalities and injuries prevented are based on the number of fatalities and "serious" injuries avoided, as reported by Williams et al., and translated to MAIS 2-5 injuries using ratios contained in Appendix E.
c) Non-injury-related components (travel delay and property damage) are not included in these estimates.
d) The estimate of moderate-to-serious injuries is based on the 320 reported serious injuries prevented.
e) Total savings are estimated from reported medical and EMS savings, estimated to be 20% of total.
f) Productivity, medical, and "other" component proportions are from tables in Appendix E.

about 115:1 on the funds expended. Medical and EMS savings alone provided a return of about 23:1.[85]

Relevance in the Current Environment. The North Carolina CIOT program remains a benchmark for statewide HVE programs. The substantial impact experienced in this program was likely the result of the intensity and duration of media and enforcement efforts, as well as the extensive use of roadblocks or checkpoints. Based on the results of telephone surveys, few residents were unaware of this enforcement effort. Although impacts of this magnitude (+16 points) have not been observed in most subsequent efforts, impacts of 8 to 10 points remain feasible, particularly in the 20 or more states with usage rates less than 80%. However, such states would likely require a primary law and an HVE mobilization with media and enforcement intensity (including checkpoints) comparable to that implemented in North Carolina.[86, 87]

If such a program were *repeatedly* implemented and if gains were sustained over the long term, fatality and injury reductions of about 4% to 5% could be achieved and, for each death (and associated injuries) prevented, approximately $3.8 million in cost savings would result. However, the literature clearly suggests that HVE interventions must be repeated (even within each year) to maintain impact. Most HVE programs have been implemented only annually, usually in conjunction with national mobilizations.

Immediate Versus Long-Term Impact

It is important to examine longer-term gains associated with repeated HVE implementations, particularly when such efforts supplement (or are supplemented by) primary law

[85] This 6-month estimate includes deaths prevented while usage was at its highest, immediately following the CIOT program in November 1993, and over much of the period prior to the next wave of activity, which occurred in July 1994. Thus, it appears to represent impact over a period when usage varied between 80% and 72%. Since the July wave was followed by another increase to about 80% usage, it would be assumed that that these 6-month estimates would be repeated over the next 6 months as well. However, only the initial impact was reported by Williams and his coinvestigators.

[86] Wave 1 included a media expenditure of nearly $450,000 (6¢ per capita over 8 weeks) and just over 36,000 citations (about 51 per 10,000 residents over 4 weeks).

[87] A similar number of fatalities and injuries avoided would also assume a comparable baseline number of occupant fatalities as in North Carolina, which is about 1,180 per year.

upgrades. Using data from three recent upgrade states in the Great Lakes region as examples (i.e., Illinois, Indiana, and Michigan), it becomes clear that the longer-term impact of repeated implementations eclipses the short-term gains so frequently reported in the literature, including reductions in deaths, injuries, and costs. These three states were chosen as examples because they represent states that have been participating in annual Operation ABC/CIOT mobilizations since 2002 and each enacted a primary law upgrade either during that time period or immediately prior to it. Indiana implemented its upgrade in 1998, Michigan in 2000, and Illinois in 2003.

An examination of only the short-term changes associated with the 2005 RDP effort in these three states (from 2004 to 2005) shows relatively small effects on *usage among crash victims* (+1.1 point in Illinois, −0.2 points in Indiana, and +2.6 points in Michigan). Out of context, this suggests that the mobilization (or HVE in general) did not have a major impact. However, as Figure 20 shows, each of these states experienced substantial long-term increases in *usage among crash victims* associated with HVE (and its law upgrades) in the years immediately prior to the 2005 mobilization and such increases continued in two of the three states.

Large increases in Indiana from 2001 to 2003 were likely associated with the implementation of *enforcement zones,* a pioneering enforcement approach similar to the use of checkpoints for impaired drivers. A 12-point increase in Michigan followed its 2000 standard enforcement upgrade and additional increases were associated with participation in subsequent mobilizations. Finally, a 10-point increase in Illinois followed its 2003 upgrade and participation in the 2004 CIOT mobilization.

Looking at the longer term, a very different picture emerges of impact, the role of primary law upgrades, and the continuing impact of subsequent HVE efforts. Usage among victims in these three states increased substantially following their respec-

tive upgrades and in conjunction with subsequent HVE efforts, culminating in the 2005 RDP, which is represented by the highlighted area of Figure 20. In Indiana, *FARS use* increased from a 4-year preupgrade average of 32% to an 8-year postupgrade average of 43% (+11 points); usage in Michigan increased from 45% to a 6-year postupgrade average of 58% (+13 points); and FARS use in Illinois increased from 38% to a 3-year postupgrade average of 46% (+8 points). Translated into changes in UPFC, these gains suggest an average of 63 fewer deaths per postupgrade year in Indiana, 167 fewer in Michigan, and 59 fewer in Illinois. The estimated cost savings associated with these reductions (and reductions in MAIS 2–5 injuries) average more than $200 million per state, per year of postupgrade effort (about $238 million in current dollars).

This examination is intended to illustrate several points: a) impact associated with interventions such as primary law upgrades and repeated HVE implementations should be viewed in the long term as well as in the short term; b) the combination of primary law upgrades and HVE is a powerful combination for impacting safety belt nonuse among persons involved in potentially fatal crashes; c) such combinations in the three states used as examples provided long-term cost savings that averaged more than $200 million per state, per year; and d) any state with a secondary law and a modest usage rate of 65% to 80% should be able to experience similar results. For primary law states with higher rates, additional targeting, greater intensity, and possible increases in sanctions may be needed.

A Summary of the Impact of Safety Belt Enforcement Efforts

Local Programs

This review examined the outcomes from studies involving 30 city or county enforcement efforts implemented from 1985 through 1999, plus two targeted-population programs implemented in 2004 [i.e., the Amarillo, Texas, pickup truck effort (Solomon et al., 2004) and the Reading, Pennsylvania, nighttime enforcement effort (Chaudhary et al., 2005)]. Additional summary information as it relates to various enforcement characteristics and dimensions are provided at the end of the "Local Enforcement" section.

Important local *benchmark* programs included: a) the *three blitz programs* implemented in Elmira, New York, in 1985, 1986, and 1999, respectively; b) the *comparison of blitz and sustained enforcement* conducted in Albany and Greece, New York, in 1986; and c) the *three blitz programs* implemented in Albemarle, High Point, and Haywood County, North Carolina, in 1993, just prior to the first statewide CIOT program.

1. *The three Elmira blitzes* were associated with increases of 28, 14, and 18 percentage points, respectively, from baseline rates of 49%, 66%, and 72%, respectively (Williams et al.,
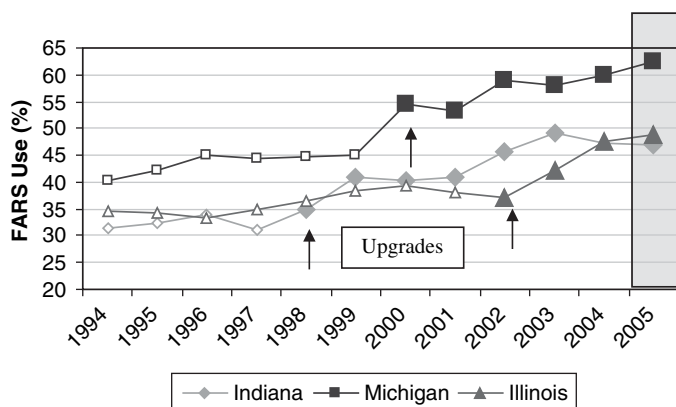

Figure 20. Changes in usage among fatally injured occupants in three primary law states participating in the 2005 Great Lakes RDP (solid symbols indicate primary law in effect).

1987, 1987, 2000). Enforcement activity included both warnings and citations issued primarily at roadblocks or checkpoints. Peak intensity was measured at 267 warnings per 10,000 residents in a 1-week wave that focused only on warnings and 52 to 54 tickets per 10,000 residents in the two waves (7 days and 12 days, respectively) that emphasized ticketing. Publicity included a combination of earned and paid media and, in the 1999 effort, feedback signs. No measure of paid media was available for the third blitz, but the first two involved expenditures of 26¢ to 31¢ per resident.

2. *The Albany and Greece, New York, demonstrations* (Rood et al., 1987) achieved usage increases of 13 points (blitz) and 17 points (sustained), respectively, from baselines of about 50%.[88] The blitz effort averaged about 40 citations per 10,000 residents (per week), comparable to those reported for Elmira, while the sustained effort resulted in only about one citation per 10,000 (per week) over a period of nearly 6 months. Over the 6-month period, the sustained effort achieved an increase that was slightly greater than the blitz program. In addition, after 4 months of follow-up, the sustained program was followed by a smaller postprogram decline than the blitz program. Similar findings were found in Texas (Mounce et al., 1990) and Illinois (Mortimer et al., 1990; Mortimer, 1992).[89]

3. *The three North Carolina blitz programs* conducted in High Point, Elizabeth City, and Haywood County were associated with increases of 13 points, 10 points, and 38 points, respectively, from modest baselines of 65%, 69%, and 43%, respectively (Williams et al., 1994). The large 38-point increase in Haywood County was likely influenced by the low baseline rate and the fact that this was the first such program to be implemented in that county. Collectively, these three demonstrations showed that a combination of intense enforcement (20 to 80 tickets per 10,000 residents per week over 4 weeks) and paid media (about 8¢ per capita per week over nearly 5 weeks) with a *hard enforcement* message was associated with large and significant increases in usage from modest baselines (average = 60%).

4. *Nighttime enforcement efforts* have been shown to increase usage among late-night, high-risk occupants, including bar patrons. These studies are of increasing importance due to high rates of observed use in some states, most of which have much lower usage among crash victims (see "Discussion" section).[90, 91] Local programs that have contributed to the understanding of the nighttime usage issue include the bar patron studies conducted in New York (Preusser et al., 1986) and Nova Scotia (Malenfant and Van Houten, 1988), as well as the early blitz programs conducted in Ottawa, Ontario (Grant, 1991) and Binghamton, New York (Wells et al., 1992). More recently, nighttime enforcement has been evaluated in Reading, Pennsylvania (Chaudhary et al., 2005).

Collectively, these studies show that: a) nighttime belt use is lower than daytime use, particularly among late-night road users and those leaving drinking establishments; b) while daytime enforcement is nearly always associated with significant increases in daytime usage, it generally does not impact nighttime SBU to the same extent;[92] and c) nighttime enforcement, whether focused on safety belts alone or combined with alcohol-impaired driving programs, has been shown to impact nighttime usage, including usage among late-night road users and bar patrons. In some cases, there were increases in nighttime usage while daytime usage remained unchanged. Again, these findings are particularly relevant to current situations where observed usage may be very high but where nighttime

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[88] The increase associated with the blitz approach in Albany was measured over a period of 6 months that included four waves of blitz enforcement. Thus, it is a longer term increase than that reported for many of the blitz efforts.

[89] Because these programs are 15+ years old and did not use paid media, their current relevance is limited. Still, the consistency of results, combined with the fact that blitzes have had diminishing returns in recent years, suggests further examination of the potential for sustained enforcement efforts.

[90] Of current interest are studies that either measured the impact of daytime enforcement on nighttime SBU or the impact of nighttime enforcement efforts (on daytime or nighttime usage). Statewide observational surveys do not include nighttime usage, even though this is when many high-risk drivers and occupants (e.g., young persons, males, drinking drivers and passengers, and traffic law violators) are more prevalent on the roadways. There is reasonably consistent evidence that observed nighttime usage is modestly lower than daytime usage, and even lower very late at night (i.e., between 9 p.m. and 3 a.m.). There is an even greater gap between daytime and nighttime usage among occupants killed in crashes (i.e., FARS usage), particularly when comparing usage among those killed very late at night (see summary of nighttime usage and enforcement issues and results provided in Appendix C).

[91] Increasing usage among occupants involved in serious (potentially fatal) crashes will be essential to further reduce deaths and injuries in high-use states. However, this group constitutes but a small subpopulation of road users—day or night. Even with measures of impact on nighttime usage, one cannot determine the precise impact on the crash-involved population. However, if it can be demonstrated that usage is increased among nighttime drivers (and their passengers), particularly among those likely to have been drinking and/or those on the road very late at night, there is an increased likelihood that usage among the crash-involved occupants is also affected.

