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HIGHWAY SAFETY

Safety Belt Use Laws Save Lives and Reduce Costs to Society

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The Honorable Daniel Patrick Moynihan
Chairman, Subcommittee on Water Resources,
Transportation and Infrastructure
Committee on Environment and Public Works
United States Senate

The Honorable John H. Chafee
Ranking Minority Member
Committee on Environment and Public Works
United States Senate

In response to your April 20, 1990, letter, this report evaluates studies on safety belt laws. As agreed with Subcommittee staff, we have summarized these studies' findings on (1) the effectiveness of safety belts in preventing deaths and serious injuries, (2) the effectiveness of safety belt mandatory use laws, and (3) the costs that society incurs when people who do not wear safety belts are involved in accidents. We are recommending that the Secretary of Transportation include in a report required by recent legislation a discussion of implementation issues we present in this report.

We are sending copies of this report to the appropriate congressional committees; the Secretary of Transportation; the Administrator, National Highway Traffic Safety Administration; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others upon request.

This work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues, who may be reached at (202) 275-1000. Other major contributors are listed in appendix IV.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Accident reports show that most of the 40,000 people killed annually in traffic crashes in the United States were not using safety belts. The National Highway Traffic Safety Administration (NHTSA) estimates that over 15,000 lives could be saved annually if all front seat occupants wore safety belts.

To assist ongoing federal and state deliberations on safety belt safety, the Chairman, Subcommittee on Water Resources, Transportation and Infrastructure, Senate Committee on Environment and Public Works, and the Ranking Minority Member, Senate Committee on Environment and Public Works, asked GAO to evaluate and summarize existing studies on safety belts. This report focuses on the (1) effectiveness of safety belts in reducing deaths and serious injuries, (2) impact of state safety belt use laws on fatality and serious injury rates, and (3) costs that society incurs when unbelted motor vehicle occupants are involved in accidents.

GAO conducted a broad search for published and unpublished studies on safety belts and safety belt laws and assembled a review panel with experience in research methodology to assist in evaluating studies and formulating conclusions. GAO's conclusions were drawn from 44 studies that contained original data or original analyses and that met minimum criteria for methodological soundness.

Background

According to NHTSA data for the United States for 1990, (1) about 6.5 million traffic crashes occurred, a rate of 1 every 5 seconds; (2) people were injured at the rate of 1 every 9 seconds and severely or fatally injured at a rate of 1 every 63 seconds; and (3) over 33,000 motor vehicle occupants were killed, and over 3 million occupants were injured, two-thirds of whom were the drivers.

The Department of Transportation (DOT) issued motor vehicle safety standards, effective January 1968, that required, among other things, manufacturers to install safety belts in new automobiles. New York in 1984 was the first state to require occupants to wear safety belts. In November 1991, according to DOT, 41 states and the District of Columbia had laws mandating safety belt use. In December 1991, the Intermodal Surface Transportation Efficiency Act of 1991 was enacted. The act provides financial incentives (grants and penalties) to encourage states to enact mandatory safety belt use laws and achieve basic levels of belt use. It also requires the Secretary of Transportation to report to the Congress on the

effectiveness of safety belts and air bags and to provide data and analysis on safety belt use in each state and nationwide.

Results in Brief

The studies GAO evaluated showed that safety belt use generally reduced both the fatality rate and the serious injury rate by 50 to 75 percent in motor vehicle crashes. Although the studies differed in the specific questions addressed and methodologies used, they were consistent in pointing to a safety benefit from wearing safety belts.

Studies that addressed the impact of state laws requiring safety belt use showed that these laws reduced both fatalities and serious injuries by 5 to 20 percent when compared with no law. GAO observed that the existing state safety belt use laws could be strengthened to (1) include coverage to rear seat occupants, (2) extend coverage to light trucks and vans, and (3) facilitate enforcement.

One recent study estimated the total annual costs of traffic crashes to society. It estimated the 1988 costs to be $334 billion. Most studies that addressed hospital cost reported that belted victims averaged 60 to 80 percent lower hospital cost than the unbelted victims. Studies found that unbelted occupants injured in crashes paid less than one-half of their hospital cost, with most cost being paid through insurance premiums or Medicare and Medicaid.

Principal Findings

Safety Belt Use Reduces Fatality Rates and Severity of Injury

Twenty-one studies compared deaths and serious injuries experienced by belted occupants with those for unbelted occupants. The studies used a wide variety of methodologies and data sources, but all showed that belted occupants fared much better than the unbelted.

Thirteen studies that analyzed occupant deaths showed that the fatality rates for belted occupants ranged from 41 to 94 percent lower than the rates for unbelted occupants. Most of the studies showed the fatality rate reduction to be in the 50- to 75-percent range. Eleven studies comparing injuries received by belted and unbelted occupants found that the injury reduction for belted occupants ranged from 17 to 88 percent lower, with most studies being in the 50- to 75-percent range. Despite using widely

different data, four studies comparing hospital admission rates showed that belted occupants required hospital admission 56 to 74 percent less frequently than unbelted occupants.

Mandatory State Safety Belt Use Laws Could Be Strengthened

All 22 studies that evaluated the effectiveness of mandatory safety belt use laws in reducing deaths and injuries showed the laws to be effective overall. The laws reduced fatality rates in the range of 5 to 20 percent, according to most of the 17 studies addressing this issue. The 14 studies that evaluated the impact of mandatory use laws on injury rates also showed that most injury reductions ranged from 5 to 20 percent. These results were based on a wide variety of study methodologies and data, and some of the results are inherently conservative.

GAO's review of information recently available from NHTSA and observations in the studies reviewed showed that many of the existing state laws mandating safety belt use could be strengthened. For example, (1) only 8 states cover rear seat occupants, (2) 32 states do not allow police to stop and ticket vehicle occupants solely for not using safety belts, (3) 17 states exempt light trucks or vans, and (4) fines for not using safety belts are generally small—only 3 states have fines over $25 and 3 states have no fines.

The 1991 act requires the Secretary of Transportation to report to the Congress by October 1992 on the effectiveness of seat belts and air bags and on belt use rates. The act also establishes grants and penalties as financial incentives for states to enact mandatory safety belt use laws and to increase belt use. However, it is not clear whether the act provides sufficient incentives to encourage states to strengthen their laws to achieve much of the savings potential available through substantially increased safety belt use. GAO believes that the Secretary's report to the Congress should include information on the extent to which the act encourages states to enact stronger, more comprehensive safety belt use laws. Other issues relating to implementation of the grants and penalties that the Secretary could address in the report are discussed in chapter 5 of this report.

The Public Bears High Cost for Unbelted Crash Victims

The societal cost of all traffic crashes is enormous. A May 1991 study sponsored by the Federal Highway Administration estimated the annual cost at about $334 billion. Overall, the studies GAO reviewed indicated that

billions of dollars annually could be saved by society through increased safety belt use.

The studies analyzing various components of societal costs showed substantially reduced costs for occupants using safety belts. Most studies of direct hospital costs showed the costs for belted occupants injured in crashes to be 60 to 80 percent lower than for unbelted victims. Few studies analyzed other costs for belted and unbelted crash victims, but all that did also showed lower costs for those wearing safety belts.

Studies that examined who pays the costs for unbelted occupants injured in crashes showed that the injured (or the family) pays less than half of the costs. About half is covered by insurance, the cost of which is spread over all who pay insurance premiums, and not just by those who generate high costs by not using safety belts. Government programs—paid through taxes—covered between 8 and 28 percent of the costs.

Recommendation

As part of DOT's report in response to the 1991 act, GAO recommends that the Secretary of Transportation include a discussion of the ways that state mandatory safety belt use laws can be strengthened. Specifically, the report should discuss whether state laws should be required to cover all occupants (including those in pickup trucks, vans, and rear seats) and have basic provisions (including fines) to facilitate enforcement. Other issues relating to the grants and penalties provided for in the 1991 act that could be discussed in the Secretary's report are presented in chapter 5 of this report. The discussion on each issue should summarize what actions DOT and the states have completed, what DOT and the states plan to do, and what legislation might be helpful for encouraging the states to increase safety belt use.

Agency Comments

GAO shared the information presented in this report with officials at NHTSA responsible for the agency's safety belt activities, who said they found the results consistent with their work. As agreed, we did not obtain written agency comments on a draft of this report.

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Abbreviations

DOT	Department of Transportation
FARS	Fatal Accident Reporting System
FHWA	Federal Highway Administration
GAO	General Accounting Office
GES	General Estimates System
GSA	General Services Administration
NASS	National Accident Sampling System
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board

Introduction

Safety belt use has long been considered an effective way to reduce deaths and injuries on the nation's highways. Safety belt technology has existed for more than a century, but belts were not installed in new cars sold in the United States until the mid-1960s. Even after belts became available, relatively few people chose to use them. States began to enact mandatory safety belt use laws in 1984 and, according to the Department of Transportation (DOT), 41 states and the District of Columbia now have some form of belt use law in effect. Safety belt use has increased from 11 percent in 1982 to 50 percent in early 1991, and federal estimates indicate that over 15,000 lives could be saved annually if all front seat occupants wore their safety belts. However, some controversy still exists regarding just how effective safety belts and mandatory safety belt use laws are in reducing fatalities and serious injuries.

Frequency of Traffic Crashes, Injuries, and Deaths

More than 40,000 people have died in traffic crashes in the United States every year for the past 25 years. Although airline crashes, railroad wrecks, and other travel mishaps receive more media attention, fatalities on the highways far exceed those sustained in all other modes of transportation combined. Over time, death and injury on the highways has become routine and expected. DOT's National Highway Traffic Safety Administration (NHTSA) estimated that in 1990

- about 6.5 million traffic crashes occurred, a rate of 1 every 5 seconds;
- deaths and injuries occurred in motor vehicle crashes at the rate of 1 every 9 seconds;
- severe or fatal injuries occurred at the rate of 1 every 63 seconds;
- Over 33,000 motor vehicle occupants were killed, and over 3 million occupants were injured; and
- 64 percent of the people injured or killed in motor vehicle crashes were the drivers.

Accident data show that only 19 percent of vehicle occupants killed in 1989 were known to have used safety belts.

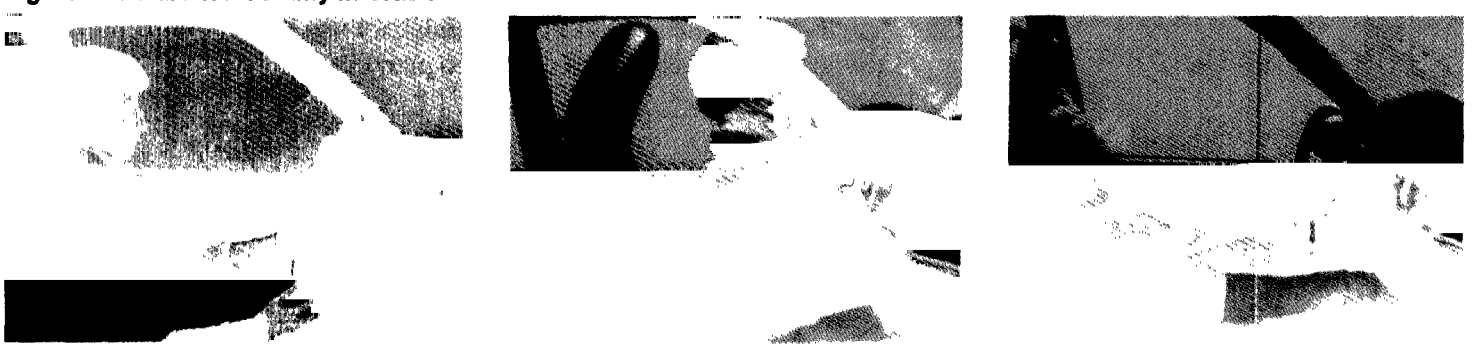
Safety Belt History

Safety belts were developed in the 1880s to keep people from bouncing off horse-drawn buggies. It was not until the 1950s that several automobile manufacturers began offering safety belts in production vehicles in the United States. In 1961, some states began requiring installed safety belts in new cars sold in their states. In 1962, car manufacturers began to install safety belt anchorages at the factory, which facilitated later addition of

safety belts by car dealers or owners. In 1964, U.S. manufacturers began making front safety belts standard equipment in their cars, although shoulder belts were available in only a few cars. By 1966 about 30 states had laws requiring front seat belts in all cars sold in their states.