[92] A very recent statewide study conducted in Indiana and reported by Vivoda, Eby, St. Louis, and Kostyniuk (2007) reinforces the finding that daytime blitz enforcement may not increase usage among nighttime road users. In this study of a daytime CIOT mobilization, nighttime usage actually declined, which was apparently associated with the mobilization. Other studies have either found a smaller nighttime increase (compared with daytime) or no increase at all in nighttime usage.

usage and usage among fatally injured occupants remains much lower (see "Discussion" section).

Statewide, Regional, and National Results and Trends

Multijurisdictional HVE efforts have been shown to have a significant impact on SBU statewide, regionally, and nationally. Seventeen years of experience with such programs include the 1991–92 Operation Buckledown/70% by '92 program, the 1993–94 North Carolina CIOT program, 6 years of OP-sTEP demonstrations implemented in 20 states as part of Campaign Safe and Sober, and 8 years of Operation ABC/CIOT mobilizations. These efforts, *in conjunction with law upgrades,* have not only demonstrated immediate increases in those jurisdictions where HVE has been implemented, they also have been accompanied by a 30-point nationwide increase in observed usage, from just under 50% in 1990 to just over 80% today. In addition, these programs have provided much information regarding the types and levels of enforcement and media associated with state, regional, and national implementations.

The Benchmark Statewide STEP. Implemented in North Carolina as the CIOT program in 1993, it was part of a 5-year combined effort to increase SBU and decrease alcohol-impaired driving (the latter objective to be accomplished via a similar effort called "Booze It and Lose It"). The first two waves of the CIOT program were accompanied by an immediate 16-point increase in statewide usage, from 63% to 79% (Williams et al., 1996). This effort involved more than 6,000 checkpoints over 7 weeks (an average of 900 per week); nearly 60,000 citations (about 81 per 10,000 residents overall or about 12 per week); and $600,000 in paid media over 15 weeks (about 8¢ per resident overall or about 0.5¢ per week). Media conveyed a "hard" enforcement message—CIOT. Following this initial effort, observed usage in North Carolina remained at about 80% over the next 4 years of the CIOT program and has since increased (modestly) to a 2006 reported rate of 89% (NHTSA, 2007).

Magnitude of Impact. Most multijurisdictional efforts have not achieved immediate increases of the magnitude found in North Carolina. The most often cited programs achieved immediate increases of 7 to 9 percentage points (e.g., 7 points in the 2000 South Carolina CIOT; an average of 9 points in the eight-state southeast regional CIOT implemented in 2001 (range: 4 to 20 points); and an average of 9 points in the 10-state *fully implemented* model programs implemented in 2002 (range: 3 to 19 points)).

Further, there is some evidence of smaller gains associated with programs implemented since 2003. For example, there was a median 5-point gain in the six states participating in the 2005 Great Lakes RDP (range: 3 to 8 points), and there have been decreasing overall gains in the national CIOT mobilizations implemented since 2003.

Program Intensity. It is likely that some of the declining impact associated with statewide and national programs is due to increasing baselines and repeated implementations. However, there is also evidence of lesser intensity and differences in approach associated with recent implementations, compared with the *benchmark* effort. Few programs implemented since 2000 have used *roadblocks or checkpoints* to the extent that North Carolina did and the *duration and intensity of recent enforcement efforts,* as measured by citation rates, have generally not been as great as those of the benchmark (measured per wave). The latter included 7 weeks of enforcement (two successive waves) with about 81 citations issued per 10,000 residents (overall). Most subsequent statewide programs have implemented 2 weeks of enforcement, resulting in about 21 citations issued per 10,000 residents (over the 2-week period).

On the other hand, the *intensity of media efforts* in recent mobilizations has been similar to that of the benchmark (at the program or wave level). Expenditures have averaged about 6¢ to 12¢ per capita (over 2 weeks), compared with 8¢ per capita (over 7 weeks) in North Carolina. Thus, on a per-week basis, the intensity of recent media efforts has generally been greater (3¢ to 6¢ per capita) than that of the benchmark (0.5¢ per capita).

Awareness. In the end, however, *awareness of enforcement,* which is thought to be the product of enforcement and media intensity and duration, has generally been lower in post-2000 mobilizations than in the benchmark. The combination of media and enforcement activity in North Carolina resulted in an 89% awareness of checkpoints and an 85% awareness of the CIOT program. By comparison, awareness of enforcement averaged 59% in the 10 *fully implemented* states in 2002 and only 26% to 35% in the less fully implemented states. Nationwide, awareness of enforcement was only 40% to 41% following the 2003 and 2004 national CIOT mobilizations, less than half that measured in North Carolina.[93] This *may* reflect the lower levels of enforcement intensity and lesser use of checkpoints, in spite of equal or greater media intensity in the recent programs.

Some Observations. The review of HVE implementations suggests that: a) it is more difficult to implement a statewide (or broader-based) program with the same intensity as a local

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[93]Only the 2000 CIOT mobilization in South Carolina resulted in a relatively comparable awareness of enforcement (73% to 82%, depending on the measure used). Unfortunately, that program was followed by a political controversy that greatly reduced enforcement in subsequent months and years.

program; b) paid media appears to greatly facilitate the impact of statewide (or broader-based) programs (see Milano, McInturff, and Nichols, 2004); c) as with local programs, repeated waves of activity produce a *ratcheting* or *saw blade* effect, with initial increases followed by modest postprogram declines, followed by additional increases and modest post-program declines with each subsequent wave of activity (see Solomon et al., 1999); d) successive program implementations will likely result in progressively higher levels of usage and awareness (of both enforcement and safety belt messages) and smaller increments of change from these higher levels (see Solomon et al., 1999 and Nichols et al., 2007); and e) in current secondary states, a primary law upgrade will substantially increase the gains associated with HVE mobilizations.

Longer-Term Impacts of HVE/STEP Efforts.   Fifteen states participated in the state, regional, or model STEP (HVE) programs implemented in 2000, 2001, or 2002. Nearly all of these states also participated in subsequent national CIOT mobilizations. Looking only at these 15 states, there was an average 15-point increase in observed usage, from 1999 through 2005.[94] The greatest increase was found among five states (Washington, Illinois, Indiana, Alabama, and Tennessee) that also upgraded their secondary laws during this period. These states experienced an average increase of 19 points from average baselines of about 65%. One state with an existing primary law (Texas) experienced a 16-point increase, from a baseline of 74% usage. Increases among seven states that retained their secondary laws (West Virginia, Vermont, Florida, Mississippi, South Carolina, Kentucky, and Nevada)[95] were lower, with an average increase of 14 points from an average baseline of 63%. Thus, most of these states continued periodic HVE activity over several years and initial increases, which averaged 8 to 9 percentage points, were subsumed within longer-term increases

averaging 15 points. In addition, states that upgraded their laws during this period nearly always experienced larger increases than states that retained their secondary laws.[96]

Impact of HVE on Usage Among Crash Victims.   Changes in FARS use in these 15 states were somewhat smaller than increases in observed use and they emerged from much lower baselines. Six-year increases in use among crash victims averaged 7 points in the 15 participating states: 10 points in five states with new upgrades (average baseline of 36%); 9 points in six states with existing upgrades (average baseline: 36%); and 6 points in seven secondary law states (average baseline of 32%). Usage among victims did not increase appreciably in North Carolina during this period, which is presumably related to the fact that baseline FARS usage was already higher than in any of the participating states (50%), and there is some indication that recent mobilizations in North Carolina have not been of the same intensity as the benchmark program.

Establishing Performance Measures.   Much information has been gained over the past decade with regard to the characteristics of media and enforcement that have been associated with HVE, STEP, or mobilization efforts. In spite of these increases in knowledge, it has been difficult to quantify threshold levels of the intensity or duration of enforcement and media required for impact *or* to establish a quantitative relationship between intensity, duration, and magnitude of increase. This difficulty is due in part to the substantial variation in enforcement and media approaches, types of messaging, fine levels, baseline rates, etc. Summarized in this report are the characteristics of enforcement, media, and awareness that have been part of past program implementations. Efforts to use these data to develop performance measures are currently being explored.

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[94] Appendix D provides more detailed data on usage rate trends (Observed and FARS) in these states.

[95] South Carolina (Dec. 2005), Mississippi (April 2006), and Kentucky (Jan. 2007) have since upgraded their secondary laws but not in time to impact 2005 usage rates.

[96] Low usage persists in South Carolina, which was one of the original CIOT states, but which suffered from political opposition to safety belt enforcement and only recently implemented a primary law (December 2005). Thus, the impact of this upgrade would not be apparent in this comparison.

CHAPTER 4

Sanctions

Sanctions for safety belt violations have typically been minimal in comparison with penalties for other violations. In general, "Stop" sign violations carry greater fine levels than nonuse of safety belts (Automotive Coalition for Traffic Safety, 2001). There is reasonably strong circumstantial evidence to suggest that, if penalties were more in line with those of other traffic law violations (and publicized), usage would be positively affected. However, there has not been a great deal of research conducted with regard to this issue. The most commonly suggested options for increasing sanctions have been increasing fines to more reasonable levels (e.g., $50 to $100) and imposing penalty points on a driver's license for safety belt violations. There also have been suggestions that reductions in damage awards for unbelted victims could impact SBU.

The Importance of Penalties in Conjunction with Legislation

The review of the impact of safety belt legislation provides consistent evidence that the *presence or absence* of a penalty contributes to the efficacy of an SBU law, particularly a primary enforcement law. Data from the 1987 Campbell study of early safety belt laws showed that when a primary law was implemented and a penalty was in effect, there was an average increase in usage of about 38 percentage points. When no penalty was in effect, such as during a warning-only period, the average increase was only 23 points, about the same as in secondary law states, with or without sanctions.

Eight years later, when Winnicki (1995) reported on his analysis of usage among fatally injured occupants, he found that the largest increases in *usage* were in primary-law states where sanctions were in effect within 4 months after implementation of the law (median increase of 21 points). In several states with delayed fines, he found a significant impact when the law went into effect *and* when the fine went into effect (i.e., in Florida, Missouri, Tennessee, North Carolina, and Washington). Again, these findings pertain to persons killed in fatal crashes, which is by definition a higher than average risk group.

Recently, the State of Washington enacted a primary law upgrade, implemented HVE efforts in conjunction with that upgrade, and increased the penalty for *all* traffic law violations. The new penalty for a safety belt violation increased from $86 to $101. This increase was publicized extensively, including on road signs. In their evaluation of the impact of Washington's primary law upgrade, Salzberg and Moffat (2004) suggested that the publicized increase in fines was an important contributor to the 12-point impact on observed usage, which increased from 83% to 95%.

Another aspect of penalties that should be considered is the fact that impaired driving studies have shown that the combination of swift, certain, and *reasonably severe* penalties have been necessary and effective deterrents to impaired driving (Nichols and Ross, 1989). Of course, these impaired driving penalties have been many times higher than those associated with violations of SBU laws.

Fine Levels and Penalty Points

Winnicki also reported that, during the early period of law enactments when usage rates were very low, the magnitude of the fine was positively related to usage. He estimated that each $10 increase in fine level would be associated with a 7.4-point increase in usage among persons involved in potentially fatal crashes.

Current Fine Levels

As of 2005, 38 states had fine levels of $25 or less (median value = $25), while 11 states and the District of Columbia had a fine level of $30 or greater (median fine level = $50). Among these states, undifferentiated by type of law, jurisdictions with a fine of $30 or greater had an average usage rate of 84.3%. States with lower fines had an average rate of 80.7% (3.6 points lower). Consistent with the data from Campbell and Winnicki, *this difference was greatest in primary law states.* Primary law states with a fine of $30 or greater had an average usage rate of 88.8%,
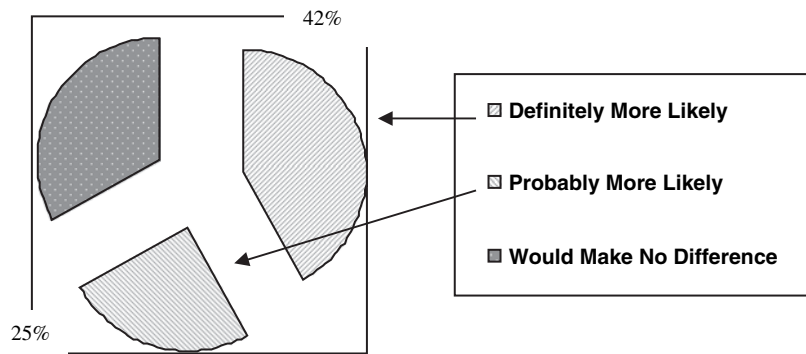
*Figure 21. Self-reported likelihood of buckling up if the fine
was increased (Automotive Coalition for Traffic Safety, 2001).*

compared with an average of 82.4% in primary states with a lower fine (+6.4 points).[97]

Opinions of Nonusers

Existing low fine levels may be related to attitudes regarding sanctions for nonuse that date back to the 1980s, when SBU laws were first enacted. At that time, there was a hesitancy to attach anything but a minimal fine to a new law. However, as Figure 21 shows, about two-thirds of nonusers and part-time users surveyed by the Automotive Coalition for Traffic Safety (ACTS) indicated that they would (probably or definitely) be more likely to buckle up if fines were increased, leaving only one-third who indicated that they would not likely change their behavior if fines increased (ACTS, 2001). Seventy-six percent of these respondents indicated that they would buckle up if nonuse could result in penalty points assessed against their driver's license. When asked about the most effective way to get them to buckle up, 30% responded that penalty points would be most effective, compared with about 15% who said that increased fines would be most effective.