Over the years, various analyses have been conducted to show what happens to occupants in crashes. Figure 1.1 shows how a steering wheel, instrument panel, and windshield absorb crash forces for an unbelted dummy.

Figure 1.1: Unbelted Dummy in Crash



Source: Insurance Institute for Highway Safety.

Federal Safety Belt Efforts

In 1964, the Congress directed the Administrator of the General Services Administration (GSA) to set safety standards for cars purchased by the federal government. Among the first GSA standards were performance requirements for the strength and quality of safety belts and anchorages.

The National Traffic and Motor Vehicle Safety Act ~~of 1966~~, as amended, specified that federal motor vehicle safety standards be developed for all vehicles sold in the United States. The first standards established under this act by the National Highway Safety Bureau, now NHTSA, used the GSA standards as a base. Most of the new federal motor vehicle safety standards became effective on January 1, 1968. The standards required the installation of shoulder belts in both front outboard seating positions and lap belts for all positions and specified minimum strength and quality of belts and anchorages.

Although safety belts were installed in all new cars, relatively few people used the belts. NHTSA has attempted to encourage safety belt use through public information and education campaigns and by requiring equipment on cars, such as warning lights, buzzers, and a starter interlock that prevented cars from starting unless the belts were buckled. The interlock, required on 1974 model year cars, was so unpopular that the Congress rescinded the requirement.

In July 1984, DOT issued a rule mandating that passive restraints[1] be phased in beginning with 1987 model year cars. The rule provided that passive restraint installation could be avoided if states representing two-thirds of the U.S. population enacted satisfactory mandatory safety belt use laws. This provision focused attention on mandatory use laws and prompted automobile manufacturers and others to provide funding and support for such laws.

NHTSA has been encouraging the states to enact mandatory safety belt use laws and has distributed material for states and others to convince the public to wear safety belts. President Bush announced a nationwide safety belt use goal of 70 percent by 1992. NHTSA has been working with the states and local agencies on public information and enforcement in order to achieve this goal.

State Mandatory Use Laws

New York was the first state to require the general public to wear safety belts. New York's law became effective on December 1, 1984, and imposed fines for nonuse beginning on January 1, 1985. As of November 1991, 41 states and the District of Columbia had mandatory safety belt use laws in effect (see app. I).[2] Mandatory use laws were not initially popular in all states, and four states (Massachusetts, Nebraska, North Dakota, and Oregon) had enacted mandatory safety belt use laws, but the laws were subsequently repealed by voter referendum. Oregon later reinstated its law. States with no belt use laws currently in effect are Kentucky, Maine, Massachusetts, Nebraska, New Hampshire, North Dakota, South Dakota, Vermont, and West Virginia. Nebraska recently passed a belt use law that is to become effective on July 15, 1992.

[1]Passive restraints—automatic safety belts and airbags—were developed to reduce injury levels to vehicle occupants without requiring the occupants to actively assist by using manual safety belts.

[2]For this report, the District of Columbia will be counted as a state, making 42 states with required safety belt use.

Mandatory safety belt use laws vary considerably among the states in terms of coverage and enforcement. Table 1.1 shows some of the differences. Most state laws cover front seat occupants only, and many exempt light trucks and/or vans. Ten states provide for "primary" enforcement in which police can stop and ticket vehicle occupants solely for not wearing safety belts. The other states permit only "secondary" enforcement in which police cannot enforce the safety belt law in the absence of other infractions. Fines for violation of state safety belt use laws range from $0 to $50. In contrast, according to a NHTSA analyst, state laws establish higher fines for nonuse of motorcycle helmets than for safety belt violations, and all state motorcycle helmet laws provide for primary enforcement.

Table 1.1: Examples of Differences in State Safety Belt Laws

Requirements	Number of states
Coverage	
Applies only to front seat occupants	34
Applies to all occupants	8
Light trucks and/or vans exempted	17
Enforcement	
Primary	10
Secondary	32
Fines	
Between $25 and $50	18[a]
$11 to $24	10
$10 or less	14[b]

[a]Only 3 of the 18 states have fines higher than $25.

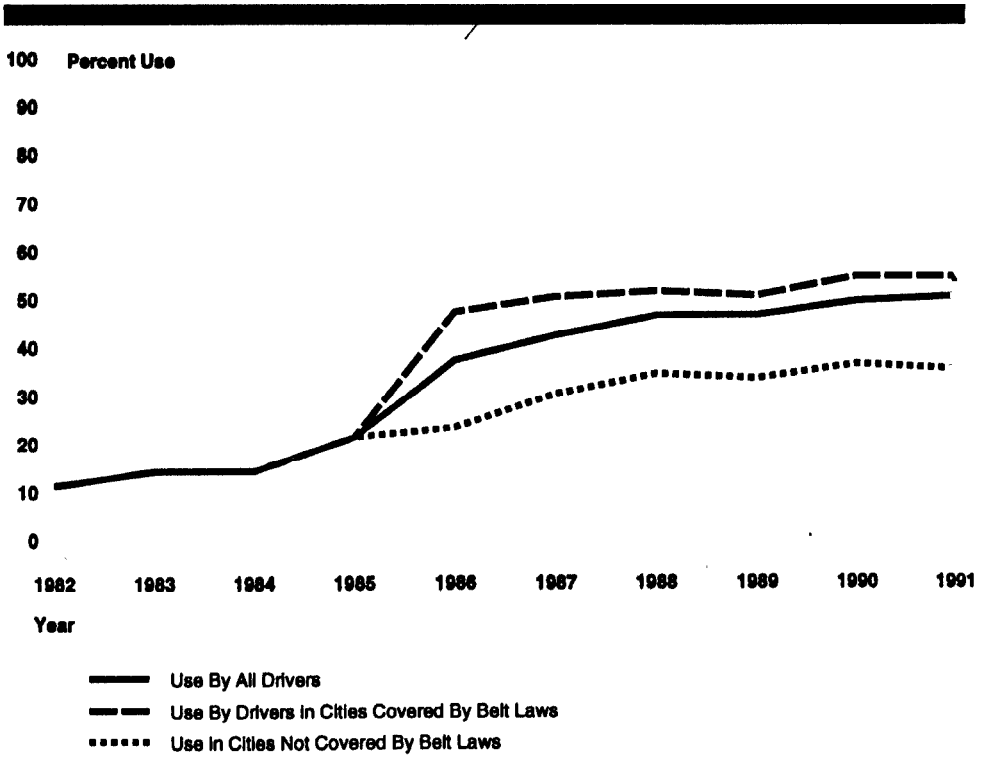
[b]Three of the states have no fines.

Source: NHTSA data—see appendix I.

Belt Use Has Increased

NHTSA has used surveys of safety belt use in 19 cities to show changes in belt use over time. Overall, drivers' use of safety belts had increased from 11 percent in 1982 to 50 percent in early 1991. (See fig. 1.2.) Belt use for the first half of fiscal year 1991 was 54 percent in the 15 cities covered by mandatory use laws and 35 percent in the 4 cities not covered by such laws.

Figure 1.2: Trends in Drivers' Use of Safety Belts



Notes: The percent shown for 1982 includes some 1981 data.
Data for 1989 and later were computed somewhat differently than earlier data.

Source: NHTSA

The surveys show that belt use has increased in cities without belt use laws as well as in those with such laws. According to NHTSA staff, the existence of belt use laws in many states has had some spillover effects into neighboring jurisdictions, and over the past decade the public has generally become more aware of the benefits of wearing safety belts. Also, some of the increase may have been related to the increasing number of cars equipped with automatic safety belts.

In addition to data from the 19-city survey, NHTSA obtains safety belt use data from the states with mandatory use laws. NHTSA staff told us that the state belt use rates are not generally based on probability sampling techniques that would provide statistically valid estimates. The states use

a variety of sampling approaches and some are more reliable than others.[3] NHTSA uses the data, however, because they are the only estimates currently available from the states. The Secretary of Transportation recently used these data to announce that safety belt use in the United States had reached 59 percent. In order to improve the quality of the state survey data, NHTSA published in the March 24, 1992, Federal Register proposed guidelines for state observational surveys of belt use.

As shown in appendix I, reported safety belt use varies widely among the states with mandatory use laws. The recently reported use rates in the states ranged from 28 to 85 percent; 8 states reported use rates lower than 50 percent, 31 states reported use rates of between 50 and 70 percent, and 3 states reported use greater than 70 percent. Despite enactment of mandatory safety belt use laws, 4 of the states observed belt use about as low or lower than the average use reported for locations without mandatory safety belt use laws in the 19-city survey. Although the general nationwide trend is toward gradually increasing safety belt use, some states have experienced reductions in safety belt use rates from the levels observed in prior years.

Several reasons have been suggested for the variations in safety belt use among the states. First, as discussed previously, mandatory safety belt use laws differ substantially among the states in terms of strength and coverage. Second, even if the laws were the same, different enforcement levels would tend to produce different results. Third, some states may be more effective than others in encouraging safety belt use through such means as public information and education campaigns.

Some Controversy About Safety Belt Effectiveness

NHTSA has estimated that safety belts have saved nearly 25,000 lives and prevented about 650,000 moderate to critical injuries between 1983 and 1990. NHTSA credits most of these savings to mandatory safety belt use laws that were enacted during that period. NHTSA has also estimated that more than 15,000 lives would be saved annually if all front seat occupants wore safety belts.

Some researchers have cited numbers quite different from NHTSA's. According to one researcher's 1989 testimony before the Congress, requiring all states to pass mandatory safety belt use laws would likely save only about 325 additional lives annually. In addition, some opponents

[3]NHTSA does not know how inaccurate the state data may be, and we did not attempt to independently review the survey methodologies or results.

have argued that under certain circumstances it is better not to wear safety belts so that occupants might be "thrown clear" of the crash, or so that vehicle occupants can avoid internal injuries from poorly designed or improperly worn safety belts. Some have cited the potential problem of safety belts entrapping occupants in burning or submerging vehicles. Although none of the studies in our synthesis supported these positions (see ch. 2), the controversy surrounding the effectiveness of safety belts and mandatory safety belt use laws has probably contributed to the lack of sufficient support for strong federal mandates.

Recent Federal Legislation

The Intermodal Surface Transportation Efficiency Act of 1991 (P.L. 102-240) has provisions requiring states that do not mandate safety belt use to transfer a portion of their federal-aid highway funds to state highway safety programs. The legislation also provides for grants for up to 3 years to states having mandatory use laws and achieving minimum levels compliance with those laws. In February 1992, bills were introduced in the Senate (S.2204) and House (H.R.4207) to repeal the penalty provisions included in the act.

Objectives, Scope, and Methodology

The Chairman of the Subcommittee on Water Resources, Transportation, and Infrastructure, Senate Committee on Environment and Public Works, and the Ranking Minority Member of the Committee asked us to summarize current data on (1) the extent to which safety belts are effective in reducing fatalities and severe injuries, (2) the extent to which mandatory laws for safety belt use have reduced fatalities and severe injuries, and (3) the societal costs related to nonuse of safety belts.

To address these objectives, we evaluated existing relevant literature and determined what conclusions could be reasonably drawn from the collective evidence. Individual studies may have limitations of scope, missing data, large margins of error, or other uncertainties. However, we have found in prior evaluation syntheses that a series of independently conducted studies that are consistent in their findings may yield a stronger vote of confidence than would any study considered individually. Thus, to the extent that studies of varying scope and analytical technique reach consistently similar conclusions, their collective value for answering a question is enhanced.

We identified relevant documents by (1) searching computerized bibliographic files, (2) surveying each state's governor's highway safety

representative (see app. II), (3) interviewing experts, (4) searching the holdings of libraries at DOT and the University of Michigan Transportation Research Institute, and (5) reviewing bibliographies we obtained. These efforts identified over 2,500 citations of documents of potential relevance. We reviewed abstracts of these documents and/or the actual documents in order to eliminate from further consideration those that

- did not directly address at least one of the three questions we were asked to consider;
- were published before 1980;[4]
- did not contain original data or analyses;
- studied only a selected subgroup of safety belt types rather than all safety belts in general use during the study period;
- were based on foreign experience;[5]
- were editorial or policy discussions rather than actual descriptions of research performed; or
- were duplicate citations, interim reports superseded by final reports, or the same research published in different places.

We identified 85 of the roughly 2,500 studies that met our criteria for inclusion and assessment. We were assisted in our evaluation of these studies by a three-member panel (see app. IV for the panel members as well as the major contributors to the report). Each of our panel members separately evaluated each of the studies.

The panelists' evaluation of individual studies focused on the methodology used by each study to address our three questions. Some of these studies addressed more than one of our questions and/or used more than one different analysis technique to address one or more of our questions. The panelists' evaluations took into consideration study components such as

- comparability of comparison groups used (e.g., age groups, seating positions);
- description of data sources used (including data collection procedures, assumptions concerning before and after time periods, etc.);

[4]We selected 1980 as our cutoff because studies published before that date used data bases containing more vehicles manufactured in the 1960s and early 1970s. Those earlier vehicles differed in many ways from vehicles currently produced. Perhaps most importantly, the safety belts installed in those vehicles were unlike those in current vehicles.

[5]Because of the abundance of material, we chose to restrict the universe of studies to the most consistent vehicles, drivers, and highways by focusing on the United States and excluding foreign studies.

- comparability of measures used (time period, cell sizes, identical groups, etc.); and
- tests of significance.

In order to evaluate the studies on a consistent and timely basis, the studies were judged on the basis of the information included in the studies; we did not attempt to supplement the studies with additional data from the authors or from other sources. The panel based its evaluations on the data sources, assumptions, and methodologies described in each study. The evaluations of the studies were not, however, based on the studies' findings or conclusions.

After the panelists completed their individual evaluations, we held a series of meetings to discuss the studies. In its deliberations, the panel considered 44 studies to be of higher quality than the others in relation to our evaluation questions. A bibliography of these studies is at the end of this report. Even among these 44 studies, the panel considered the quality of the various analysis techniques presented and selected those techniques most appropriate for addressing our questions. Throughout the report, when we refer to the studies in our evaluation synthesis, we are referring to those 44 studies we determined to be of higher quality for our evaluation questions.

Chapters 2, 3, and 4 of this report present the results from the 44 studies or portions of studies in our evaluation synthesis. Among these studies,

- 21 addressed the effectiveness of safety belts in reducing deaths and injuries,
- 22 addressed the effectiveness of safety belt mandatory use laws in reducing deaths and injuries, and
- 9 addressed differences in societal costs for belted and unbelted crash victims.[6]

Where possible, the standard error of estimate is given with the study result. Many studies, however, were not designed to be representative. In addition, the injury descriptions used in the report are those used in the studies. Within a particular study, specific types of injuries are comparable among belted and unbelted groups. However, there is no guarantee that the same term—for example "serious"—is defined identically by different authors.

[6]These total 52 rather than the 44 studies in our evaluation synthesis because some studies addressed more than one question.

In addition to the studies in our evaluation synthesis, we have used other studies and data as background or general information. These are described where they are used in the report.

Vehicle and safety belt designs change over time, possibly causing some changes in safety belt effectiveness. During the late 1980s, many vehicle manufacturers changed from manual 3-point belts to automatic belts of various designs. During the early 1990s in response to public demand, many of these manufacturers began shifting away from the automatic belts to a combination of manual 3-point belts and airbags. Since relatively few vehicles with automatic belts or airbags were in the fleet of vehicles during the time periods covered by the studies in our synthesis, the results from our synthesis reflect data primarily from manual 3-point belts.

In the tables throughout the report, the percent of fatalities, injuries, and hospitalizations are given for unbelted (not wearing a safety belt) and belted (wearing a safety belt). The "percent reduction" shown in these tables shows the difference between these figures (i.e., the unbelted and the belted) expressed as a percent of the unbelted figure. The consistency of data definitions and categorizations within a study supports this type of calculation.

The use of the percent reduction result facilitates comparisons between studies. Some studies included this result, while others included the raw data that allowed us to compute it. We also used raw data to check, and correct when necessary, percentage calculations in the studies, and simple calculations were used to isolate results for vehicle occupants covered by mandatory use laws. We have noted throughout the report where we performed such calculations.

We conducted our review between July 1990 and November 1991 in accordance with generally accepted government auditing standards. We discussed the facts presented in this report with responsible NHTSA officials and have incorporated their comments as appropriate. These officials found our findings to be consistent with their work.

In May 1991, we issued a report entitled Highway Safety: Interim Report on Safety Belt and Motorcycle Helmet Effectiveness (GAO/RCED-91-158) to assist congressional deliberations on pending legislation proposing federal financial incentives for state laws mandating safety belt use. We reported that studies showed safety belts to be very effective in reducing deaths and injuries. This information is discussed more fully in chapter 2 of this

report. In June, the Senate passed legislation that included the basic safety belt provisions that were in the act ultimately signed in December. We also issued a related report entitled Highway Safety: Motorcycle Helmet Laws Save Lives and Reduce Costs to Society (GAO/RCED-91-170, July 29, 1991).

Safety Belts Are Effective in Preventing Deaths and Reducing the Severity of Injuries

All 21 safety belt effectiveness studies in our synthesis showed safety belts to be very effective. These studies varied in scope, data sources, and methodological approaches, but despite these differences, vehicle occupants wearing safety belts consistently fared better than those who were unbelted. All 13 studies that compared fatality rates for vehicle occupants wearing safety belts to those not wearing safety belts showed that safety belts were very effective in improving the occupant's chances of surviving a crash. Also, all 11 studies that compared injuries received by belted and unbelted vehicle occupants showed that belted occupants were injured less frequently and/or less severely than the unbelted.

Safety Belts Are Effective in Reducing Fatalities

Thirteen studies compared fatality rates for vehicle occupants wearing safety belts with rates for those not wearing belts. These studies used either nationwide data from DOT's Fatal Accident Reporting System (FARS), or National Accident Sampling System (NASS), or data from individual state, police, or hospital reports.[1] Most studies used data for front seat occupants only, but four studies included data for rear seat occupants as well. Details on these 13 studies are shown in table 2.1. The studies are listed in the bibliography.

Table 2.1: Safety Belt Effectiveness in Reducing Fatalities

Study	Data source	Seating position	Fatalities (percent)		Percent reduction
			Unbelted	Belted	
Nationwide studies:					
Evans (1986)	1975-83, FARS	Drivers and right front passengers	[a]	[a]	41(± 4)[b]
McGee	1980-84, FARS	Driver and right front passengers	[a]	[a]	50[c]
Partyka (7/86)	1985, FARS	Drivers	[a]	[a]	58
		Right front passengers	[a]	[a]	50
Partyka (10/86)[d]	1982-85, FARS	Drivers	[a]	[a]	53
		Right front passengers	[a]	[a]	44
Partyka (5/88)	1982-87, FARS	Passenger car Front seat	[a]	[a]	55

(continued)

[1]Appendix III provides an overview of the various data sources used in the studies.

Study	Data source	Seating position	Fatalities (percent) Unbelted	Belted	Percent reduction
USDOT (7/88)	1986 NASS	Passenger car Occupants	0.428[c]	0.052[c]	88[c]
State studies:					
Agent	1984-88 Ky. Police reports	Drivers	0.24	0.06	75
		Nondrivers	0.23	0.07	70
Campbell (7/87)	1973-81 N.C. Police reports	Drivers	0.362[c]	0.097[c]	73
		Right front passengers	0.381[c]	0.13[c]	66
Connecticut	Police reports: 7/15/85 through 12/31/85	Front seat occupants	0.16	0.05	69[c]
	1986		0.68	0.04	94[c]
Iowa	11/87-3/88 at 16 Iowa Hospitals	Vehicle occupant victims	1.72	0.14	92[c]
Maghsoodloo	1984-87 Ala.	Front seat occupants	[a]	[a]	50(± 1)[b]
Mounce	1989; six hospitals in three Tex. cities	Drivers	1.53	0.3	80[c]
Pennsylvania	1988 Pa.	Front seat	1.13	0.18	84[c]
		Back seat	0.38	0.06	84[c]

Note: The dates of the Partyka studies are underlined in the bibliography.

[a]Not shown in the study.

[b]The number in parentheses represents the standard error of estimate.

[c]GAO computed the number from data in the study.

[d]Two additional studies by Partyka (dated 11/86 and 4/87) contained some different analysis, but the overall results were the same as in the 10/86 study.

All 13 fatality studies showed that safety belts were very effective in improving vehicle occupants' chances of surviving a crash. The percentage difference in fatality rates between belted vehicle occupants and unbelted occupants ranged from 41 to 94, but most estimates clustered between 50 and 75 percent. Stated another way, the studies show that unbelted occupants died at rates of about two to four times those for belted occupants.

Four of the studies analyzed data separately for drivers and other vehicle occupants. Although all studies showed lower fatality rates for belted than unbelted occupants, the studies that showed separate data for drivers indicated that drivers benefitted slightly more from belt use than the other occupants. This is particularly important because drivers are the vehicle occupants most likely to die in crashes; two-thirds of all passenger vehicle occupant deaths in 1990 were drivers.

According to the five studies using FARS data for all states, safety belt effectiveness (percent difference in fatalities) ranged from 41 to 58 percent. The one study using NASS data showed a much higher safety belt effectiveness rate of 88 percent nationwide. For the seven studies using individual state data, the safety belt effectiveness rate ranged from 50 to 94 percent. With the exception of the study done in Alabama, the lowest effectiveness rate for the studies using state data was 66 percent.

The most impressive thing about the results of these studies is the consistently high effectiveness level of safety belts in reducing deaths. No study even came close to indicating that occupants might have been just as well off by not using safety belts. On the contrary, even those studies on the lower end of the effectiveness range indicated that unbelted occupants died at about twice the rate for belted occupants. The consistency and the high level of the estimates despite the differences in data sources and types of analyses provides strong evidence of the effectiveness of safety belts in reducing deaths in motor vehicles.

Safety Belt Use Reduces Severity of Injury

Eleven studies compared injuries received by belted and unbelted vehicle occupants in crashes. Like the fatality studies discussed previously, these studies were developed from diverse data sources and included a variety of seating positions (e.g., drivers, right front passengers, or all occupants). However, unlike the fatality studies in which the criteria for injury severity remained constant among the studies (i.e., alive or dead), the types and severity of injuries these studies analyzed varied widely from one study to another. Most studies used rather general injury descriptions unique to each study, making any direct comparisons among these studies less feasible than for the fatality studies. However, each study used the same criteria for both the belted and unbelted occupants in their data so that differences in injury rates could be computed. Details on these 11 studies are shown in table 2.2.

Table 2.2: Safety Belt Effectiveness in Reducing Injuries

Study	Data source	Seating position	Injury description	Injuries (Percent)		Percent reduction
				Unbelted	Belted	
Agent	1984-88 Ky. police reports	Drivers	Incapacitating	2.73	1.66	39
		Nondrivers	Incapacitating	3.54	1.97	44
Campbell (7/87)	1973-81 N.C. police reports	Drivers	Serious or fatal	3.73	1.57	58
		Right front passengers	Serious or fatal	4.3	2.03	53
Connecticut	Police reports: 7/15/85 through 12/31/85	Front seat occupants	Disabling	3.2	1.5	53[a]
	1986		Disabling	7.79	1.51	81[a]
Huelke	National Crash Severity Study	All occupants	Severe or worse to:			
			Head	7	5	29[a]
			Neck	6	4	33[a]
			Face	2	0.6	70[a]
			Chest	30	25	17[a]
			Back	3	1.3	57[a]
			Abdomen	55	16	71[a]
			Upper extremity	8	3	63[a]
			Lower extremity	14	6	57[a]
Iowa	11/87 to 3/88 at 16 Iowa hospitals	Vehicle occupant victims	Permanent disability	2.11	0.29	86[a]
			Head injury	14.4	1.7	88[a]
			Fracture(s)	20.2	7.5	63[a]
			Laceration(s)	34.3	12.2	64[a]
Kerwin	1984 Colo. state police	Front seat occupants	Injury (unspecified)	46.48[a]	16.02[a]	66(± 4)[b]
Maghsoodloo	1984-87 Ala.	Front seat occupants	Serious	[c]	[c]	49
Mounce	1989; six hospitals in three Tex. cities	Drivers	Incapacitating	19.39	5.24	73[a]
Pennsylvania	1988 Pa.	Front seat	Major injury	3.62	0.89	75[a]
		Back seat	Major injury	2.03	0.49	76[a]
USDOT GES (8/90)	1988 General Estimates System	Drivers	Severe or fatal	7.09[a]	1.98[a]	72[a]
		Passengers	Severe or fatal	21.26[a]	9.48[a]	55[a]
USDOT GES (12/90)	1989 General Estimates System	Drivers	Severe or fatal	7.81[a]	1.82[a]	77[a]
		Passengers	Severe or fatal	22.69[a]	8.24[a]	64[a]

(Table notes on next page)

[a]GAO computed the number from data in the study.