Opinions of Hard-Core Nonusers

In North Carolina, a telephone survey of hard-core nonusers found 62% who said that they would not buckle up regardless of the magnitude of the fine or that they did not know how high a fine would convince them to buckle up (Reinfurt, Williams, Wells, and Rodgman, 1996). This survey took place immediately after the benchmark CIOT program that included about 6,000 checkpoints and the issuance of nearly 60,000 citations across the state. These nonusers were considered to be among the least likely to buckle up and, as other studies have found, were typically young males, driving older vehicles or pickup trucks, and with poor driving records. In-

terestingly, as in the ACTS survey, 62% of these *hard-core nonusers* said that they would buckle up if a violation resulted in points assessed against their license.

Canadian Experience with Demerit Points

The Canadian experience is often mentioned with regard to the potential for penalty or demerit points to increase usage. Canada began to use high-visibility STEP efforts in the early 1980s in an effort to increase usage in the individual provinces and nationwide. That approach was associated with substantial increases in usage (see discussion of Canadian enforcement history in the "Enforcement Section" of this report). In addition, penalty points were implemented in most provinces and territories as part of the nationwide effort to increase usage. A national use rate of 90% was achieved in 1994 and penalty points (in 9 of 12 jurisdictions) *may* have played a role in that accomplishment. Boase et al. (2004) pointed out that the principle involved in the various demerit systems implemented in Canada was that the points accumulated and thus repeat violations resulted in additional sanctions, such as the loss of a license and increased cost of insurance.

With regard to the Canadian experience, there has been reasonably frequent speculation that penalty or demerit points played a role in that nation's success in reaching a 90% usage rate, but there is no hard documentation of such impact.

Reduced Damage Awards

Another form of penalty that has been suggested involves reduced damage awards to victims of crashes if they were unbuckled at the time of the crash. Here again, logic suggests that such a penalty might have an impact, but there is no research to support that hypothesis. Still, in the realm of self-reported data, the ACTS survey found that, among nonusers and part-time users who were asked if reduced damages would increase their likelihood of buckling up, about 65% said that it definitely or likely would cause them to buckle up. This pro-

[97]These rates and fine levels were derived from Glassbrenner (2005).
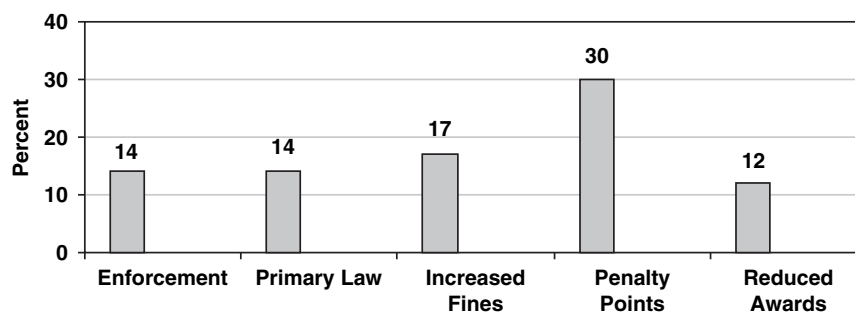
Figure 22. Responses to the question: What would be the most effective way to get you to buckle up more frequently? (Automotive Coalition for Traffic Safety, 2001).

portion was nearly identical to the proportion that said increased fines would affect their behavior.

An older study of operators of state-owned vehicles in three Florida government agencies found that a disincentive such as this, combined with dashboard stickers and signature sheets warning of a 25% reduction in benefits for not buckling up, resulted in substantial 38- to 48-point increases in observed usage. However, these increases were from very low usage levels of only about 10% (Rogers, Rogers, and Bailey, et al., 1988). Further, these observations were of employees driving official vehicles. Usage among employees while driving their own vehicles increased by only 6 to 8 points from similarly low baselines.

Choosing Between Alternative Sanctions

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: a) increased enforcement; b) primary law upgrade; c) increased fines; d) penalty points; and e) reduced damage awards. Figure 22 shows that the most frequently selected option was penalty points (30%), followed by increased fines (15%), increased enforcement or primary laws (14% each), and reduced awards (12%).

Hedlund (2006) pointed out that the issue of penalties must be considered in the context of their potential impact on enforcement. Penalties that are too low are likely to be ineffective, but penalties that are too high may make some police reluctant to issue citations. Among the U.S. public, there is reasonably strong support for increased fines of up to about $50, but less support for penalty points. The 2000 Motor Vehicle Occupant Safety Survey (MVOSS) found that, while 62% of the public favored fine increases and 21% opposed them, only 31% favored penalty points and 49% opposed them (Block, 2001). This lower level of support for penalty points may affect legislators' willingness to enact such sanctions into law. On a more positive note, however, support for such sanctions has been increasing over time and experience with primary laws suggests that public support will increase substantially if such sanctions are enacted.

An additional piece of information is provided by the 2000 MVOSS (Block, 2001). In an effort to make the issue of penalties somewhat less personal, respondents were asked if someone they knew who didn't buckle up all of the time would wear his or her safety belt if assessed various fine amounts. Figure 23 shows that, as the proposed fine level increased, so did the expectation that it would change the behavior of the person in question. With a fine of $50, 57% of respondents indicated
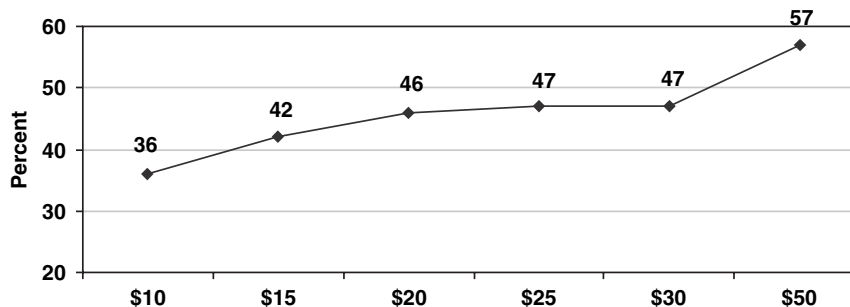
Figure 23. Percent of respondents stating that it is likely that a nonuser that they know would buckle up if assessed the state fine (by fine level) (Block, 2001).

that a nonuser known to them would likely buckle up. This is compared with 47% for a proposed fine of $25 (the median fine for nonuse in the United States) and 10% for a proposed fine of $10.

Summary of Sanctions

In summary of penalties and their potential impact, there is relatively little research regarding their past, present, or potential impact, particularly compared with evidence regarding the impact of laws, upgrades, and enforcement. However, there is consistent circumstantial evidence to suggest that publicized increases in fines and assessment of penalty points would impact SBU. Further, relatively recent survey data suggest that an increase in fines (up to about $50) would be supported by a majority of the public and that public acceptance of increasing penalties for seat belt nonuse is increasing, rather than decreasing.

CHAPTER 5

Conclusions and Discussion

Conclusions

Strong state SBU laws are the foundation from which other successful programs can be implemented. Initial laws are largely responsible for elevating usage in the United States from below 15% in 1983 to over 50% by 1992. Early laws have been associated with a median 9% reduction in fatalities and a median 13% reduction in serious injuries.

Since 1992, upgrades in 18 jurisdictions (through February of 2007) have been associated with increases in observed usage that have averaged 13 to 16 percentage points. More importantly, recent upgrades have been found to have had an impact on higher risk motorists, such as young males, rural drivers, occupants of pickup trucks, and drinking drivers. Based on existing studies, primary law upgrades have been associated with a median 7% to 8% reduction in fatalities. Cost savings estimates are as high as $300 million per year, based on impacts reported for some states. If current secondary law states would enact primary law upgrades, they would likely achieve about a 10 percentage point increase in usage among occupants killed in crashes, a 6% to 7% reduction in occupant deaths and injuries, and an annual cost savings of about $100 million per year. The combination of primary law upgrades and continued implementation of HVE provides the greatest potential for current secondary laws to achieve high usage rates, both observed and among fatal crash victims.

HVE efforts have also been associated with significant increases in usage at the local, state, and national levels. At the local level, the Elmira, New York, benchmark program resulted in an immediate 28-point increase in observed SBU. On the statewide level, the North Carolina benchmark program was associated with an immediate 16-point increase in observed usage, a 7% reduction in driver occupant deaths, and cost savings estimated to be as high as $300 million per year. While more recent programs have had more modest impacts, they also have been of lesser intensity and have reached much lower levels of enforcement awareness, compared with the benchmarks. Recent statewide efforts, when supported with paid and earned media, have attained median increases of 7 to 9 percentage points.

There is consistent circumstantial evidence to suggest that publicized increases in fines (to approximately $50 plus court costs) and/or imposing penalty points for safety belt violations, *if publicized,* would increase the impact of current legislation and enforcement efforts. The research in this area is not nearly as strong as it is for legislation or enforcement, but it is consistent. Further, there is evidence of increasing public support for larger fines and possibly for penalty points.

The past 10 years have witnessed the implementation of a series of successful statewide and national enforcement mobilizations (sometimes implemented in conjunction with primary law upgrades) that have been associated with increases in the national usage rate from about 61% in 1996 to 82% in 2005, an increase of more than 21 points. However, usage remains lower among high-risk nighttime drivers and passengers and it appears that the rate of increase in observed daytime usage is slowing. This suggests a need to reexamine all possible means for getting *high-risk* occupants to buckle up. One of the highest risk groups is represented by occupants who are on the roadways late at night, often traveling to or from drinking establishments. Additional emphasis has recently been placed on reaching this target group. While there have not been a sufficient number of studies of the potential impact of nighttime enforcement efforts, the handful of available studies suggest that such efforts, when accompanied by sufficient publicity, can have an impact on late-night road users, including bar patrons.

Two important findings from state and local studies are that: a) daytime enforcement may not affect late-night SBU, and b) nighttime enforcement efforts may affect late-night usage without affecting daytime use.

Discussion

One objective of this report and the review from which it emanated is to suggest how states at various levels of SBU might make additional progress in increasing usage, either among the population as a whole or, more importantly, among high-risk and crash-involved occupants. As indicated, the larger review suggests that the basic foundation for acceptably high usage rates is a law that allows for standard/primary enforcement and a *reasonable* penalty. With such a law and with substantial media and publicity, enforcement and sanctions have the greatest potential for impact.

Currently, in the United States, there is a mixture of primary and secondary laws, modestly high and very low fines, and little use of penalty points for safety belt law violations. On the other hand, most states have been participating at least annually in enforcement mobilizations and, as a result of such participation, some of these states have acquired observed use rates of 90% or greater. After participating in HVE mobilizations for several years, some states are experiencing smaller increases associated with such efforts and, as a result, there has been some concern whether or not additional progress in these states is possible, particularly those with usage rates of 85% to 90% and higher.

A review of observed usage and usage among crash victims suggests that there is still much progress to be made and much to be gained in terms of reductions in deaths, injuries, and related costs. This position is based on: a) the known effectiveness of legislative and enforcement efforts; b) the potential effectiveness of increased and publicized sanctions; and c) the relatively low rates of usage among crash victims in most states.

In those states with the highest usage rates, both observed and among victims, it is likely that there will need to be a refocus of programs to better target the highest risk motorists and perhaps more attention paid to measuring progress in terms of usage among occupants involved in potentially fatal crashes. Of course, any state could benefit from such a refocus, regardless of its current usage rate.