[b]The number in parentheses represent the standard error of estimate.

[c]Not shown in the study.

Regardless of differences in injury definitions, data sources, or other variables in these studies, every study showed that belted occupants were injured less frequently or less severely than unbelted occupants. The injury reduction for belted occupants ranged from 17 to 88 percent, with most of the estimates clustered between 50 and 75 percent. In other words, like the results for fatalities, most of these studies indicate that unbelted occupants suffered injuries at about two to four times the rate for belted occupants.

Safety Belt Use Reduces Frequency of Medical Treatment

DOT's 1986 NASS report contained nationwide data on the extent to which belted and unbelted occupants involved in crashes required medical treatment. The report showed that 22 percent of the unbelted occupants required some medical treatment for their injuries compared with 10 percent of the belted occupants. Like most of the other studies addressing safety belt effectiveness, this indicates that unbelted occupants were injured at more than twice the rate for belted occupants.

Another way to estimate the effectiveness of safety belts in reducing injury severity in crashes is to compare the percentage of belted occupants requiring hospitalization with the percent of unbelted occupants requiring hospitalization. Those not seriously injured can get a checkup or receive minor medical treatment and then go home. Those more seriously injured are admitted to hospitals. Four studies contained data on hospitalization of crash victims comparing those who used safety belts with those who did not. Three were hospital-based studies, and the other was a report summarizing NASS data. Table 2.3 summarizes the results of these studies.

Table 2.3: Safety Belt Effectiveness in Reducing Hospital Admissions

Study	Data source	Seating position	Hospitalization frequency (percent)		Percent reduction
			Unbelted	Belted	
Iowa	11/87 to 3/88 at 16 Iowa hospitals	Vehicle occupant victims	27.5	9.2	67[a]
Orsay	1/1/86 to 7/1/86 at four Chicago-area hospitals	Occupants of cars and two-axle trucks	19.2	6.8	65[a]
Reath	6-months in 1987 University of Tennessee Medical Center at Knoxville	Vehicle occupants	59	26	56[a]
USDOT (7/88)	1986 NASS	Passenger car occupants	3.31[a]	0.86[a]	74[a]

[a]GAO computed the number from data in the study.

Despite the wide variation in data sources, the four studies consistently showed that occupants who used safety belts were hospitalized 56 to 74 percent less frequently than occupants who did not use safety belts. Stated another way, occupants not using safety belts required hospitalization at rates about two to four times the rates for belted occupants.

Is It Ever Better to Not Use Safety Belts?

Several views have been expressed for not using safety belts, for example,

- it is better to be "thrown clear" of the crash than remain in the vehicle,
- safety belts can trap occupants in burning or submerging vehicles, or
- poorly designed or improperly used safety belts can do more harm than good.

People have heard these views as well as reasons for using safety belts and many may not know what to believe.

None of the studies in our synthesis supported any of those views for not wearing belts. Using various data bases, the studies included a wide range of crashes people actually experienced. None of the synthesis studies deleted data such as fire or submersion-related crashes, injuries possibly caused by improperly used or poorly designed safety belts, or crashes in which occupants might have been thrown clear. All studies of actual

crashes showed reduced deaths and injuries for belted occupants. No studies supported a hypothesis that it is better not to use safety belts.

In a prior review, we looked into the effectiveness of lap belts for rear seat occupants.[2] The National Transportation Safety Board (NTSB) had analyzed 26 frontal crashes and questioned lap belt effectiveness. We agreed with NTSB that there were problems with some of the available data, but we disagreed with NTSB's conclusions on lap belt effectiveness. We pointed to other studies using different methodologies and data showing that rear seat lap belts protected wearers more often than they harmed them. We did not dispute the conclusion of NTSB and others that lap/shoulder belts offer superior protection for occupants. Few lap belts are produced in current vehicles, and the older vehicles with lap belts are gradually being replaced. However, some of the studies in our current synthesis used data for rear seat occupants from time periods in which lap belts were available in a higher proportion of the fleet of vehicles on the highways.

The NTSB issued a report in 1988 on 167 crashes in which the performance of lap/shoulder belts was analyzed.[3] The NTSB cautioned that its sample of 167 crashes cannot be used to derive statistical estimates of safety belt effectiveness. The results of a single crash or a small sample of crashes cannot be used to estimate what might happen in other crashes, and the same is true for anecdotal reports of people being thrown clear by not using safety belts or trapped by safety belts in burning or submerging vehicles; isolated events do not provide adequate evidence of safety belt effectiveness. The NTSB report on 167 crashes noted, however, that "... common sense dictates that the lap/shoulder belt be worn 100 percent of the time."

[2]Motor Vehicle Safety: A Review of the NTSB Report on Rear Seat Lap Belt Effectiveness (GAO/RCED-88-13, Nov. 13, 1987).

[3]Performance of Lap/Shoulder Belts in 167 Motor Vehicle Crashes, National Transportation Safety Board, Washington, D.C. (Mar. 1, 1988).

Mandatory Safety Belt Use Laws Are Effective in Reducing Deaths and Serious Injuries

All of the 22 studies in our synthesis that analyzed the effectiveness of mandatory safety belt use laws showed that state laws have been effective overall in preventing deaths and reducing injuries. The 17 studies analyzing fatalities and the 14 studies evaluating injuries used a wide variety of data and methodologies but, despite their diversity, most showed that states' mandatory safety belt laws reduce deaths and serious injuries from 5 to 20 percent. We believe, however, that if these laws were more comprehensive and better enforced, they would show larger reductions in deaths and injuries.

Mandatory Use Laws Have Reduced Fatality Rates

Seventeen studies in our synthesis addressed changes in the frequency of fatal injuries caused by implementation of mandatory use laws. Five of the studies used data from the Fatal Accident Reporting System (FARS), 11 used accident reports from state data systems, and 1 used information from insurance claims records. The time periods covered by these studies ranged from 18 months to 13 years, thus providing time periods of varying durations before and after enactment of mandatory use laws. Table 3.1 summarizes these studies.

Table 3.1: Law's Effectiveness in Reducing Fatalities

Study	Data source	Factors Studied	Percent reduction
Multiple state studies			
Campbell (12/88)	1975-87 FARS	Covered occupant fatalities vs. others: 25 states plus D.C.	6.3[a]
Hoxie	1980-86 FARS	Front seat passenger car fatalities: 17- state average	5.8
Partyka (2/87)	1984-85 FARS	Front seat passenger vehicle fatalities: 8 states	6.0
Wagenaar	1976-86 FARS	Front seat fatalities, age 10 or older, per mile[b]: 8 states	8.7
Single state studies			
Asch	1979-86 N.J.	Vehicle occupant fatalities	18.9
Connecticut	7/85-12/86 Conn.	Front seat fatalities	5.5
Hawaii DOT	1983-88 Hawaii	Front seat fatalities per mile[b]	27.0
Hood	1982-87 Fla.	Daytime driver fatalities	10.8
Latimer	1984-85 N.Y.	Sampled/projected fatalities	20.0
Lund	1980-85 N.Y., Pa., Ohio	N.Y. fatalities vs. Pa. and Ohio	9.0
McCartt	1982,84,85 N.Y.	Deaths of occupants covered by the law	18.2
Mounce	1981-89 Tex.	Driver fatalities	27.8[a]
Petrucelli	1980-85 N.Y.	Occupant deaths per mile[b]:	
		1985 vs. 1984	8.3
		1985 vs. 1980-84 average	21.4[a]
Reinfurt	1981-88 N.C.	Deaths of occupants covered by the law:	
		Warning ticket phase	3.5[a]
		$25 citation phase	17.9[a]
Saalberg	League General Insurance (Mich.)	Fatal injury claims (July 1984 thru June 1988)	26.7
Sidhu	1981-86 FARS (Ill.)	Front seat occupant fatalities	6.0
Streff	1978-87 Mich.	Deaths of occupants age 16 or older	1.5

[a]GAO computed the number from data in the study.

[b]These studies used vehicle miles traveled to represent a person's risk of being in a crash. These figures were obtained by the authors from various sources.

All 17 studies showed mandatory safety belt use laws to be effective in reducing fatalities; most showed reductions in deaths to be from 5 to 20

percent. Four of the studies showed combined results for multiple states that ranged from 5.8 to 8.7 percent fewer fatalities as a result of the mandatory use laws. The results of the individual state studies were scattered much more widely—from 1.5 to 27.8 percent fewer fatalities. The overall results are summarized in table 3.2.

Table 3.2: Results of Individual State Studies

Effectiveness range	Number of results in the range[a]
(Percent fewer fatalities)	
1 - 4.9	2
5 - 9.9	8
10 - 14.9	1
15 - 19.9	3
20 - 24.9	2
25 or more	3

[a]Two studies each had two results.

Differences in the data used by the researchers can create substantial differences in the results. The results for New York, the first state to enact a mandatory safety belt use law, demonstrate the influence that specific data and methods had on the results. Petrucelli's study demonstrates the effect that data selection can have on the results. It shows that the 1985 death rate was 8.3 percent lower than 1984, but also that this same 1985 death rate was 21.4 percent lower than the average death rate for 1980 through 1984. Two studies in Michigan showed even more diverse results. One study used a time series analysis of state data over a 10-year period and showed a 1.5-percent reduction in fatalities as a result of Michigan's mandatory use law. Another study in our synthesis used claims data from one insurance company (adjusted for changes in number of insured vehicles) and identified a 26.7-percent reduction in fatal injury claims after enactment of Michigan's mandatory use law. This insurance company data, however, represents a limited sample of crashes in Michigan.

Authors used a variety of approaches to account for changes in fatality frequency caused by factors other than the mandatory use laws. For example, three studies used estimated total vehicle miles traveled to produce a rate of deaths per mile driven. Others analyzed the ratio of fatal injuries to all injuries or to all occupants involved in crashes. Since most mandatory use laws apply only to front seat occupants of vehicles, some studies analyzed fatalities among "covered" occupants (drivers and front

seat passengers) compared with "noncovered" victims such as rear seat occupants. We considered these comparisons conservative since any increased use of safety belts by covered occupants because of a mandatory use law might result in increased use by noncovered occupants because of conformity or of a misunderstanding of the scope of the law.

Although the studies showed a wide range of life-saving effects of mandatory safety belt use laws, the overall finding is that they have reduced highway deaths. More about the general level of savings and additional reasons for the variations are discussed later in this chapter.

Mandatory Use Laws Have Reduced Injury Rates

Fourteen studies showed the relationship of mandatory safety belt use laws to injuries. Table 3.3 summarizes the results of these studies. All the studies relied on state or local data. Ten of the studies analyzing injuries utilized state accident report data systems, 2 used regional hospital data, and 2 used insurance claims records. As noted previously, the time periods also varied. In addition, as discussed in chapter 2, different injury descriptions used in each study limits direct comparisons among the studies.

All 14 studies showed decreases in injuries after states had implemented mandatory safety belt use laws. Like the results discussed in the previous section for fatalities, most of the studies of injuries showed reductions of between 5 to 20 percent. Overall injury reductions in the 10 state data studies ranged from 6.3 to 25.7 percent. For the two hospital studies, the injury reduction ranged from 9.1 to 60.0 percent. In the two insurance studies, the injury change ranged from a 7.3-percent increase to a 39.2-percent decrease.

Table 3.3: Laws' Effectiveness in Reducing Injuries

Study	Data source	Factors studied	Percent reduction
State data			
Asch	1979-86 N.J.	Severe occupant injuries	15.0
Campbell (10/89)	Conn.,Ill., Iowa, Md., N.Y., N.C., Tex., Wash.	Serious and fatal injuries	0.7 to 12.1
		Moderate, serious, and fatal injuries combined	1.7 to 11.6
Chorba	1985-87 N.C.	Severe and fatal injuries	9.2[a]
Connecticut	7/85-12/86 Conn.	Severe injuries	13.9
		Moderate injuries	14.5
Hood	1982-87 Fla.	Incapacitating injuries in daytime:	
		With law alone	12.2
		With enforcement	20.5
Latimer	1984-85 N.Y.	Sampled/projected injuries:	
		Severe	11.0
		Moderate	13.0
McCartt	1982,84,85 N.Y.	Occupants covered by the law:	
		Serious injuries	18.6
		Moderate injuries	20.5
Mounce	1981-89 Tex.	Driver incapacitating injury	11.7[a]
		Driver nonincapacitating injury	25.7[a]
Reinfurt	1981-88 N.C.	Serious or worse injuries:	
		Warning ticket phase	6.6[a]
		$25 citation phase	4.4[a]
Streff	1978-87 Mich.	All injuries	6.3
		Severe	–0.3
		Moderate	14.0
Hospital data			
Lestina	1987-88 Charlottesville, Va. area	Admitted to hospital:	
		Drivers	12.5[a]
		Right front passengers	60.0[a]
		Treated and released:	
		Drivers	26.8[a]
		Right front passengers	9.1[a]
States	1983-86 Monroe County, N.Y.	Serious or worse injury to:	
		Head	18.2
		Face	20.0
		Chest	23.1
		Abdomen	16.1

(continued)

Study	Data source	Factors studied	Percent reduction
Insurance data			
Highway Loss Data Institute	13 insurance companies and 8 states—1984-87	Ratio of injury claims to collision claims for collisions over $1000:	
		N.Y	8.4
		N.J.	3.2
		Mich.	13.0
		Tex.	-7.3
		Conn.	8.4
		Fla.	1.5
		Kans.	0.1
		Md.	2.8
Saalberg	League General Insurance (Mich.) (7/84 to 6/88)	Injury claims:	
		Severe	32.0
		Serious	39.2
		Moderate	29.5

[a]GAO computed the number from data in the study.

Most of the injury reductions according to the 10 studies using state data were between 5 and 15 percent. One unusual result was a slight (0.3 percent) increase in severe injuries in Streff's study of Michigan data, despite a 6.3-percent decrease for all injuries in the study. The study did not explain the reasons for the small increase in severe injuries, but did point out that the data were adjusted to control for changes over time in exposure to risk and the effects of economic conditions in Michigan. For comparison, another study in Michigan by Saalberg showed a large (32.0 percent) reduction in insurance claims for severe injuries.

The two studies using hospital data showed greater injury reductions overall than the studies using state data. The lowest reduction (9.1 percent) was for right front passengers who were treated and released, and the highest reduction (60 percent) was from the same study for right front passengers admitted to the hospitals in the Charlottesville, Virginia, area. The Monroe County, New York, study that analyzed serious or worse injuries to various parts of the body showed injury reductions ranging from 16.1 to 23.1 percent.

The two studies using insurance company data were quite different from any of the other studies. One compared ratios of injury claims to collision

claims in eight states and found reductions in seven of these states after the laws went into effect. The reductions ranged from 0.1 to 13 percent for the seven states; Texas showed an increase of 7.3 percent. The other insurance study computed the change in the number of injury claims (adjusted for changes in the number of insured vehicles) and found reductions of between 29.5 and 39.2 percent in the number of injury claims after the state's mandatory safety belt use law was enacted.

The insurance company study showing the increased injury rate in Texas did not attempt to explain the increase. An increase in injury rates in Texas, however, is inconsistent with the findings of the Texas study by Mounce, which indicated a decrease of 11.7 percent in driver incapacitating injuries and a decrease of 25.7 percent in driver nonincapacitating injuries.

Comprehensive Laws and Active Enforcement Improve Safety Belts' Savings

Our synthesis studies discussed in this chapter show that mandatory safety belt use laws are effective in reducing deaths and injuries, but the percentages of savings are much lower than those related to the effectiveness of safety belts as discussed in chapter 2. A logical explanation for the difference is safety belt use; the results in this chapter are based on the incremental increases in safety belt use brought about by the early mandatory use laws in the United States, while the results in chapter 2 are based on comparisons of data when safety belts were used or not used. The laws only had an effect on deaths and injuries for those vehicle occupants who changed their behavior from nonusers of safety belts to users. The studies of the effects of the laws would not show any effect for (1) those who already used safety belts before the laws were enacted and simply continued using them or (2) those who still did not use safety belts during the study periods after the laws were in effect. The studies used data for the first few years of experience under mandatory safety belt use laws when safety belt use rates, according to NHTSA data, were about 50 percent or less overall in areas covered by the laws.

NHTSA officials told us that it is not surprising to see relatively low effectiveness results for the existing mandatory use laws. They said that the safest drivers tend to respond first to mandatory use laws while the highest risk drivers tend to be the last to comply. The largest savings, they said, is achieved after belt use rates exceed 80 percent. They cited a 1984 report that analyzed the results of mandatory safety belt use laws in other

[1]Roger L. McCarthy, Robert K. Taylor, Sally B. Sanford, and Robert C. Lange. Seat Belts: Effectiveness of Mandatory Use Requirements. Report 840329, Society of Automotive Engineers, (Feb. 1984).

countries.[1] The report concluded that drivers with the more aggressive risk-taking behavior and the highest likelihood of having an accident are less likely than others to comply with belt laws and are the last to be affected by an enforcement program.

We were not asked to evaluate the effects of differences in coverage or enforcement of state safety belt laws, but it became apparent during our review that these differences were related to the extent to which vehicle occupants use safety belts and ultimately to the reductions in deaths and injuries attributable to mandatory use laws. We found evidence of a relationship in our synthesis studies supplemented by recently reported information from NHTSA. However, because an evaluation of coverage and enforcement of state laws was not one of our synthesis questions, we did not perform a detailed search for relevant studies or ask the panel to review the data relating to this issue.

Although our analysis was more limited for state laws than for the three synthesis questions, we observed that

- two studies in our synthesis showed enforcement and fines to be related to reduced injury severity;
- data reported by the states show safety belt use to be related to the level of fines established by the state laws;
- two studies in our synthesis discussed the relationship that primary enforcement has with safety belt use increases and fatality reductions;
- data reported by the states show the states with primary enforcement have a median safety belt use rate substantially higher than the states with secondary enforcement;
- the state data show the states having laws requiring occupants in all seating positions to use safety belts to have a noticeably higher median belt use rate than the states with laws only covering front seat occupants; and
- other information indicates public information campaigns and active enforcement of the laws lead to higher safety belt use.

Two studies from our synthesis provided data on enforcement and fines. The Florida study by Hood showed that enactment of the law even without enforcement reduced incapacitating injuries by 12.2 percent. The reduction improved to 20.5 percent after enforcement began. The North Carolina study by Reinfurt indicated a 3.5-percent reduction in fatalities during the warning ticket phase of the law and a 17.9-percent reduction during the $25 citation phase.

To determine whether the levels of fines established under the various state laws are related to the levels of safety belt use, we analyzed the October 1991 fines and use rates reported by the states (see app. I). Over one-third (or 5 of 14) of the states with low fines ($10 or less) reported relatively low belt use of 50 percent or less. In contrast, only 6 percent (or 1 of 18) of the states with fines of $25 or more reported similarly low belt use. Thus, lower belt use was related to lower fines.

Two of the synthesis studies compared states with primary enforcement to those with secondary enforcement. Wagenaar's 1988 study analyzed FARS data for eight states over an 11-year period and showed an aggregate fatality reduction of 8.7 percent. When separated by enforcement type, states having primary enforcement showed a 9.9-percent reduction compared with a 6.8-percent reduction for states with secondary enforcement. This result is consistent with Campbell's December 1988 study; he observed that states with primary enforcement tended to have higher rates of safety belt use than states with secondary enforcement and that the level of enforcement of the law is also related to safety belt use.

To determine whether the type of mandated state law enforcement is related to the levels of safety belt use, we analyzed the October 1991 enforcement type and the use rates reported by the states (see app. I). The median use rate reported for the 10 primary enforcement states was 67.5 percent compared with 56.0 percent for the 32 secondary enforcement states. Thus, the states with primary enforcement showed a median use rate 11.5 points or 20.5 percent higher.

Similarly, we used the state-reported data to see if there was a relationship between safety belt use and the number of seating positions covered by state mandatory use laws; that is, was belt use for states covering all occupants in certain vehicles higher or lower than that for the states with laws covering only front seat occupants. We found that the median use rate reported for the 8 states with laws covering all occupants was 67.5 percent compared with 58 percent for the 34 states covering front seat occupants. Only two of the eight states covering all occupants were states that also provide for primary enforcement.

One synthesis study mentioned public information campaigns and law enforcement levels. Hoxie's study suggested that public awareness campaigns and increased enforcement might be useful to "reinvigorate" state mandatory safety belt use laws. This message is consistent with the

experience of NHTSA during its summer 1991 campaign to increase safety belt use.

NHTSA's recent efforts support the conclusion that public information and increased enforcement can substantially improve the effectiveness of the laws. NHTSA reported that it initiated the summer 1991 campaign because of what agency officials described as a "stabilization" of safety belt use rates between 1987 and 1990 in mandatory safety belt use law states. The campaign focused on three holidays—Memorial Day, Independence Day, and Labor Day—and emphasized intensified law enforcement and widespread distribution of public information. Safety belt use rates during the period increased from 50 to 54 percent, as measured by NHTSA's 19-city survey. This was the largest 3-month increase in the 10-year history of the survey.

This analysis does not constitute a synthesis of all relevant studies relating to the coverage and enforcement of state safety belt use laws. However, the available information indicates that a relationship exists between reported safety belt use and the strength of state laws and related activities. Thus, it appears that more comprehensive state laws (as well as active enforcement and public information) may increase belt use, thereby achieving more of the lifesaving and injury reduction potential of safety belt use that we describe in chapter 2 and avoiding more of the high societal costs that we discuss in chapter 4.

Increased Safety Belt Use Would Reduce the Societal Cost of Traffic Accidents

The societal cost of traffic crashes is enormous—a recent report sponsored by the Federal Highway Administration (FHWA) estimated the total annual cost to be about $334 billion, including both direct and indirect costs. Although the precise cost savings potential of increased safety belt use is not known, the studies indicate that the annual savings could be billions of dollars. The nine studies in our synthesis clearly showed that accident victims using safety belts incur lower direct hospital costs than unbelted victims. Most of these costs are borne by society in general in the form of tax-supported programs and insurance premiums. Society also incurs indirect costs through lost or reduced productivity from crash victims. Although many of the societal costs related to the nonuse of safety belts in crashes are not well documented, every synthesis study that analyzed selected cost components found lower costs for belted occupants.

Traffic Accident Costs Are Enormous

Recent estimates of annual direct economic costs of traffic accidents have ranged from $49 billion to $74 billion. When pain and suffering are added, the annual total cost is much larger. However, it is difficult to place a dollar value on personal loss such as that created by the untimely and unnecessary death of a parent, spouse, child, or close friend. The NHTSA Administrator recently pointed out that every day, on average, more than 125 families assemble at grave sites around the country to mourn the loss of a family member—frequently a young person—killed in a crash.[1]

Although the daily fatality rate from traffic crashes is high, the injury rate is much higher. DOT's NASS data show that in 1986 nearly 2 million passenger car occupants (does not include light trucks, vans, and other vehicles) or about 5,000 people per day were injured seriously enough in traffic crashes to require medical treatment. The NASS data show that most of the injured were not using safety belts.

FHWA sponsored a recent study by the Urban Institute on the costs of highway crashes.[2] The report, issued in May 1991, estimated that crashes cost the United States $334 billion in 1988, including $71 billion in out-of-pocket costs; $46 billion in lost wages and household production; and $217 billion in pain, suffering, and lost quality of life. Developing estimates for all the related costs involves numerous assumptions and judgments. For example, estimates must be made for costs related to

[1]Over one-third of the vehicle occupants killed in 1989 were under 25 years old.

[2]T. Miller, et al. The Costs of Highway Crashes, The Urban Institute, Washington, D.C. (May 15, 1991).

probable physical impairment levels over time, lost productivity, and vocational rehabilitation.