A Taxonomy Based on Observed Use Rates

Observed SBU has been the primary measure by which most programs have been evaluated over the past 2 decades. Thus, this examination begins with a taxonomy of states based on observed usage. Using statewide reported use rates for 2006,[98] there were 11 states with *usage of 90% or greater* in that year.[99,100,101] The median rate in these 11 states was 91% (range: 90% to 96%). All had standard/primary enforcement laws and all appear to have participated regularly in recent CIOT mobilizations by intensifying enforcement (with an estimated average of about 11 citations per 10,000 residents per week) and implementing paid media to publicize their enforcement activities (expending an estimated average of 3¢ to 7¢ per resident, per week, based on the various campaigns reviewed). These data seem to suggest that there is little potential for further impact in these states.

However, a closer look at the median usage rate among occupants killed in 2005 (the last year for which FARS data were available at this writing) shows that the median usage among crash victims *in these high-use* states was only 54% (range: 44% to 68%).[102] This translates to a median UPFC of about 71% (with a range of 60% to 81%).[103] In three of these states (Hawaii, New Mexico, and Georgia) the *FARS rate* was less than 50% and the UPFC was less than 67%. Thus, about a third of occupants *involved in potentially fatal crashes* in these states were still not buckled up.

Three of the 11 states (Oregon, Michigan, and California) had FARS rates of 60% or greater (UPFC >75%). Oregon had a FARS rate of 68%, which translated to a UPFC of about 81%. Thus, in these states, about 20% of those involved in potentially fatal crashes were not buckled at the time of the crash. While this group is likely to be very difficult to reach, any impact on its members (as measured by changes in UPFC) is likely to have a direct impact on deaths and serious injuries.

As a group, these 11 states (particularly Oregon, Michigan, and California) *may* have to shift their focus, tactics, and measurement approach to impact this high-risk group of holdouts (i.e., the approximately 20% to 30% of crash-involved occupants who remain unbuckled). Programmatically, this will likely require enforcement that is more specifically directed at the high-risk driver, who is frequently on the road late at night and often after drinking alcohol. Highly publicized

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[98] Based upon SBU in 2006—Use Rates in the States and Territories, *Traffic Safety Facts: Crash Stats.* Report DOT-HS-810-690. National Highway Traffic Safety Administration, 2007.

[99] Reported rates are rounded to the nearest whole percentage point.

[100] 2006 usage is coded as not available for three states in the source document. Two of these states (Arizona and Nevada) reported usage rates greater than 90% in 2005; the third state (Pennsylvania) reported 83% usage in 2005.

[101] These 11 states with 90%+ usage in 2006 (and their rates) were: Washington (96%); Michigan and Oregon (94%); California and Hawaii (93%); Maryland (91%); and Texas, Georgia, New Jersey, Iowa, and New Mexico (90%).

[102] Based on 2005 FARS data, which were the latest data available at this writing.

[103] UPFC in this section is estimated for each group, based on an overall 52% effectiveness estimate for safety belts against deaths (i.e., aggregating usage for all vehicle types and seating position) in 2005.

increases in fines would likely add to the impact in these states, as would the *publicized* use of penalty points for convictions.[104] From an evaluation standpoint, these states may have to place more emphasis on measuring impact in terms of increases in nighttime usage, usage among crash victims, and/or UPFC.

A second group of 18 jurisdictions, those *with observed usage between 80% and 89%,* includes 17 states and the District of Columbia.[105] The median observed rate for these states was 84% in 2006. As expected, however, use among crash victims was considerably lower and there was much variation from state to state, with a median usage rate of only 44% (range: 37% to 55%). The median UPFC was about 63% (range: 55% to 72%). Thus, between 28% and 45% of those involved in potentially fatal crashes in these states were not buckled up—leaving substantial room for additional gains.

Ten of these 18 jurisdictions had standard/primary laws and eight had secondary laws. West Virginia, Delaware, Alabama, and the District of Columbia had FARS rates under 40% and UPFC of less than 59%. In the eight states with secondary laws, top priority should be placed on obtaining a standard/primary enforcement law. This would likely result in an immediate 10-point increase in usage among crash victims (i.e., the FARS rate). Continued conventional enforcement and media efforts would likely result in additional increases. As in the previous category of states, increased usage among high-risk groups would be likely with a focus on nighttime enforcement and/or a publicized increase in fine levels (and/or license demerit points). Also, as with the previous group of states, evaluation should include measurement of usage among nighttime road users and/or those involved in fatal and serious injury crashes.

All of the remaining states, with the exception of Arizona, Nevada, and Pennsylvania (for which 2006 rates were not available in the source document), currently have observed rates of less than 80%. With primary laws in place, continued enforcement (day or night), and fines of at least $30, each of these states should be capable of reaching an observed rate of 85% to 90%. If any would choose to focus on high-risk nighttime drivers and drinking drivers at this time, even higher rates would likely result.

A Taxonomy Based on FARS Usage and UPFC

One problem with the above taxonomy is the substantial variation in use rates among victims (FARS rates) within each category of observed usage. Assuming that FARS use is accurately and reliably recorded, a more relevant taxonomy would be based on FARS data itself. Table 11 shows five groups of jurisdictions based on 2005 *usage among crash victims* and among the hypothetical population of *occupants involved in fatal crashes* (UPFC).[106] This table also includes relevant information with regard to law type,[107] fine level,[108] and observed usage for 1998 (the first full year of mobilization efforts) and 2005.[109] Note that while the national observed usage rate was 80% in 2005, the FARS rate was 45% and UPFC was about 63%.

Using the FARS rate, the top tier of states includes three primary law states with rates of 60% or greater. (See Appendix F for a complete array of states by observed and FARS usage rates.) They are Oregon (68%), Michigan (63%), and California (77%). The median UPFC among these states is 78%, ranging from 77% in California to 81% in Oregon. All three states had 2005 observed usage rates of 93%. Perhaps the most relevant point is that, while observed rates in these states suggest that only 7% of motorists were unbuckled, UPFC rates suggest that between 19% and 23% of persons involved in potentially fatal crashes were unbuckled. Still, as was suggested for states with such high rates, further progress will likely require more specific targeting of high-risk groups, likely nighttime enforcement, and monitoring of FARS and nighttime usage rates (see Appendix F for observed/FARS usage distributions).

The same is true for the next group, which consists of eight primary law states that had 2005 FARS rates between 50% and 60%. Median FARS usage was 54% (range: 50% to 55%) and median UPFC was 70% (range: 67% to 71%). These rates suggest that about 30% of crash-involved occupants were unbuckled (range: 28% to 37%). Observed usage in this group ranges from 78% in Alaska to 95% in Washington. Based on FARS

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[104]While there is reasonably strong public support for primary enforcement and increases in fines, there is less support for the assessment of penalty points.

[105]From highest to lowest usage, jurisdictions that reported 80% to 89% observed usage were: Utah, North Carolina, and West Virginia (89%); Illinois (88%); Delaware (86%); the District of Columbia (85%); Indiana, Oklahoma, and Connecticut (84%); Minnesota, Alaska, New York, and Alabama (83%); Vermont and Ohio (82%); Florida (81%); and Colorado and Idaho (80%).

[106]The UPFC values in this table are *estimates,* based on a national-level estimate of the overall effectiveness of safety belts against deaths (E) across all vehicle types, as calculated in Appendix A. Ideally, effectiveness (E) would be calculated individually for each state, using the state-specific distribution of involvement in fatal crashes by vehicle type and seating position.

[107]*Law type* status is as of September 2006. The source is Traffic Tech # 317: Primary Enforcement Saves Lives: The Case for Upgrading Secondary Safety Belt Laws. *Traffic Safety Facts.* National Highway Traffic Safety Administration, 2006.

[108]*Fine level* does not include court costs. Some fines have wide ranges. Minimum fine is shown in this table. Potential for assessing penalty points on license indicated by asterisk. Source of these data is Glassbrenner, SBU in 2005—Use Rates in the States and Territories. Traffic Safety Facts. *Research Note,* 2005.

[109]*Observed usage* is also from Glassbrenner (2005); rates are rounded to nearest full percentage point. Rates for Georgia, Iowa, and Minnesota were updated based on data from NHTSA's Traffic Safety Facts, March 2007.

Table 11. Categorization of jurisdictions by usage among victims of fatal crashes (FARS Use) in 2005: Law type, fine level, UPFC, and observed use also included.

State	Law	Fine ($)	FARS Use	(Est.) UPFC	Obs. Use 1998–2005
I. States with 60%+ Use Among Victims (FARS)					
OR	P	$94	68%	82%	83% → 93%
MI	P	$25	63%	78%	70% → 93%
CA	P	$20	62%	77%	89% → 93%
II. States with 50% to 59% Use Among Victims					
NY	P	$50*	55%	71%	75% → 85%
AK	P	$15	55%	72%	57% → 78%
IA	P	$25	54%	71%	77% → 87%
WA	P	$101	54%	71%	79% → 95%
MD	P	$25	54%	70%	83% → 91%
NJ	P	$42	53%	69%	63% → 86%
TX	P	$25+	52%	70%	74% → 90%
NC	P	$25	50%	67%	77% → 87%
III. States with 40% to 49% Use Among Victims					
HI	P	$45	49%	66%	81% → 95%
NM	P	$25*	49%	68%	83% → 90%
IL	P	$25	49%	66%	65% → 86%
VT	S	$10	48%	63%	63% → 85%
IN	P	$25	47%	65%	62% → 81%
NV	S	$25	47%	65%	76% → 95%
MN	S	$25	47%	64%	64% → 84%
CT	P	$37	45%	62%	70% → 82%
UT	S	$15+	45%	62%	67% → 87%
GA	P	$15	44%	61%	74% → 90%
DE	P	$25+	44%	60%	62% → 84%
ME	S	$25+	43%	58%	61% → 76%
CO	S	$15	43%	61%	66% → 79%
ID	S	$10	43%	61%	57% → 76%
OH	S	$25	42%	59%	61% → 79%
FL	S	$30	41%	58%	57% → 74%
OK	P	$20	40%	58%	56% → 83%
LA	P	$25+	40%	58%	66% → 78%
State	**Law**	**Fine**	**FARS**	**(Est.)**	**Obs. Use**

State	Law	Fine ($)	FARS Use	(Est.) UPFC	Obs. Use 1998–2005
IV. States with 30% to 39% Use Among Victims					
AL	P	$25	39%	57%	52% → 82%
AZ	S	$10	39%	58%	62% → 94%
TN	P	$10+	39%	57%	57% → 74%
WI	S	$10	38%	55%	62% → 73%
DC	P	$50*	38%	55%	80% → 89%
WV	S	$25	38%	56%	57% → 85%
PA	S	$10	37%	53%	68% → 83%
RI	P	$75	35%	52%	59% → 75%
KY	P	$25	35%	53%	54% → 67%
VA	S	$25	35%	52%	74% → 80%
WY	S	$10+	34%	54%	50% → N/A
MO	S	$10	34%	51%	60% → 77%
MA	S	$25	33%	50%	51% → 65%
KS	S	$10	33%	51%	59% → 69%
AR	S	$25	32%	50%	53% → 68%
NE	S	$25	32%	50%	65% → 79%
SC	P	$10	32%	49%	65% → 70%
NH	S	$25	30%	46%	N/A
V. States with 20% to 29% Use Among Victims					
MT	S	$20	27%	44%	73% → 80%
MS	P	$25	27%	43%	58% → 61%
SD	S	$20	26%	41%	46% → 69%
ND	S	$20	25%	40%	40% → 76%
State	**Law**	**Fine**	**FARS**	**UPFC**	**Obs. Use**

Notes:
- FARS rate is calculated on known use; unknown use is omitted from rate calculation
- Observed use and fine data from Glassbrenner (2005)
- UPFC calculated by vehicle type; then aggregated (See Appendix A for example of procedure)
- Asterisk in fine column signifies points also assessed
- See Appendix F for scatter plot

and UPFC rates, these states (like Oregon, Michigan, and California) may need to redirect their enforcement, publicity, and penalty efforts to more effectively impact the behavior of young males, nighttime drivers, and drinking drivers. Such a focus should directly impact usage among crash-involved drivers. A side benefit of such an approach would likely be a reduction in alcohol-related deaths, since about 70% of occupants killed in alcohol-related crashes are currently unbuckled. Another benefit would be that these states could provide a model for other states still implementing more traditional enforcement efforts.

The third group includes 18 states with FARS rates between 40% and 49% (median: 45%). The median UPFC in this group was about 62% (range: 58% to 66%). An average of 38% of crash-involved occupants in this group were unbuckled (range: 34% to 42%). By comparison, *observed usage* ranged from 74% (in Georgia) to 95% (in Hawaii). This could be considered a transition group, within which there is still room for progress using more general enforcement and publicity efforts. Even if their strategies do not change, many of these states will likely have to monitor usage among crash victims in order to document further progress. All would benefit from more focused,

intense, and publicized enforcement, combined with tougher and more visible sanctions.