Using 1985 costs, a 1989 report to the Congress estimated the economic cost of motor vehicle injury in the United States to be about $49 billion.[3] The report noted that injury is the leading cause of death for children and adults under age 45 and that motor vehicles are the most costly injury source. Recently, the NHTSA Administrator has used $74 billion as the annual cost of motor vehicle crashes. The $74 billion estimate, however, is based on costs from the 1970s which were updated by NHTSA to 1986 levels. As of early May 1992, NHTSA was working on a report containing a more current estimate of the costs.

The broad studies addressing the overall societal costs of traffic crashes do not break out the costs for belted and unbelted vehicle occupants. Safety belt use would have little if any effect on some societal costs of traffic crashes, such as those related to pedestrians and cyclists. However, according to FARS data, vehicle occupants comprise about three-fourths of all traffic fatalities, and only about one-third of the passenger car occupants involved in fatal crashes were known to use safety belts. As a result, safety belts have the potential to affect a large portion of the total societal costs created by traffic crashes.

Safety Belts Substantially Reduce Costs

The synthesis studies addressing cost differences among belted and unbelted vehicle occupants included only portions of the total societal costs of crashes—typically only hospital costs. A few of the studies included other indicators such as ambulance costs or insurance claims costs for personal injury. The studies provide information related to the effect that safety belts have on the costs of treating vehicle occupants involved in crashes. Every measure of cost analyzed in these studies showed lower rates for belted than unbelted vehicle occupants.

Safety Belt Use Greatly Reduces Hospital Costs

Belted occupants involved in crashes had lower hospital costs than unbelted occupants in part because they were admitted to hospitals less frequently. As discussed in chapter 2, the four studies addressing the differences in hospitalization rates showed that occupants using safety belts were hospitalized at rates 56 to 74 percent lower than those who did not use safety belts. Because belted occupants were more often treated

[3]Dorothy P. Rice, Ellen J. MacKenzie, and Associates. Cost of Injury in the United States: A Report to Congress. San Francisco, Calif.: Institute for Health & Aging, University of California and Injury Prevention Center, the Johns Hopkins University (1989).

and released, they more often avoided the higher costs associated with hospital admissions.

Eight studies in our synthesis contained useful data on the cost of medical treatment in hospitals for both belted and unbelted crash victims. As shown in table 4.1, the studies used a variety of time frames and data sources. Seven of the studies included the data for all crash victims who came to the hospitals for treatment (including those treated and released) while one (the Hooker study) included data for only those patients actually admitted to the hospital. These studies reported on victims brought to hospitals and did not cover situations where safety belt use may have reduced injury to the extent that no visit to a hospital was necessary.

Table 4.1: Safety Belt Effectiveness in Reducing Hospital Charges

Study	Data source	Seating position	Average hospital charges		Percent reduction[a]
			Unbelted	Belted	
Hooker	5 months in 1989; University of Louisville Trauma Center	Drivers	$18,165	$7,634	58
Iowa	11/87 to 3/88 at 16 Iowa hospitals	Vehicle occupant victims	2,462	753	69
Kerwin	1984 Colorado statewide matched pairs	Front seat	1,695	476	72
Marine	September 1984 at 5 Colorado hospitals	Vehicle accident survivors	2,972	401	87
Mercy	4 months in 1985; Mercy Hospital, Miami, Fla.	Automobile occupants	2,340	864	63
Mounce	1989; 6 hospitals in 3 Texas cities	Drivers	1,356	994	27
Orsay	1/1/86 to 7/1/86 at 4 Chicago-area hospitals	Drivers	1,619	590	64
		Right front passengers	1,815	387	79
		Back seat passengers	1,127	486	57
Reath	6 months in 1987; University of Tennessee Medical Center at Knoxville	Vehicle occupants	9,631	3,429	64

[a]In all cases, GAO computed the percent reduction.

All these studies showed that hospital costs were lower for belted vehicle occupants than for unbelted occupants. Belted crash victims had average hospital costs that were from 27 to 87 percent lower than those for unbelted victims; most of the savings attributable to safety belts were between 60 and 80 percent. Only one study showed the cost reduction to be less than 50 percent. Stated another way, most of the studies showed

hospital costs for unbelted crash victims to be 2-1/2 to 5 times the cost for belted victims.

We attempted to determine why the reduction for safety belt users was so much lower in the Mounce study than in the others—the 27 percent reduction is less than half the next lowest study result. One possible reason for some of the difference is that the study only used crashes that occurred within the city limits of three urban areas in Texas. Crashes on city streets tend to occur at slower speeds than rural crashes, thus tending to produce less severe injuries. In addition, using only urban crashes may have reduced differences in crash severity because extreme speeds would tend to be reduced. Also, victims (unbelted as well as belted) in cities are likely to receive any needed medical treatment faster than those who crash in rural areas, thus tending to minimize medical complications and costs. Another possible factor influencing the results is the study's reliance on self-reported data on safety belt use from vehicle occupants. Since Texas is one of the primary enforcement states, crash victims have a financial incentive to say that they used their safety belts. This may be one explanation for the high belt use rates reported in this study and the unusually low difference in hospitalization costs for belted and unbelted occupants.

Safety Belt Use Reduces Other Costs

For several of the hospital cost studies in our synthesis, researchers cautioned that the available hospital data represented only part of the larger picture of medical costs arising from traffic crashes. Not included were costs for such services as ambulance transportation, physicians and surgeons fees, rehospitalization, rehabilitation, and long-term care. Because of the difficulties of assembling such data, little information was available on these related costs. However, every study in our synthesis that obtained and analyzed data on other costs found that safety belt use resulted in lower costs. For example, two of the studies obtained and analyzed data on the use of ambulance services. In these, belted victims were less often brought to the hospitals by ambulance (or helicopter)—26 percent less in the Miami study, and 37 percent less in the Chicago study.

The study in our synthesis by Saalberg of a Michigan automobile insurance company indicates the impact that safety belt use can have on a wide range of costs. The study compiled personal injury claims data for 1 year before and 3 years after Michigan's mandatory safety belt use law took effect. Included were medical costs, payments for loss of income, survivors benefits, funeral expenses, and other services to victims. The

study found that both the number of claims and injury severity declined once the mandatory use law was in effect, and that after 3 years the cost of personal injury claims per insured vehicle had fallen by 35 percent (adjusted for inflation). Medical expenses, the largest category of costs, decreased by 23 percent. Other cost categories experienced larger decreases; payment of survivors benefits, for example, dropped by 54 percent. These savings were achieved even though Michigan's reported safety belt use increased after the law took effect, but did not rise on a sustained basis above 50 percent during the study period.

The Iowa study analyzed crash injuries and hospital charges in 16 of the state's hospitals. The study also projected the disability status of victims, and concluded that 18 victims would be permanently disabled. Sixteen of these victims were not wearing safety belts. In relation to all crash victims in the study, 2 percent of the unbelted occupants were expected to be permanently disabled compared with 0.3 percent of the belted occupants. This difference is important because the direct and indirect societal costs for each permanently disabled person can be very large.

The Iowa study did not attempt to assign a value to years of life lost, but it did show that young people had relatively low safety belt use and a relatively high death rate. Males in the 16 to 24 age group had the lowest safety belt use rates. The 16 to 24 age group represented 38 percent of the accident victims brought to the 16 hospitals and they accounted for 47 percent of the deaths. As a result, many years of life were lost through nonuse of safety belts.

The synthesis studies addressing the differences in costs of treating belted and unbelted occupants were generally restrictive in scope and did not estimate costs other than those specifically under study. However, Reath's study at the University of Tennessee Medical Center in Knoxville noted

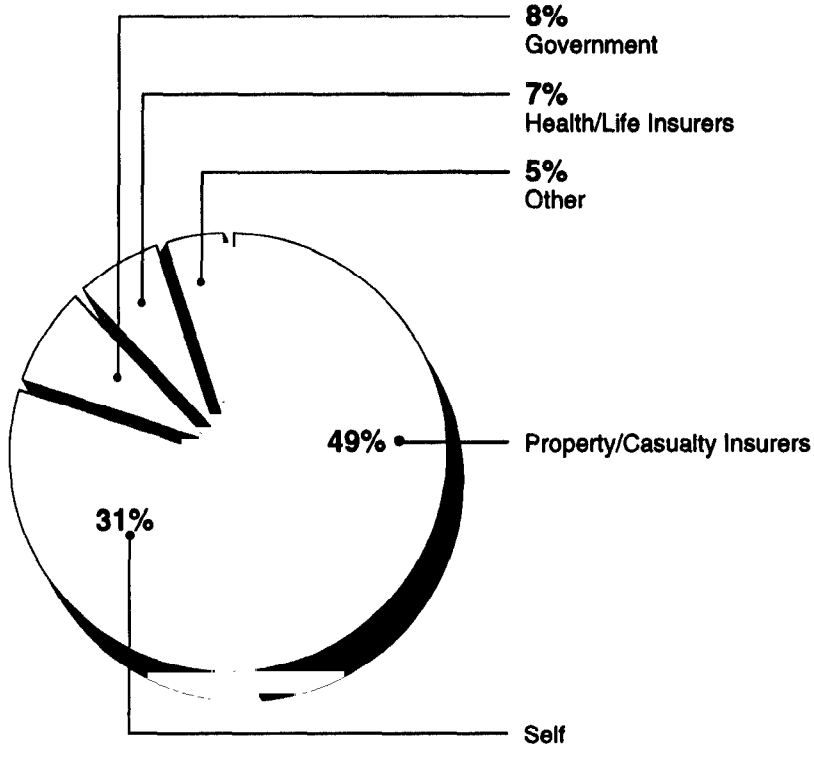
> The financial impact of restraint usage cannot be overstated. Mean hospital charges were reduced by 64%. However, these charges did not include professional fees, or the costs of followup care and rehabilitation. It is suggested that the reduction in charges would be even higher, perhaps as high as 75%, were these charges also included. And, since seatbelt usage costs nothing, it can be viewed as the most cost effective means of injury reduction currently available for motor vehicle crashes.

Society Pays Many of the Costs

The 1991 Urban Institute study suggests that society pays for up to 69 percent of out-of-pocket costs, lost wages, and lost household production

that result from motor vehicle crashes. Figure 4.1 shows who pays and the percentage paid as shown in the Urban Institute report.

Figure 4.1: Who Pays the Costs?



NHTSA published a report dated January 1992 that used data from five states to estimate the cost of hospital care to people injured in motor vehicle crashes in 1990 and the sources of payment of those costs.[4] The report does not include costs for people treated and released from hospital emergency rooms, those treated in a physician's office or on an outpatient basis, and other medical costs. Although the report cautions that the data inherently understates the rate of injury and the level of government payments, it estimates that first year hospital costs for 1990 crashes were $6.5 billion. Of this amount, 29.2 percent ($1.9 billion) was paid by

[4]Joan S. Harris. Source of Payment for the Medical Cost of Motor Vehicle Injuries in the United States, 1990. U.S. Department of Transportation, National Highway Traffic Safety Administration, DOT HS 807 800, (Jan. 1992).

government sources, 52.3 percent ($3.4 billion) by insurance, and 18.5 percent ($1.2 billion) by others.

Five hospital cost studies in our synthesis collected data on the payment method of victims. Among the unbelted victims, from 8 to 28 percent were covered by Medicare or Medicaid—that is, by tax-supported programs. From 41 to 55 percent were covered by insurance, while the remaining 22 to 49 percent were considered self-pay. (See table 4.2 for details.) For hospitals, the self-pay category generally means there is no third party to bill. Some of these costs not covered by public programs or insurance ultimately will not be paid by the injured person or the person's family, so a portion of the "self-pay" costs will be paid by other sources of funding for the hospitals.

Table 4.2: Who Pays Hospital Charges for Unbelted Vehicle Occupants Injured in Crashes

		Percent covered by		
Study	Data source	Medicare/ Medicaid	Insurance[a]	None/ self pay
Hooker	5 months in 1989; University of Louisville Trauma Center	28	50	22
Iowa[b]	11/87 to 3/88 at 16 Iowa hospitals	12	55	30
Mounce[b]	1989; 6 hospitals in 3 Texas cities	10	45	44
Orsay	1/1/86 to 7/1/86 at 4 Chicago-area hospitals	8	41	49
Reath	6 months in 1987; University of Tennessee Medical Center at Knoxville	19	45	36

Note: Totals may not add to 100 due to rounding.