The fourth group of jurisdictions includes 17 states and the District of Columbia, all of which have usage rates among victims that are below 40% (median 35%; range: 30% to 39%). The median UPFC in this group is 53% (range: 46% to 57%). Observed usage among these jurisdictions ranges from 70% in South Carolina to 94% in Arizona. Clearly, there is much room for additional impact in these states, even with current daytime enforcement efforts. Eleven still have secondary laws and at least six have very low fines of only $10. As a group, there is much potential for impact among these states.[110]

The final grouping includes states with FARS rates of less than 30% and UPFC rates of 40% to 44%. Three of these four states have secondary laws with fines of under $25. Nearly

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[110]It should be noted that among these states is South Carolina, which implemented a benchmark CIOT program in 2000 and enacted a primary law upgrade in 2005. South Carolina had a FARS rate of only 32% in 2005. Clearly, there have been obstacles to sustaining a high usage rate in this state.

60% of occupants involved in fatal crashes in these four states are unbuckled.

In summary of this examination of state usage rates, both observed and among crash victims, there is substantial room for impact in nearly all states if more focus is placed on high-risk occupants who are most likely to be involved in fatal crashes. They include those traveling at night and those traveling in vehicles driven by drinking drivers. States with lower FARS rates (e.g., under 40%) should reexamine their efforts to determine why, in spite of reasonably high observed usage rates, more crash victims are not buckled up.

As a postscript, it is important to reiterate that, as the information in Appendix C suggests, there is a strong relationship between alcohol use and the nonuse of safety belts. While it cannot be definitively stated that these are the *same* groups of road users, there certainly appears to be a great degree of overlap. Considering the fact that about two-thirds of the victims of alcohol-related crashes are in the drinking driver's vehicle (mostly the drinking driver himself) and the fact that about 70% are unbuckled at the time of the crash, there is considerable potential for addressing the alcohol-related fatality issue by getting drinking drivers and their passengers to buckle up. Since both problems peak at nearly identical times (i.e., between midnight and 3 a.m.), there is opportunity for coordinated enforcement efforts.

From the standpoint of reducing alcohol-related deaths, a focus on nighttime enforcement could impact the problem by: a) increasing deterrence (since safety belt nonuse is a more observable offense than impaired driving) and b) simply increasing protection among occupants involved in alcohol-related crashes. From the standpoint of reducing unrestrained deaths, focusing enforcement on one of the highest risk, lowest use groups (i.e., drinking drivers and their passengers) would seem to provide maximum potential for directly affecting those most likely to be involved in a crash. Further, such an approach would facilitate manpower and staffing problems that enforcement agencies may face when mounting nighttime enforcement activities.

References

Blincoe, L. J. *The Economic Cost of Motor Vehicle Crashes, 1994.* Report DOT-HS-808-425. National Highway Traffic Safety Administration, 1996.

Blincoe, L., Seay, A., Zaloshnja, E., Miller, T., Romano, E., Luchter, S., and Spicer, R. *The Economic Impact of Motor Vehicle Crashes, 2000.* Report DOT-HS-809-446. National Highway Traffic Safety Administration, 2002.

Blincoe, L. J. and Faigin, B. M. *The Economic Cost of Motor Vehicle Crashes, 1990.* Report DOT-HS-807-876. National Highway Traffic Safety Administration, 1992.

Block, A. W. *2000 Motor Vehicle Occupant Safety Survey.* Report DOT-HS-809-389. National Highway Traffic Safety Administration, 2001.

Boase, P., Jonah, B. A., and Dawson, N. Occupant Restraint Use in Canada. *Journal of Safety Research,* Vol. 35, 2004, pp. 223–229.

Bowman, B. L., and Rounds, D. A. *Restraint System Usage in the Traffic Population: 1987 Annual Report.* Report DOT-HS-807-342. National Highway Traffic Safety Administration, 1988.

Bowman, B. L., and Rounds, D. A. *Restraint System Usage in the Traffic Population: 1988 Annual Report.* Report DOT-HS-807-447. National Highway Traffic Safety Administration, 1989.

Campbell, B. J. The Association Between Enforcement and Seat Belt Use. *Journal of Safety Research,* Vol. 19, 1988, pp. 150–163.

Campbell, B. J., Stewart, J. R., and Campbell, F. A. *1985–1986 Experience with Belt Laws in the United States.* University of North Carolina, Highway Safety Research Institute, Chapel Hill, N.C., 1987.

Chaudhary, N. and Solomon, M. G. *Evaluation of Alabama, Michigan, and New Jersey Safety Belt Law Change to Primary Enforcement.* National Highway Traffic Safety Administration (under review).

Chaudhary, N. K., Alonge, M., and Preusser, D. F. Evaluation of the Reading, PA Nighttime Safety Belt Enforcement Campaign: September 2004. *Journal of Safety Research,* Vol. 36, 2005, pp. 321–326.

Datta, T. K., and Guzek, P. *Restraint System Use in 19 U.S. Cities: 1989 Annual Report.* Report DOT-HS-807-595. National Highway Traffic Safety Administration, 1990.

Datta, T. K., and Guzek, P. *Restraint System Use in 19 U.S. Cities: 1990 Annual Report.* Report DOT-HS-808-147. National Highway Traffic Safety Administration, 1991.

Datta, T. K., and Guzek, P. *Restraint System Use in 19 U.S. Cities: 1991 Annual Report.* Report DOT-HS-808-148. National Highway Traffic Safety Administration, 1992.

Dinh-Zarr, T. B., Sleet, D. A., Shults, R. A., Zaza, S., Elder, R. W., Nichols, J. L., Thompson, R. S., and Sosin, D. M., Task Force on Community Preventive Services, 2001. Reviews of Evidence Regarding Inter-ventions to Increase Use of Safety Belts. *American Journal of Preventive Medicine,* Vol. 21(4S), 2001, pp. 48–65.

Dussault, C. Effectiveness of a Selective Traffic Enforcement Program Combined with Incentives for Seat Belt Use in Quebec. *Health Education Research,* Vol. 5, 1990, pp. 217–224.

Eby, D. W., Vivoda, J. M., and Fordyce, T. A. The Effects of Standard Enforcement on Michigan Safety Belt Use. *Accident Analysis and Prevention,* Vol. 34, 2002, pp. 815–823.

Farmer, C. M., and Williams, A. F. *Effect on Fatality Risk of Changing from Secondary to Primary Seat Belt Enforcement.* Insurance Institute for Highway Safety, Arlington, Va., 2004.

Glassbrenner, D. Safety Belt Use in 2005—Use Rates in the States and Territories. *Traffic Safety Facts: Research Note.* Report DOT-HS-809-970. National Highway Traffic Safety Administration, 2005.

Glassbrenner, D. and Utter, D. *Observed Shoulder Belt Use from the June 2001 Mini-NOPUS.* Report DOT-HS-809-319. National Highway Traffic Safety Administration, 2001.

Goryl, M. E., and Cynecki, M. J. *Restraint System Usage in the Traffic Population.* Report DOT-HS-806-714. National Highway Traffic Safety Administration, 1985.

Goryl, M. E. *Restraint System Usage in the Traffic Population: 1985 Annual Report.* Report DOT-HS-806-978. National Highway Traffic Safety Administration, 1986.

Goryl, M. E., and Bowman, B. L. *Restraint System Usage in the Traffic Population: 1986 Annual Report.* Report DOT-HS-807-080. National Highway Traffic Safety Administration, 1987.

Grant, B. A. Canadian Seat Belt Wearing Rates, Promotion Programs, and Future Directions. *Proceedings, Strategic Highway Research Program and Traffic Safety on Two Continents, Part Four,* Gothenburg, Sweden, Sept. 1991.

Hedlund, J. H. *Countermeasures that Work: A Highway Safety Countermeasures Guide for State Highway Safety Offices.* Report DOT-HS-809-980. National Highway Traffic Safety Administration, 2006.

Hunter, W. W., Stewart, J. R., Stutts, J. C., and Marchetti, L. M. Nonsanction Seat Belt Law Enforcement: A Modern Day Tale of Two Cities. *Accident Analysis and Prevention,* Vol. 25, 1993, pp. 511–520.

Jonah, B. A., and Grant, B. A. Long-Term Effectiveness of Selective Traffic Enforcement Programs for Increasing Seat Belt Use. *Journal of Applied Psychology,* Vol. 70, 1985, pp. 257–263.

Jonah, B. A., Dawson, N. E., and Smith, G. A. Effects of a Selective Traffic Enforcement Program on Seat Belt Usage. *Journal of Applied Psychology,* Vol. 67, 1982, pp. 89–96.

Kahane, C. J. *Lives Saved by Federal Motor Vehicle Safety Standards and Other Vehicle Safety Technologies, 1960–2002—Passenger Cars and Light Trucks—with a review of 19 FMVSS and Their Effectiveness in Reducing Fatalities, Injuries, and Crashes.* Report DOT-HS-809-833. National Highway Traffic Safety Administration, 2004.

Kaye, B. K., Sapolsky, B. S., and Montgomery, D. J. Increasing Seat Belt Use Through PI&E Enforcement: The Thumbs Up Campaign. *Journal of Safety Research,* Vol. 26, 1995, pp. 235–244.

Lange, J. E., and Voas, R. B. Nighttime Observations of SBU: An Evaluation of California's Primary Law. *American Journal of Public Health,* Vol. 88, 1998, pp. 1718–1720.

Lund, A. K., Stuster, J., and Fleming, A. Special Publicity and Enforcement of California's Belt Use Law: Making a "Secondary" Law Work. *Journal of Criminal Justice,* Vol. 17, 1989, pp. 329–341.

Malenfant, J. E. L., Wells, J. K., Van Houten, R., and Williams, A. F. The Use of Feedback Signs to Increase Observed Daytime Seat Belt Use in Two Cities in North Carolina. *Accident Analysis and Prevention,* Vol. 28, 1996, pp. 771–777.

Malenfant, J. E. L., and Van Houten, R. The Effects of Nighttime Seat Belt Enforcement on Seat Belt Use by Tavern Patrons: A Preliminary Analysis. *Journal of Applied Behavior Analysis,* Vol. 21, 1988, pp. 271–276.

Masten, S. The Effects of Changing to Primary Enforcement on Daytime and Nighttime Seat Belt Use. *Traffic Safety Facts: Research Note.* Report DOT-HS-810-743. National Highway Traffic Safety Administration, 2007.

Milano, M., McInturff, B., and Nichols, J. L. The Effect of Earned and Paid Media Strategies in High Visibility Enforcement Campaigns. *Journal of Safety Research,* Vol. 35, 2004, pp. 203–214.

Mounce, N. K., Brackett, R. Q., and Womack, K. N. *Evaluation of Six Occupant Protection Selective Traffic Enforcement Programs in Texas.* Texas Transportation Institute, Texas A&M University, College Station, Tex., 1990.

Mortimer, R. G. Extra Enforcement and the Use of Seat Belts by Drivers in Illinois. *Accident Analysis and Prevention,* Vol. 24(6), 1992, pp. 661–666.

Mortimer, R. G., Goldsteen, K., Armstrong, R. W., and Macrina, D. Effects of Incentives and Enforcement on the Use of Seat Belts by Drivers. *Journal of Safety Research,* Vol. 22, 1990, pp. 25–37.

MVS: Crash Costs: In *Motor Vehicle Safety.* National Highway Traffic Safety Administration, 2006. www.nhtsa.dot.gov/people/crash/MVS/. Accessed Dec. 3, 2006.

Preliminary Results: Five-State OP sTEP Demonstration Program. *S.T.E.P Demonstration News.* National Highway Traffic Safety Administration, April 5, 1995.

Nichols, J. L. *Methods to Increase SBU: A Review of What Works.* Prepared for NHTSA's Integrated Project Team (IPT) on Increasing SBU. National Highway Traffic Safety Administration, 2002.

Nichols, J. L., and Jones, R. K. *Increasing SBU in the United States: A Review of the State of Knowledge.* Volume I: Safety Belt Legislation. National Highway Traffic Safety Administration (under review).

Nichols, J. L., Ledingham, K. A., and Preusser, D. F. *Effectiveness of the May 2005 Rural Demonstration Program and the Click It or Ticket Mobilization in the Great Lakes Region.* Report DOT-HS-810-753. National Highway Traffic Safety Administration, 2007.