[a]Included are Private/Commercial Insurance and Workmen's Compensation.

[b]Other or unknown payment sources accounted for an additional 3 and 2 percent of the unbelted vehicle occupants in the Iowa and Mounce studies, respectively.

Saalberg's Michigan insurance study analyzed the relationship between safety belts and insurance costs. Although insurance, either medical insurance or motorists' liability insurance, covers a portion of the costs of caring for injured motorists, insurance costs are borne by employers and individuals who pay premiums. The cost of higher insurance claims associated with unbelted victims increases insurance premiums for everyone, not simply for those who do not use safety belts.

Costs are often shifted to taxpayers when crash victims survive but are unable to work either temporarily or permanently. While studies discussed in this chapter as well as in chapter 2 indicated a higher rate of temporary and permanent disability among unbelted victims, data on such long-term effects were generally not available in our synthesis studies. Unfortunately, none of the studies captured information on the level of income replacement from disability or welfare benefits provided to belted and unbelted victims.

Although some of the costs to support those disabled in crashes are paid by crash victims themselves and by the general public through tax-supported programs and insurance, other costs are borne by the families and friends of the injured. Some costs of traffic crashes, such as the loss of peoples' ability to communicate or contribute to their families or to society, are very difficult to quantify.

Because of the general limitations of data on the costs of crashes and the difficulties in attributing the costs to safety belt use or nonuse, estimates of the total societal costs related to the nonuse of safety belts are not very precise. However, given the effectiveness of safety belts and the general magnitude of crash costs shown in the studies, we believe that increased safety belt use has the potential to save U.S. citizens billions of dollars annually.

Recent Legislation, Conclusions, and Recommendation

Legislation signed in December 1991 provides financial incentives for states to enact mandatory safety belt use laws, but it is unclear how DOT will implement the legislation and how the states will respond. We observed that the existing state safety belt use laws could be strengthened to (1) include coverage for occupants of pickup trucks, vans, and rear seats, and (2) facilitate police enforcement. Because of the potential savings in deaths, injuries, and costs to society achievable through increased safety belt use, it is important that the 1991 act be effectively implemented and states encouraged to strengthen their existing safety belt laws.

Recent Legislation

As discussed in chapter 1, the 1991 act provided for two types of financial incentives for the states—(1) grants to encourage safety belt use in states having laws mandating safety belt use and (2) penalties to restrict the use of federal highway construction funds in states without mandatory use laws. Such incentives could encourage the few states without mandatory use laws to enact such laws. However, the act's provisions may do little to encourage states to strengthen their existing laws. Much will depend on how DOT implements the act and what the states do in response to the financial incentives.

State Safety Belt Use Laws Could Be Strengthened

Although the 1991 act requires states to have mandatory safety belt use laws to be eligible for the grants and to avoid the penalties, it does not require strong state laws. For example, the act did not have any provisions relating to state fines for noncompliance with mandatory use laws. As discussed earlier, many state laws provide for little or no fines for safety belt nonuse. Also, since the act does not require primary enforcement, state laws may merely rely on secondary enforcement—that is, prohibit police from enforcing safety belt laws unless there is some other violation to justify a ticket. In addition, the act applies to front seat occupants of passenger vehicles, and passenger vehicles are defined to exclude vehicles constructed on a truck chassis. As a result, state use laws apparently do not have to include rear seat occupants or any occupants of pickup trucks or many vans even though over 10,000 such occupants have died annually during the last 2 years for which data are available.

In chapter 3, we showed the relationships between state safety belt use laws, safety belt use, and occupant deaths and injuries; stronger, more comprehensive laws are related to more savings. The act's grant or penalty provisions, however, do not require or provide direct financial incentives

for the states to enact comprehensive laws. The law encourages the few remaining states with no safety belt use laws to enact basic laws requiring some vehicle occupants to use safety belts. However, it is not clear that the law provides sufficient incentives to encourage the 42 states that already have some form of safety belt laws in effect to strengthen them in order to achieve the additional savings that can be achieved by well enforced, comprehensive laws.

Other Implementation Issues

In addition to the strength of state laws, other issues relating to the implementation of the act may influence state efforts to increase belt use. These issues address, among other things, the criteria for the grants, the funding expected to be available, and the reliability of belt use data.

Belt Use Criteria for Grants Already Met by Many States

The percent use criteria for the grants established by the act appear to provide little challenge for many states. The act established grants to states for up to 3 years with eligibility for the grants for 2 of the 3 years to be based on each state's rate of safety belt use. A state will be eligible if it achieves at least 50 percent compliance with its law during the second year and 70 percent compliance during the third year; simply having a law is sufficient for the first year. Assuming the state safety belt use rate information submitted to NHTSA reasonably reflects actual statewide belt use, 34 of the 42 states with safety belt use laws in effect already met in 1991 the 50-percent use criteria for the second year of the grants which will be no earlier than 1993 for any state. As a result, only a few states will need to improve their performance in order to be eligible for the second-year grants. Since most states will be eligible for the first 2 years' grants by making no additional efforts for safety belt use, the grants provide no incentive for them to do better. In addition, since four states in 1991 already showed use rates that met the 70-percent use criteria for the third-year grants, the grants provide no incentive for them to improve. We believe that variable grants (and/or penalties) based on a sliding scale of safety belt use rates could provide all states with a financial incentive to improve.

The Grant Provisions Allow Inconsistent Criteria

The act allows inconsistent criteria as a basis for grants to states for safety belt use. Since second- and third-year eligibility is based on a percent compliance with each state's law and the laws vary in coverage among the states, the 50- and 70-percent criteria apply to different populations for each state. For example, rear seat occupants are included in eight state laws, but they are not included in the others. Also, some states exempt pickup trucks or vans, so safety belt use in those vehicles does not matter

for the purposes of the grants. Occupants in different types of vehicles tend to use safety belts at different rates. For example, according to a NHTSA analyst and state data we obtained, pickup truck occupants tend to use safety belts at lower rates than passenger car occupants. Therefore, a percentage goal based on whatever each state's law happens to cover may be easier to meet in some states than others. The result is inconsistent compliance criteria, and states having safety belt laws with broad coverage may find themselves at a disadvantage in reaching the compliance target rates compared with states with less comprehensive laws, assuming other factors are equal.

Amounts of Grants and State Expenditures Are Unknown

The grants established by the 1991 act (1) are in effect for only 3 years; (2) must be used for a specific program for safety belts, helmets, and child restraints; and (3) require an increasing proportion of state cost sharing over time. The state share under the program for the use of the grants is at least 25 percent the first year, 50 percent the second year, and 75 percent the third year. Thus, by the third year when the federal safety belt use goal is 70 percent, some states may find achieving the goal to be a costly proposition. At a time when many states are having difficulties raising sufficient funds to cover existing programs demanded by their citizens, state decisionmakers may have questions about

- the amount of safety belt grant money that will actually be available to them through DOT,
- what programs or actions the state must implement to achieve the federal goals, and
- whether the state will have sufficient funds available to meet the cost-sharing requirements of the grants.

Questionable Belt Use Data

NHTSA analysts told us that the statewide safety belt use rates provided by the states are not generally based on probability sampling techniques that would provide statistically valid estimates. The states use a variety of sampling approaches and some are more reliable than others. NHTSA uses the information because it is the only state-by-state belt use data currently available. Because the act bases grants to the states on safety belt use rates, representative statewide safety belt use data have become even more important. In order to improve the quality of the state survey data, NHTSA published in the March 24, 1992, Federal Register proposed guidelines for state observational surveys of belt use. This request for public comments on proposed guidelines is the first step in a process that may ultimately result in more reliable belt use data.

Grants and Penalties for Belts Depend on State Helmet Laws

The act's connection between safety belts and motorcycle helmets may limit states' financial incentives to improve safety belt efforts. The act requires states to have universal motorcycle helmet use laws and mandatory safety belt use laws to qualify for the grants and avoid the penalties. Although only 9 states do not currently have laws mandating safety belt use, 26 states do not have laws mandating motorcycle helmet use for all riders. As a result, unless the 26 states change their laws on motorcycle helmets, they cannot be financially rewarded for any efforts or achievements on safety belt laws. In addition, the states without universal helmet laws will be subject to the penalty provisions of the act without regard to any state activities relating to safety belts. Since more than 10 times as many people have died annually in car and light truck crashes than in motorcycle crashes for the last 2 years for which data are available, it would not appear to be productive to condition state incentives for safety belt efforts on what the states may be able to do with motorcycle helmets. Although some states may have political difficulties enacting universal motorcycle helmet use laws, they still have the potential to reduce fatalities, injuries, and costs through increased use of safety belts.

Enforcement and Public Information Help

The act does not include financial incentives for several safety belt-related factors that contribute to savings in deaths, injuries, and societal costs caused by crashes. In addition to the strength and coverage of the state laws, chapter 3 showed that related state efforts such as enforcement and public information programs have been effective. If federal financial incentives or cost sharing were offered for these efforts, states might be more likely to consider and use these additional methods for increasing safety belt use.

Secretary of Transportation's Report to the Congress

The act requires the Secretary of Transportation to report biannually to the Congress, beginning in October 1992 and ending in October 2000, on the actual effectiveness of (1) the combination of inflated occupant restraints and lap and shoulder belts, (2) inflated restraints alone, and (3) lap and shoulder belts alone. The Secretary, in consultation with the Secretaries of Labor and Defense, is also required to provide data and analysis on lap and shoulder belt use, nationally and in each state, by federal, state, and local law enforcement officers; by military personnel; by federal and state employees other than law enforcement officers; and by the public. The reporting requirement recognizes the importance of changes in safety belt use and related technology and should help the Congress direct future efforts.

Conclusions

We analyzed the best available studies addressing safety belt effectiveness and, although the studies varied greatly in methodologies and data used, all showed safety belts to be highly effective. Vehicle occupants who did not use safety belts generally died or suffered serious injuries at rates two or more times the rates for occupants using safety belts.

Moreover, societal costs resulting from the nonuse of safety belts amount to billions of dollars annually in the United States. The studies we reviewed clearly showed that crash victims using safety belts incur lower average costs than unbelted victims. Some costs created by nonuse of safety belts are paid by those injured in the crashes, but many are paid by taxpayers through the Medicare and Medicaid programs and by insurance policyholders. Although the tangible cost of traffic crashes is high and can be reasonably estimated, other costs, such as those for crash-induced disabilities that affect the lifestyles of crash victims and those who care for them, are difficult to quantify.

While the cost of safety belt nonuse may be billions of dollars annually, the savings achievable by using belts requires virtually no expenditure or investment. Since safety belts are already in place and their use is simple and effective, no expensive research programs are needed and no additional equipment must be purchased to accomplish these savings.

Mandatory safety belt use laws are now in effect in 42 states (including the District of Columbia). Although the laws have increased safety belt use and reduced deaths and injuries, the increases in safety belt use have leveled off substantially in recent years. NHTSA has data from the states showing that higher safety belt use rates are related to stronger state laws. We believe that stronger laws may be needed to change the behavior of those who have not complied with the existing laws. The laws can be strengthened by providing (1) coverage to occupants of pickup trucks, vans, and rear seats; (2) primary enforcement rather than only secondary enforcement; and (3) fines that are sufficient to encourage belt use.

It is too early to know how much success DOT will have using the new incentives to encourage states to increase safety belt use. The reporting requirement in the law should help the Congress analyze the changes in restraint effectiveness and safety belt use that may occur through the 1990s. We believe the mandated report would be more helpful if DOT also includes a discussion of the implementation issues raised in this chapter. For example, while it appears that comprehensive state laws are related to higher levels of belt use and effectiveness, the new law does not

specifically require comprehensive state laws. If DOT describes how the Department and the states have addressed each issue, what issues remain unresolved, and how additional legislation could improve safety belt use, we believe that the Congress would be in a better position to guide future federal efforts.

Recommendation to the Secretary of Transportation

As part of DOT's report required by the 1991 act, we recommend that the Secretary of Transportation include a discussion of the ways that state mandatory safety belt use laws can be strengthened and other issues relating to the act's grant and penalty provisions that we have discussed in this report. Specifically, the report should discuss whether state laws should cover all vehicle occupants (including those in pickup trucks, vans, and rear seats) and have certain basic provisions (including fines) to facilitate enforcement. Other issues relating to the implementation of the 1991 act, including criteria for the grants, safety belt use data, and related concerns, are presented in this chapter. Useful information on each issue would include what actions DOT and the states have completed, what DOT and the states plan to do, and what legislation might be helpful for encouraging states to further increase safety belt use.

Agency Comments

We shared the information presented in this report with officials at NHTSA responsible for the agency's safety belt activities, who said they found our results consistent with their work. As agreed, we did not obtain written agency comments on a draft of this report.

Key Provisions of Safety Belt Use Laws

November 1991

	EFFECTIVE	ENFORCEMENT	FINE	SEATS	VEHICLES and COVERAGE BY LAW	LATEST USAGE RATE(%)*
ALABAMA	07/18/91	Secondary	25	Front	Passenger car, MY>'65	53
ALASKA	09/12/90	Secondary	15	All	Motor vehicle. Over age 16.	66
AMER. SAMOA	01/01/89	Primary	25	All	Passenger car, truck, van.	62
ARIZONA	01/01/91	Secondary	10	Front	Passenger car, van, MY>'72.	65
ARKANSAS	07/15/91	Secondary	25	Front	Passenger car, truck, van.	52
CALIFORNIA	01/01/86	Secondary	22	All	Passenger car, van, small truck.	71
COLORADO	07/07/87	Secondary	10	Front	Passenger car, van, taxi, ambulance, RV, small truck.	51
CONNECTICUT	01/01/86	Primary	37	Front	Passenger car, van, truck, van.	61
DELAWARE	01/01/92	Secondary	20	Front	Passenger car.	42
DIST. OF COL.	12/12/85	Secondary	15	Front	Vehicle seating 8 or less people.	49
FLORIDA	07/01/86	Secondary	20	Front	Motor vehicle, pick up truck.	60
GEORGIA	09/01/88	Secondary	15	Front	Passenger car to carry under 10 people.	54
GUAM	11/20/86	Primary	70	Front	Passenger car, truck, van.	92
HAWAII	12/16/85	Primary	20	Front	Vehicle registered in State.	85
IDAHO	07/01/86	Secondary	5	Front	Motor Vehicle under 8K lbs.	45
ILLINOIS	07/01/85	Secondary	25	Front	Motor vehicle to carry under 10 people, RV.	51
INDIANA	07/01/87	Secondary	25	Front	Passenger car, bus, school bus.	52
IOWA	07/01/86	Primary	10	Front	Passenger car, van, truck 10K lbs. or less.	68
KANSAS	07/01/86	Secondary	10	Front	Passenger car, van.	64
LOUISIANA	07/01/86	Secondary	25	Front	Passenger car, van, truck under 6K lbs.	37
MARIANA ISL	04/20/90	Primary	25	All	Passengar car, truck.	95
MARYLAND	07/01/86	Secondary	25	Front	Passenger and multi-purpose vehicle, pick-up truck.	72
MICHIGAN	07/01/85	Secondary	25	Front	Motor vehicle.	64
MINNESOTA	08/01/86	Secondary	25	Front	Passenger car, pick up truck, van, RV.	52
MISSISSIPPI	03/20/90	Primary	No	Front	Passenger car, van.	32
MISSOURI	09/28/85	Secondary	10	Front	Passenger car to carry under 10 people.	64
MONTANA	10/01/87	Secondary	20	All	Motor vehicle.	67
NEVADA	07/01/87	Secondary	25	All	Passenger car under 6K lbs.	68
NEW JERSEY	03/01/85	Secondary	20	Front	Passenger car.	58
NEW MEXICO	01/01/86	Primary	25	Front	Motor vehicle under 10K lbs. Over age 10.	67
NEW YORK	12/01/84	Primary	50	Front	Passenger car. Over age 9.	68
NORTH CAROLINA	10/01/85	Primary	25	Front	Passenger car to carry under 10 people.	60
OHIO	05/06/86	Secondary	20	Front	Passenger and commercial car, van, tractor, truck.	50
OKLAHOMA	02/01/87	Secondary	10	Front	Passenger car, van, pickup truck.	37
OREGON	12/06/90	Primary	50	All	Passenger car.	70
PENNSYLVANIA	11/23/87	Secondary	10	Front	Passenger car, truck, motor home.	60
PUERTO RICO	01/19/75	Primary	10	Front	Passenger car. Over age 4.	71
RHODE ISLAND	06/18/91	Secondary	No	All	Passenger car. Over 12.	28
SOUTH CAROLINA	07/01/89	Secondary	10	Front	Passenger car, truck, van, RV, taxi.	60
TENNESSEE	04/21/86	Secondary	25	Front	Vehicle under 8.5K lbs.	51
TEXAS	09/01/85	Primary	25	Front	Passenger car, van, truck under 1.5K lbs.	68
UTAH	04/28/86	Secondary	10	Front	Motor vehicle.	45
VIRGIN ISL	10/01/91	Primary	50	Front	Passenger car.	34
VIRGINIA	01/01/88	Secondary	25	Front	Motor vehicle.	58
WASHINGTON	06/11/86	Secondary	25	All	Passenger and multi-purpose vehicle, bus, truck.	69
WISCONSIN	12/01/87	Primary	10	All	Motor vehicle.	58
WYOMING	06/08/89	Secondary	No	Front	Passenger car, van, pickup truck.	66

*Reported October 1991 **Total Use Laws: 41 States plus D.C., Puerto Rico, and the Territories.**

U.S. Department of Transportation, Washington, DC 20590
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Regional Operations (202) 366-2672

Identification of Studies on the Effect of Safety Belts and Safety Belt Use Laws

United States General Accounting Office

IDENTIFICATION OF STUDIES ON THE EFFECT OF SAFETY BELTS AND SAFETY BELT USE LAWS

INTRODUCTION

The U.S. General Accounting Office has been asked to perform an evaluation synthesis of the available research on: (1) the effectiveness of safety belts, (2) the effectiveness of mandatory safety belt use laws, and (3) the societal costs associated with non-use of safety belts. Evaluation areas of interest include belt effectiveness in terms of reducing deaths and serious injuries, the experience states have had with mandatory belt use laws in terms of increased belt use and improved safety, and the costs to society related to belt use.

The purpose of this questionnaire is to obtain information concerning evaluations/reports involving your state. We are interested in **unpublished** as well as published studies performed since 1975. Please send the completed questionnaire and a copy of any listed report you might have to:

R. Kenneth Schmidt
U.S. General Accounting Office
Suite 802
370 L'Enfant Promenade, SW
Washington, DC 20024

If you have any questions, please call Ken Schmidt at (202) 401-6041 or Roy Jones at (202) 401-6130. Thank you very much for your assistance.

1. Please provide the name, title, and phone number of the individual who should be contacted if we need to clarify any response to this questionnaire or need additional information.

   Name _____

   Title _____

   Telephone Number ( ) _____

2. Would you like a copy of our final report? *(Check one.)*

   1. ☐ Yes
   2. ☐ No

3. Are you aware of any studies conducted in your state since 1975 which address the issues of safety belt effectiveness, use, or cost? *(Check one.)*

   1. ☐ Yes ⟶ Continue
   2. ☐ No ⟶ Skip to question 5

4. **Please provide the following information about the studies you are aware of that have been conducted in your state.** *(Please attach additional sheets if necessary.)*

A. Author(s)_____

Title_____

_____

Date of Study_____

Further information can be obtained from:

Name _____

Title _____

Telephone Number ( ) _____

B. Author(s)_____

Title_____

_____

Date of Study_____

Further information can be obtained from:

Name _____

Title _____

Telephone Number ( ) _____

C. Author(s)_____

Title_____

_____

Date of Study_____

Further information can be obtained from:

Name _____

Title _____

Telephone Number ( ) _____

D. Author(s)_____

Title_____

_____

Date of Study_____

Further information can be obtained from:

Name _____

Title _____

Telephone Number ( ) _____

5. If you would like to comment on our search for studies or other matters related to safety belts, please use the space below. *(Attach additional sheets if necessary.)*

Thank you for your assistance.

Description of Sources of Crash Data

Various governmental and private organizations collect data on the deaths, injuries, and costs associated with traffic crashes. None of the sources provides ideal data for an analysis of safety belt effectiveness, belt law effectiveness, and costs of belt nonuse. However, each is useful to some extent, and where the results of analyses using dissimilar data lead to similar conclusions, confidence with the results is increased. Discussed in the next sections are data sources used by studies in our synthesis.

DOT's Fatal Accident Reporting System

FARS was established in 1975 and contains data on a census of fatal traffic crashes within the 50 states, the District of Columbia, and Puerto Rico. To be included in FARS, a crash must involve a motor vehicle travelling on a road customarily open to the public and result in the death of a person (a vehicle occupant or someone else) within 30 days of the crash. The data are collected from a variety of sources by state employees under DOT contract in each state.

The FARS file contains descriptions, in a standard format, of each fatal crash reported. Each crash has more than 90 different coded data elements that characterize the crash, the vehicle(s), and the people involved. Uniformity, comprehensiveness, and detail are advantages of FARS. However, since it only includes crashes in which someone died, the data represent only the most severe crashes rather than typical crashes.

DOT's National Accident Sampling System

NASS was established in 1979 to collect data from a variety of sites selected to be representative of the geographic and demographic characteristics of the United States. NASS was designed to collect data for a representative sample of minor, serious, and fatal police-reported crashes involving all types of motor vehicles. NASS data are collected by researchers under contract with DOT. The researchers independently collect detailed data about the crash sites, the vehicles, and the people involved in the sampled crashes through such means as personal observation, interviews, and reviews of medical records.

The number of sampling locations has been reduced several times since NASS was established—at one time, as many as 50 of the possible 1,200 locations were used, but the number of sites was reduced to 24 in 1991. The latest report summarizing NASS results that was available during our synthesis was for 1986.

DOT's General Estimates System

The General Estimates System (GES) began operation in 1988 as part of a reorganization of NASS. However, rather than an independent collection of detailed crash data, GES codes basic information into a computer file from a sample of police reports. About 45,000 police reports are sampled annually from 60 locations around the country. The police reports are chosen in an effort to reflect the geography, roadway mileage, population, and traffic density of the country so that GES sample crashes are intended to be representative of all police reported crashes. Reports containing GES data are relatively timely—the GES report of 1990 data was issued in November 1991.

Police Reports

Police reports are the primary source of most crash data, but they have been criticized for inconsistencies and inaccuracies. One reason for differences in police reports from one area to another is the extent to which minor crashes are reported; some collect data only for the more severe crashes or those in which someone was injured. There are also some differences in how states classify vehicles such as light trucks. In addition, police reports may contain errors regarding occupant injury type and severity because of (1) limited police medical training and (2) other priorities police must deal with at the scene of a crash, such as controlling traffic and people in the crash area, identifying drivers and other vehicles involved in the crash, and determining responsibility for the crash.

Hospital Records

Hospital records contain a relatively complete and accurate description of the injuries people receive in traffic crashes and the related costs of hospital treatment for those injuries. The data are limited, however, by (1) the number of hospitals reporting the data, (2) the lack of information for those injured who did not report to a hospital, (3) the lack of cost information for treatment performed in the hospital by physicians or others who bill separately, and (4) no routine information about related subsequent care or therapy performed after the patient's discharge from the hospital. In addition, differences in location and degrees of specialization may create some differences in hospital admission rates, levels of medical treatment, and costs. For example, regional referral and trauma centers tend to receive a higher percentage of more severe injuries than a typical community hospital and would thus tend to have higher admission rates, levels of care, and costs.

Vehicle Insurance Information

Before paying claims related to any vehicle crash, insurers collect detailed data such as the location of the crash, how it happened, who was involved,

background information on the driver(s), vehicle identification numbers, the extent of vehicle damage, and the injuries received by the occupants. Since the insurers pay many of the bills for their policyholders, they also have details about many of the societal cost elements of traffic crashes. The insurers, however, are not obliged to share data they collect with DOT or safety researchers. As a result, relatively little insurance data has been summarized and reported in ways that might help improve vehicle or highway safety.

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