Nichols, J. L. and Ross, H. L. The Effectiveness of Legal Sanctions in Dealing with Drinking Drivers. In *Surgeon General's Workshop on Drunk Driving: Background Papers.* Office of the Surgeon General, U.S. Department of Health and Human Services, Rockville, Md., 1989, pp. 93–112.

Perkins, D. D., Cynecki, M. J., and Goryl, M. *Restraint System Usage in the Traffic Population.* Report DOT-HS-806-582. National Highway Traffic Safety Administration, 1984.

Phillips, B. M. *SBU Among Drivers.* Contract DOT-HS-805-398. National Highway Traffic Safety Administration, 1980.

Phillips, B. M. *Restraint System Usage in the Traffic Population.* Contract DTNH-22-80-C-07283. National Highway Traffic Safety Administration, 1983.

Preusser, D. F., and Preusser, C. W. Evaluation of Louisiana's Safety Belt Law Change to Primary Enforcement. Report DOT-HS-808-620. National Highway Traffic Safety Administration, 1997.

Preusser, D. F., Lund, A. K., Williams, A. F., and Blomberg, R. D. Belt Use by High Risk Drivers Before and After New York's Seat Belt Use Law. *Accident Analysis and Prevention,* Volume 20, 1988, pp. 245–250.

Preusser, D. F., Williams, A. F., and Lund, A. K. The Effect of New York's Seat Belt Use Law on Teenage Drivers. *Accident Analysis and Prevention,* Volume 19(2), 1987, pp. 73–80.

Preusser, D. F., Williams, A. F., and Lund, A. K. Seat Belt Use Among New York Bar Patrons. *Journal of Public Health Policy,* Vol. 7(4), 1986, pp. 470–479.

Reinfurt, D. W., Williams, A. F., Wells, J. K., and Rodgman, E. Characteristics of Drivers Not Using Seat Belts in a High Belt Use State. *Journal of Safety Research,* Vol. 27(4), 1996, pp. 209–215.

Reinfurt, D. W., Campbell, B. J., Stewart, J. R., and Stutts, J. C. Evaluating the North Carolina Safety Belt Wearing Law. *Accident Analysis and Prevention,* Vol. 22(3), 1990, pp. 197–210.

Rogers, R. W., Rogers, J. S., Bailet, J. S., Runkle, W., and Moore, B. Promoting Safety Belt Use Among State Employees: The Effects of Prompting and a Stimulus-Control Intervention. *J. Applied Behavior Analysis,* Vol. 21, 1988, pp. 263–269.

Rood, R. H., Kraichy, P. P., and Carman, J. A. *Selective Traffic Enforcement Program for Occupant Restraints.* Report DOT-HS-807-120. National Highway Traffic Safety Administration, 1987.

Rood, R. H., McCartt, A. T., Kraichy, P. P., and Carman, J. A. *Evaluation of New York State's Mandatory Occupant Restraint Law: Volume IV—Enforcement and Adjudication of Violations of the Law.* Report DOT-HS-807-077. National Highway Traffic Safety Administration, 1987.

Safety Belt Usage in Illinois: June 2004 Observational Survey Results. Illinois Department of Transportation, Division of Traffic Safety, Evaluation Unit, Springfield, Ill., 2004.

Salzberg, P. M., and Moffat, J. M. Ninety-Five Percent: An Evaluation of Law, Policy, and Programs to Promote Seat Belt Use in Washington State. *Journal of Safety Research,* Vol. 35, 2004, pp. 215–222.

SBU Laws Save Lives and Reduce Costs to Society. Report GAO/RCED-92-106. Resources, Community, and Economic Development Division, U.S. General Accounting Office, 1992.

Seat Belt Summit: Policy Options for Increasing Seat Belt Use in the United States in 2001 and Beyond. Automotive Coalition for Traffic Safety, Arlington, Va., 2001.

Seat Belt Use in 2006—Use Rates in the States and Territories. *Traffic Safety Facts: Crash Stats.* Report DOT-HS-810-690. National Highway Traffic Safety Administration, 2007.

Skinner, D. *An Update of Estimates for Belt Use Laws: 1988 NCSA Briefing.* Transportation Systems Center, Cambridge, Mass, 1989.

Skinner, D. and Hoxie, P. *Effects of Seatbelt Laws on Highway Fatalities: Update–April 1988.* National Highway Traffic Safety Administration, 1988.

Solomon, M. G. *Evaluation of NHTSA's Region IV Click It or Ticket Campaign.* Report DOT-HS-809-404. National Highway Traffic Safety Administration, 2002.

Solomon, M. G., and Chaffe, H. B. *Evaluation of the May 2004 Mobilization: Programs to Increase Safety Belt Use.* National Highway Traffic Safety Administration (under review).

Solomon, M. G., Chaudhary, N. K., and Cosgrove, L. A. *May 2003 Click It or Ticket Safety Belt Mobilization.* Report DOT-HS-809-694. National Highway Traffic Safety Administration, 2004.

Solomon, M. G., Ulmer, R. G., and Preusser, D. F. *Evaluation of Click It or Ticket Model Programs.* Report DOT-HS-809-498. National Highway Traffic Safety Administration, 2002.

Solomon, M. G., and Preusser, D. F. *Evaluation of South Carolina's Click It or Ticket Campaign.* Contract No. DTNH22-99-25099. National Highway Traffic Safety Administration (under review).

Solomon, M. G., Preusser, D. F., and Nissen, W. J. *Evaluation of Maryland, Oklahoma, and the District of Columbia's Seat Belt Law Change to Primary Enforcement.* Report DOT-HS-809-213. National Highway Traffic Safety Administration, 2001.

Solomon, M. G., Nissen, W. J., and Preusser, D. F. *Occupant Protection Special Traffic Enforcement Program Evaluation.* Report DOT-HS-808-884. National Highway Traffic Safety Administration, 1999.

Streff, F. M., Molnar, L. J., and Christoff, C. Increasing Safety Belt Use in a Secondary Enforcement State: Evaluation of a Three-County Special Enforcement Program. *Accident Analysis and Prevention,* Vol. 24(4), 1992, pp. 369–383.

Subramanian, R. *Alcohol Involvement in Fatal Crashes: Technical Report DOT-HS-809-579.* National Center for Statistics and Analysis, National Highway Traffic Safety Administration, 2003.

The Economic Cost to Society of Motor Vehicle Accidents. Report DOT-HS-806-342. National Highway Traffic Safety Administration, 1983.

The Highway Safety Needs Report: Report of the Secretary of Transportation to the United States Congress Pursuant to Section 225 of the Highway Safety Act of 1973. U.S. Department of Transportation, 1976.

Traffic Safety Facts: 2005 Data; Occupant Protection. Report DOT-HS-810-621, National Highway Traffic Safety Administration, 2006.

Ulmer, R. G., Preusser, C. W., and Preusser, D. F. *Evaluation of California's Safety Belt Law Change to Primary Enforcement.* Report DOT-HS-808-205. National Highway Traffic Safety Administration, 1994.

Ulmer, R. G., Preusser, C. W., and Preusser, D. F. *Evaluation of Georgia's Seat Belt Law Change to Primary Enforcement.* Report DTNH22-94-D-05044. National Highway Traffic Safety Administration, 1997.

Vivoda, J. M., Eby, D. W., St. Louis, R. M., and Kostyniuk, L. P. *A Study of Nighttime Seat Belt Use in Indiana.* Report DOT-HS-810-734. National Highway Traffic Safety Administration, 2007.

Voas, R. B., Fell, J. C., Tippetts, A. S., Blackman, K., and Nichols, J. L. *Impact of Primary Safety Belt Laws on Alcohol-Related Front-Seat Occupant Fatalities: Five Case Studies.* Pacific Institute for Research and Evaluation, Beltsville, Md. (in press).

Wagenaar, A. C., Maybee, R. G., and Sullivan, K. P. Mandatory Seat Belt Laws in Eight States: A Time-Series Evaluation. *Journal of Safety Research,* Vol. 19(2), 1988, pp. 51–70.

Wells, J. K., Preusser, D. K., and Williams, A. F. Enforcing Alcohol-Impaired Driving and Seat Belt Use Laws. *Journal of Safety Research,* Vol. 23, 1992, pp. 63–71.

Williams, A. F., Wells, J. K., McCartt, A. T., and Preusser, D. F. "Buckle Up NOW!" An Enforcement Program to Achieve High Belt Use. *Journal of Safety Research,* Vol. 31, 2000, pp. 195–201.

Williams, A. F., Reinfurt, D., and Wells, J. K. Increasing Seat Belt Use in North Carolina. *Journal of Safety Research,* Vol. 27, 1996, pp. 33–41.

Williams, A. F., Hall, W. H., Tolbert, W. G., and Wells, J. K. Development and Evaluation of Pilot Programs to Increase Seat Belt Use in North Carolina. *Journal of Safety Research,* Vol. 25, 1994, pp. 167–175.

Williams, A. F., and Lund, A. K. Mandatory Seat Belt Use Laws and Occupant Crash Protection in the United States: Present Status and Future Prospects. In *Preventing Automobile Injury: New Findings from Evaluation Research,* Graham, J. D. (ed.). Auburn House Publishing Company, Dover, Mass., 1988, pp. 51–72.

Williams, A. F., Lund, A. K., Preusser, D. F., and Blomberg, R. D. Results of a Seat Belt Law Enforcement and Publicity Campaign in Elmira, New York. *Accident Analysis and Prevention,* Vol. 19, 1987, pp. 243–249.

Williams, A. F., Preusser, D. F., Blomberg, R. D., and Lund, A. K. Seat Belt Use Law Enforcement and Publicity in Elmira, New York: A Reminder Campaign. *American Journal of Public Health,* Vol. 77(11), 1987, pp. 1450–1451.

Williams, A. F., Wells, J. K., and Lund, A. K. Shoulder Belt Use in Four States with Belt Use Laws. *Accident Analysis and Prevention,* Vol. 19, 1987, pp. 251–260.

Winnicki, J. *SBU Laws: Evaluation of Primary Enforcement and Other Provisions.* Report DOT-HS-808-324. National Highway Traffic Safety Administration, 1995.

APPENDIX A

Calculations of Lives Saved, Number Involved in Fatal Crashes, and Overall Effectiveness of Safety Belts Against Deaths in 2005

This appendix describes the approach used to estimate the *number of persons saved by safety belts* (which is used to calculate *UPFC*), number of *occupants involved in potentially fatal crashes,* and overall *effectiveness of safety belts,* given distribution of those involved by vehicle type and by seating position. Deaths coded as "other" vehicle were omitted.

Step 1: *Usage by Vehicle Type*

		Restraint Used	Restraint Not Used	Total with Known Use	Involvement by Vehicle Type
Cars	#	9,361	8,889	18250	**59.3%**
	%	**51.3%**	**48.7%**	100%	
LTVs	#	4,578	7,966	12,105	**40.7%**
	%	**36.5%**	**63.5%**	100%	
Totals	#	13,940	16,854	29,162	100%
	%	**45.3%**	**54.7%**	100%	
Note: Unknowns Distributed Among Used and Not Used Categories.					

Step 2: *Lives Saved (by Vehicle Type and Seating Position)* and *Overall Effectiveness*

Vehicle & Seating	# Killed	# Used	Not Used	E Effect	Est. # Saved	Est. # Involved	% of Total	Overall Effect
Car/Front	16,588	8,727	7,861	0.45	7,140	23,728	.519	.233
Car/Rear	1,662	635	1,027	.044	499	2,161	.047	.021
LTV/Front	11,301	4,222	7,079	0.60	6,333	17,634	.386	.231
LTV/Rear	1,243	356	887	0.73	964	2,207	.048	.035
Totals	**30,794**	**13,940**	**16,854**	**n/a**	**14,629**	**44,917**	**n/a**	**.521**
	A	B	C	D	E	F	G	H

Notes:
Data in Columns **A, B,** and **C** are from 2005 FARS file; Estimates in Column **D** (effectiveness of safety belts against deaths) are from Kahane (2004);
Number (of lives) Saved (Column **E**) = (Column **B** * Column **E**)/(1 − Column **E**); calculated for each combination of vehicle type and seating position.
Number Involved (Column **F**) = Column **B** (# Used) + Column **C** (# Not Used) + Column **E** (# Saved).
Percent of Total (occupants involved; for each combination) = **Number Involved** (in each row of Column **F**) divided by bottom cell of Column F;
H (overall effect) = Sum of products of Column **D** multiplied by Column **G** (**.521** shown in bottom cell of Column **H**)

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Step 3: *Calculating UPFC: Overall, and by Vehicle Type and Seating Position*

Vehicle/ Seating	# Killed	# Used	Not Used	(E) Effect	# Saved	# Involved	% of Total	UPFC
Car/Fr	16,588	8,727	7,861	0.45	7,140	23,728	.519	.669
Car/R	1,662	635	1,027	.044	499	2,161	.047	.525
LTV/Fr	11,301	4,222	7,079	0.60	6,333	17,634	.386	.599
LTV/R	1,243	356	887	0.73	964	2,207	.048	.598
Totals	**30,794**	**13,940**	**16,854**	**n/a**	**14,629**	**44,917**	**n/a**	**.631**
	A	B	C	D	E	F	G	H

Notes:

Data in Columns **A, B,** and **C** are from 2005 FARS file; Estimates in Column **D** (effectiveness of safety belts against deaths) are from Kahane (2004).

Number (of lives) Saved (Column **E**) = (Column **B** * Column **E**)/(1 − Column **E**); calculated for each combination of vehicle type and seating position.

Number Involved (Column **F**) = Column **B** (# Used) + Column **C** (# Not Used) + Column **E** (# Saved).

Percent of Total (occupants involved; for each vehicle/seating combination) =

Number Involved (in each cell of Column **F**) divided by bottom cell of Column **F**.

UPFC for each Vehicle/Seating Combination shown in Column **H** = (Column **B** + Column **E**) divided by (Column **B** + Column **C** + Column **E**).

Overall UPFC = Sum of products of Column **G** multiplied by Column **H,** for each vehicle type and seating position (**.631** shown in bottom cell of Column H).

APPENDIX B

Calculations of Changes in UPFC Associated with the Primary/Standard Law Upgrades

Table 1. Changes associated with first group of seven upgrades.

State	Year	# Used	Not Used	Total Killed	Overall Effect[111]	# Saved	# Involved	UPFC (%)	Change (Points)
CA	1992	969	1916	2885	0.52	1050	3935	51.3	
	1994	1351	1518	2869	0.52	1463	4332	65.0	13.6
LA	1994	159	502	661	0.53	180	841	40.3	
	1996	251	443	694	0.53	283	977	54.7	14.4
GA	1995	335	884	1219	0.52	363	1582	44.1	
	1997	409	866	1275	0.52	443	1718	49.6	5.4
OK	1996	146	509	655	0.52	158	813	37.4	
	1998	188	467	655	0.52	204	859	45.6	8.2
DC	1996	9	26	35	0.47	8	43	41.0	
	1998	9	23	32	0.47	8	40	42.3	1.3
MD	1996	233	204	437	0.50	233	670	69.6	
	1998	238	214	452	0.50	238	690	68.9	-0.7
IN	1997	239	532	771	0.51	249	1020	47.9	
	1999	336	484	820	0.51	350	1170	58.6	10.8
Ave.					**0.51**				**7.6**
		A	B	C	D	E	F	G	H

Notes: **A** (# restrained deaths) and **B** (# unrestrained deaths) were calculated by dividing known restrained (and known unrestrained) occupants killed by the number of victims where restraint was known, then multiplying that percentage by the total number killed (**C**).
D (effect) was calculated for each state according to the procedure in Appendix A.
E (# Saved) was calculated by the formula: Lives Saved = (A x E)/(1 − E).
F (# Involved) = A + B + E; **H** (UPFC) = (A + E)/F.

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[111]Overall effect calculated for each state based on the procedures shown in Appendix A.

Table 2. Changes associated with the second group of seven upgrades.

State	Year	# Used	Not Used	Total Killed	Overall Effect[112]	# Saved	# Involved	UPFC (%)	Change (Points)
AL	1998	272	640	912	0.51	287	1199	46.6	
	2000	305	545	850	0.51	321	1171	53.4	6.8
MI	1999	479	593	1062	0.51	496	1558	62.5	
	2001	538	471	1009	0.51	558	1567	69.9	7.4
NJ	1999	181	316	497	0.49	175	672	53.0	
	2001	206	293	499	0.49	199	698	58.0	5.0
WA	2001	225	278	503	0.50	226	729	61.9	
	2003	259	186	445	0.50	260	705	73.7	11.8
DE	2002	33	62	95	0.49	32	127	51.2	
	2004	59	48	107	0.49	57	164	70.8	19.6
IL	2002	396	675	1071	0.50	397	1468	54.0	
	2004	468	516	984	0.50	470	1454	64.5	10.5
TN	2003	334	632	966	0.51	352	1318	52.1	
	2005	394	616	1010	0.51	415	1425	56.7	4.6
Ave.					0.50				9.3
		A	B	C	D	E	F	G	H

Notes: **A** (# restrained deaths) and **B** (# unrestrained deaths) were calculated by dividing known restrained (and known unrestrained) occupants killed by the number of victims where restraint was known, then multiplying that percentage by the total number killed (**C**).
D (effect) was calculated for each state according to the procedure in Appendix A.
E (# Saved) was calculated by the formula: Lives Saved = $(A \times E)/(1 - E)$.
F (# Involved) = $A + B + E$; **H** (UPFC) = $(A + E)/F$.

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[112]Overall effect calculated for each state based on the procedures shown in Appendix A.

A P P E N D I X   C

Issues and Findings Regarding Nighttime SBU and Enforcement

1. As progress has been made to increase SBU, there have been declining impacts (in terms of observed usage) asso-

   ciated with daytime programs implemented to increase use (Glassbrenner, 2005; Nichols and Jones, under review).
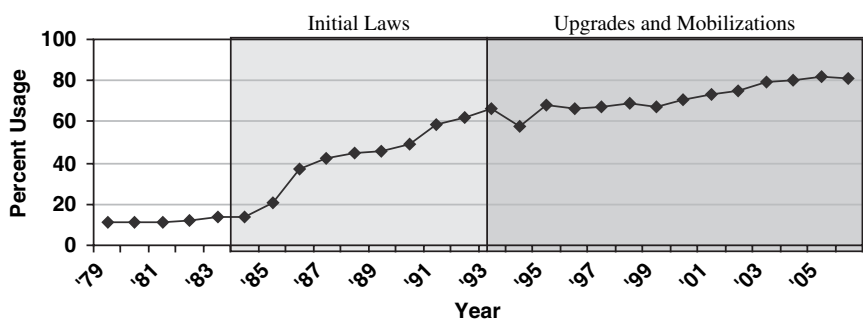
2. States with high usage rates have much lower rates among fatally injured occupants. For example, the nine states

   with 90%+ usage have a median FARS rate of only 54% (range: 47% to 68%). Source: FARS.
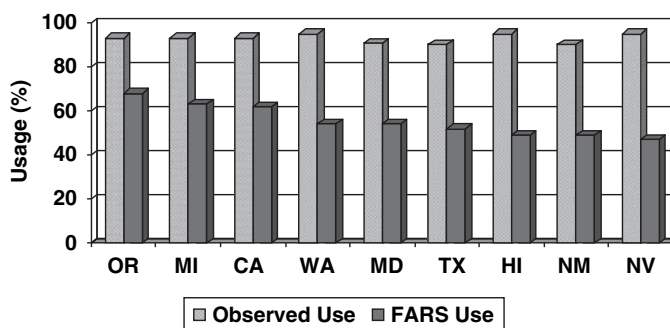
3. One reason why FARS use is lower than observed use is that occupants with the highest risk of being involved in a serious crash are least likely to buckle up (e.g., youth, males, alcohol-positive drivers and passengers, occupants of pickup trucks, drivers with past violations and/or crashes, etc.).

4. High-risk occupants are relatively more prevalent during late-night hours, when there is little or no publicized en-

   forcement of belt laws. Statewide observational surveys measure only daytime use, usually immediately following a national CIOT mobilization.

5. There is a strong relationship between the presence of alcohol and nonuse of safety belts. Some relevant facts include:
   a. Nearly two-thirds of all persons killed in alcohol-related crashes are either the drinking drivers themselves (nearly half) or their passengers (about 17%).

b. Drinking drivers involved in fatal crashes are nearly three times more likely to be unbuckled (than non-drinking drivers) and unrestrained drivers are three times more likely to be drinking (than restrained drivers) (Subramanian, 2003).

c. With the prevalence of males and young persons (as well as other high-risk groups) among both drinking and unrestrained drivers, it is apparent that there is much overlap among unrestrained and drinking driver target groups. Further, as the next figure shows, both problems peak late at night.

This figure shows the number of unbuckled, alcohol-related deaths (solid line) by time of day, compared with the number of unbuckled, nonalcohol related deaths by time of day (dotted line). The combination of alcohol and nonuse, as it relates to fatalities, peaks at about 2 a.m. (Source: 2005 FARS data.)
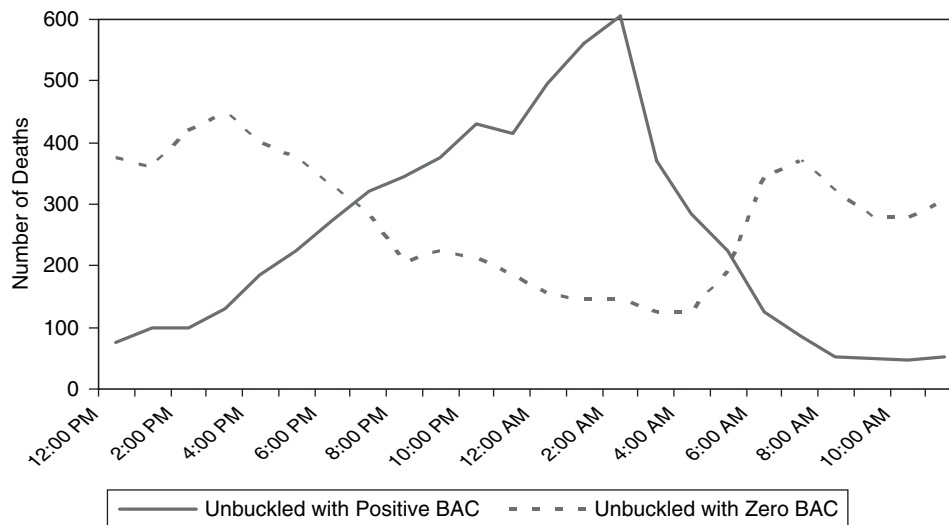
d. HVE can increase nighttime usage and usage among high-risk occupants, particularly in conjunction with primary law upgrades. Some relevant findings include:
   i. Daytime enforcement may not affect nighttime usage to the same extent that it affects daytime usage (e.g., Grant, 1991; Vivoda et al., 2007).
   ii. Nighttime enforcement, particularly when aimed at late-night motorists and drinking drivers, can increase late-night usage (e.g., Malenfant and Van Houten, 1988; Wells et al., 1992).
   iii. Primary law upgrades have also been found to increase nighttime usage (e.g., Masten, 2007); usage among high-risk occupants (Eby et al., 2001); and usage among drinking drivers (Lange and Voas, 1998; Voas et al., in press).
   iv. Some studies have shown that HVE, complementing upgrades, has resulted in substantial increases in observed usage, even from very high baseline rates (e.g., Salzberg and Moffat, 2004).

APPENDIX D

Trends in Observed and FARS Use Rates in 15 States that Participated in Statewide or Regional HVE Programs

Table 1. Observed use rates (%) in participating STEP states.

	1999	2000	2001	2002	2003	2004	2005	2006	7-yr Chg.
NC (% Use)	78	81	83	84	86	96	87	89	
Annual Change		3	2	1	2	10	-9	2	11
Cumulative Change				5	6	8	18	9	11	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
WA (% Use)	81	82	83	93	95	94	95	96	
Annual Change		1	1	10	2	-1	1	1	15
Cumulative Change			1	12	14	13	14	15	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
TX (% Use)	74	77	76	81	84	83	90	90	
Annual Change		3	-1	5	3	-1	7	0	16
Cumulative Change			2	7	10	9	16	16	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
GA (% Use)	74	74	79	77	85	87	82	90	
Annual Change		0	5	-2	8	2	-5	8	16
Cumulative Change			5	3	11	13	8	16	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
WV (% Use)	52	50	52	72	74	76	85	89	
Annual Change		-2	2	20	2	2	9	4	37
Cumulative Change			0	20	22	24	33	37	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
IL (% Use)	66	70	71	74	80	83	86	88	
Annual Change		4	1	3	6	3	3	2	22
Cumulative Change			1	8	14	17	20	22	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
IN (% Use)	57	62	67	72	82	83	81	84	
Annual Change		5	5	5	10	1	-2	3	27
Cumulative Change			10	15	25	26	24	27	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
AL (% Use)	58	71	79	79	77	80	82	83	
Annual Change		13	8	0	-2	3	2	1	25
Cumulative Change			8	21	19	22	24	25	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
VT (% Use)	70	62	67	85	82	80	85	82	
Annual Change		-8	5	18	-3	-2	5	-3	12
Cumulative Change			-3	15	12	10	15	12	

Table 1. (Continued).

	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
FL (% Use)	59	65	70	75	73	76	74	81	
Annual Change		6	5	5	-2	3	-2	7	22
Cumulative Change			11	16	14	17	**15**	22	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
TN (% Use)	61	59	68	67	69	72	74	79	
Annual Change		-2	9	-1	2	3	2	5	18
Cumulative Change			7	6	8	11	**13**	18	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
MS (% Use)	55	50	62	62	62	63	61	74	
Annual Change		-5	12	0	0	1	-2	13	19
Cumulative Change			12	7	7	8	**6**	19	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
SC (% Use)	65	74	70	66	73	66	70	73	
Annual Change		9	-4	-4	7	-7	4	3	8
Cumulative Change			5	1	8	1	**5**	8	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
KY (% Use)	59	60	62	62	66	66	67	67	
Annual Change		1	2	0	4	0	1	0	8
Cumulative Change			3	3	7	7	**8**	8	
	1999	2000	2001	2002	2003	2004	2005	2006	Chg.
NV (% Use)	80	79	75	75	79	87	95		
Annual Change		-1	-4	0	4	8	8	15	
Cumulative Change			-5	-5	-1	7	**15**		

Table 2. FARS use rates (%) in participating STEP states.

	1999	2000	2001	2002	2003	2004	2005	6-yr Chg.
NC (% Use)	50	46	49	47	54	53	50	
Annual Change		-4	3	-2	7	-1	-3	0
Cumulative Change			-1	-3	4	3	0	
	1999	2000	2001	2002	2003	2004	2005	Chg.
WA (% Use)	40	40	45	49	58	58	54	
Annual Change		0	5	4	9	0	-4	14
Cumulative Change			5	9	18	18	14	
	1999	2000	2001	2002	2003	2004	2005	Chg.
TX (% Use)	44	47	47	50	51	55	52	
Annual Change		3	0	3	1	4	-3	8
Cumulative Change			3	6	7	11	8	
	1999	2000	2001	2002	2003	2004	2005	Chg.
GA (% Use)	39	41	45	44	45	45	44	
Annual Change		2	4	-1	1	0	-1	5
Cumulative Change			6	5	6	6	5	
	1999	2000	2001	2002	2003	2004	2005	Chg.
WV (% Use)	33	31	32	34	40	39	38	
Annual Change		-2	1	2	6	-1	-1	5
Cumulative Change			-1	1	7	6	5	
	1999	2000	2001	2002	2003	2004	2005	Chg.
IL (% Use)	39	39	38	37	42	48	49	
Annual Change		0	-1	-1	5	6	1	10
Cumulative Change			-1	-2	3	9	10	
	1999	2000	2001	2002	2003	2004	2005	Chg.
IN (% Use)	41	40	41	46	49	47	47	
Annual Change		-1	1	5	3	-2	0	6
Cumulative Change			0	5	8	6	6	
	1999	2000	2001	2002	2003	2004	2005	Chg.
AL (% Use)	32	36	46	40	42	44	39	
Annual Change		4	10	-6	2	2	-5	7
Cumulative Change			10	8	10	12	7	
	1999	2000	2001	2002	2003	2004	2005	Chg.
VT (% Use)	26	47	39	42	57	51	48	
Annual Change		21	-8	3	15	-6	-3	22
Cumulative Change			13	16	31	25	22	

Table 2. (Continued).

	1999	2000	2001	2002	2003	2004	2005	Chg.
FL (% Use)	36	33	36	37	40	39	41	
Annual Change		-3	3	1	3	-1	2	5
Cumulative Change			0	1	4	3	**5**	
	1999	2000	2001	2002	2003	2004	2005	Chg.
TN (% Use)	27	27	30	34	35	36	39	
Annual Change		0	3	4	1	1	3	12
Cumulative Change			3	7	8	9	**12**	
	1999	2000	2001	2002	2003	2004	2005	Chg.
MS (% Use)	23	26	30	27	33	23	27	
Annual Change		3	4	-3	6	-10	4	4
Cumulative Change			4	4	10	0	**4**	
	1999	2000	2001	2002	2003	2004	2005	Chg.
SC (% Use)	35	37	32	34	33	27	32	
Annual Change		2	-5	2	-1	-6	5	-3
Cumulative Change			-3	-1	-2	-8	**-3**	
	1999	2000	2001	2002	2003	2004	2005	Chg.
KY (% Use)	30	34	30	36	32	34	35	
Annual Change		4	-4	6	-4	2	1	5
Cumulative Change			0	6	2	4	**5**	
	1999	2000	2001	2002	2003	2004	2005	Chg.
NV (% Use)	40	35	33	39	41	51	47	
Annual Change		-5	-2	6	2	10	-4	7
Cumulative Change			-7	-1	1	11	**7**	

Summaries of Changes in Observed and FARS Use

Table 3. Summary of change in observed use (1999–2005).

Chg (pts)	Base (%)	Type of State (Law Type)
9	78	Benchmark (NC): An initial primary law state
16	74	Initial primary law state (TX)
13	76	Two initial primary states (NC+TX)
17	66	All upgrade states (WA+GA+IL+IN+AL+TN)
19	65	New upgrade states (WA+IL+IN+AL+TN)
14	63	Secondary law states (WV+VT+FL+MS+SC+KY+NV)
15	66	All participating states

Table 4. Summary of change in FARS use (1999–2005).

Chg (pts)	Base (%)	Type of State (Law Type)
0	50	Benchmark (NC): An initial primary law state
8	44	Initial primary law state (TX)
4	47	Two Initial primary states (NC+TX)
9	36	Upgrade states (WA+GA+IL+IN+AL+TN)
10	36	New upgrade states (WA+IL+IN+AL+TN)
6	32	Secondary law states (WV+VT+FL+MS+SC+KY+NV)
7	36	All participating states

APPENDIX E

Estimated Costs of Fatalities and MAIS 2–5 Injuries

Table 1. Estimated costs of fatalities, by year: 1990–2007.

	Unit Cost per Fatality	Component Proportions of Costs			Component Costs		
		Lost Productivity	Medical and EMS	Other	Lost Productivity	Medical and EMS	Other
1990	693,836	0.807	0.007	0.186	560,264	4,635	128,937
1991	725,960	0.807	0.007	0.186	586,203	4,850	134,907
1992	758,083	0.807	0.007	0.186	612,143	5,064	140,876
1993	790,207	0.807	0.007	0.186	638,082	5,279	146,846
1994	822,330	0.862	0.016	0.122	708,896	13,144	100,290
1995	844,906	0.862	0.016	0.122	726,358	13,505	103,043
1996	867,482	0.862	0.016	0.122	747,820	13,866	105,797
1997	890,059	0.862	0.016	0.122	767,282	14,227	108,550
1998	912,635	0.862	0.016	0.122	786,744	14,587	111,303
1999	935,211	0.862	0.016	0.122	806,206	14,948	114,057
2000	957,787	0.822	0.024	0.154	786,899	22,928	147,960
2001	980,363	0.822	0.024	0.154	805,447	23,468	151,448
2002	1,002,939	0.822	0.024	0.154	823,995	24,009	154,935
2003	1,025,516	0.822	0.024	0.154	842,543	24,549	158,423
2004	1,048,092	0.822	0.024	0.154	861,092	25,090	161,910
2005	1,070,668	0.822	0.024	0.154	879,640	25,630	165,398
2006	1,093,244	0.822	0.024	0.154	898,188	26,171	168,886
2007	1,115,820	0.822	0.024	0.154	916,736	26,711	172,373

Costs for 1990 are derived from cost data from Blincoe & Faigin (1992); 1994 from Blincoe (1996); and 2000 from Blincoe, Seay, Zaloshnja, Miller, Romano, Luchter, & Spicer (2002). Estimates for all other years are interpolated. (An alternative approach would have been to use CPI index for post-2000 years. In such case, estimates through 2005 would vary by less than 1%. After 2005, however, the CPI would have provided 2% to 3% higher estimates). **Note that these estimates do not include non-injury-related costs such as property damage and travel delay.**

Table 2. Estimated costs of MAIS 2–5 injuries (per fatality): 1990–2007.

	MAIS 2-5 Cost per Fatality	MAIS 2-5 Injuries per Fatality	Component Proportions			Component Costs		
			Lost Productivity	Medical	Other	Lost Productivity	Medical and EMS	Other
1990	846,138	17.5	0.485	0.291	0.224	$410,251	$246,493	$189,394
1991	865,134	17.5	0.485	0.291	0.224	$419,461	$252,027	$193,646
1992	884,130	17.5	0.485	0.291	0.224	$428,672	$257,560	$197,898
1993	903,125	17.5	0.485	0.291	0.224	$437,882	$263,094	$202,150
1994	922,121	14.5	0.485	0.291	0.224	$447,092	$268,628	$206,402
1995	1,057,836	14.5	0.485	0.291	0.224	$512,893	$308,164	$236,779
1996	1,193,551	14.5	0.485	0.291	0.224	$578,695	$347,699	$267,157
1997	1,329,266	14.5	0.485	0.291	0.224	$644,497	$387,235	$297,534
1998	1,464,981	14.5	0.485	0.291	0.224	$710,298	$426,771	$327,912
1999	1,600,696	14.5	0.485	0.291	0.224	$776,100	$466,307	$358,290
2000	1,736,412	14.5	0.499	0.295	0.207	$866,135	$511,555	$358,721
2001	1,872,127	14.5	0.499	0.295	0.207	$933,831	$551,537	$386,758
2002	2,007,842	14.5	0.499	0.295	0.207	$1,001,527	$591,520	$414,796
2003	2,143,557	14.5	0.499	0.295	0.207	$1,069,222	$631,502	$442,833
2004	2,279,272	14.5	0.499	0.295	0.207	$1,136,918	$671,484	$470,870
2005	2,414,987	14.5	0.499	0.295	0.207	$1,204,614	$711,467	$498,907
2006	2,550,702	14.5	0.499	0.295	0.207	$1,272,309	$751,449	$526,944
2007	2,686,417	14.5	0.499	0.295	0.207	$1,340,005	$791,431	$554,981

Injury ratios and costs for 1990 are derived from cost data from Blincoe & Faigin (1992); 1994 from Blincoe (1996); and 2000 from Blincoe, Seay, Zaloshnja, Miller, Romano, Luchter, & Spicer (2002). Injury ratios remain fixed from one study year to another. Cost estimates for all nonstudy years are interpolated. (An alternative approach would have been to use CPI index for post-2000 years. In such case, estimates through 2005 would vary by less than 1%. For 2006 and 2007, however, the CPI would have provided 2% to 3% higher estimates). **Note that these estimates do not include non-injury-related costs such as property damage and travel delay.**

APPENDIX F

Distribution of States by 2005 Observed SBU (Horizontal Axis) and by 2005 Usage among Crash Victims (FARS Use) (Vertical Axis)

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	
70																																						70
69												(2005 data)																										69
68																																		OR				68
67																																						67
66																																						66
65																																						65
64																																						64
63																																		MI				63
62																																		CA				62
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58																																						58
57																																						57
56																																						56
55																				AK					NY	IA												55
54																																MD				WA		54
53																								NJ														53
52																															TX							52
51																																						51
50																												NC										50
49																											IL			NM						HI		49
48																										VT												48
47																						IN			MN											NV		47
46																																						46
45																								CT				UT										45
44																									DE					GA								44
43																	ME			CO																		43
42																	ID			OH																		42
41															FL																							41
40																			LA				OK															40
39														TN								AL												AZ				39
38													WI														WV			DC								38
37																							PA															37
36																																						36
35					KY											RI						VA																35
34	WY*																		MO																			34
33				MA					KS																													33
32								AR		SC											NE																	32
31																																						31
30	NH*																																					30
29																																						29
28																																						28
27		MS																					MT															27
26									SD																													26
25																	ND																					25
	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	

% Use Among Crash Victims (vertical axis)

Observed Usage (%)

*Note that no observed usage was available for Wyoming and New Hampshire for 2005. Also note that Arizona's observed rate was later revised downward.

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation