Reviews of Evidence Regarding Interventions to Increase the Use of Safety Belts

Tho Bella Dinh-Zarr, PhD, MPH, David A. Sleet, PhD, MA, Ruth A. Shults, PhD, MPH, Stephanie Zaza, MD, MPH, Randy W. Elder, MEd, James L. Nichols, PhD, Robert S. Thompson, MD, Daniel M. Sosin, MD, MPH, and the Task Force on Community Preventive Services

Background: The use of safety belts is the single most effective means of reducing fatal and nonfatal injuries in motor vehicle crashes. If all motor vehicle occupants consistently wore safety belts, an estimated 9553 deaths would have been prevented in 1999 alone.

Methods: The *Guide to Community Preventive Services*'s methods for systematic reviews were used to evaluate the effectiveness of three interventions to increase safety belt use. Effectiveness was assessed on the basis of changes in safety belt use and number of crash-related injuries.

Results: Strong evidence was found for the effectiveness of safety belt laws in general and for the incremental effectiveness of primary safety belt laws relative to secondary laws. Strong evidence for the effectiveness of enhanced enforcement programs for safety belt laws was also found. Additional information is provided about the applicability, other effects, and barriers to implementation of these interventions.

Conclusions: These reviews form the basis of the recommendations by the Task Force on Community Preventive Services presented elsewhere in this supplement. They can help decision makers identify and implement effective interventions that fit within an overall strategy to increase safety belt use.

Medical Subject Headings (MeSH): community health services; decision making; evidence-based medicine; practice guidelines; preventive health services; public health practice; meta-analysis; review literature; motor vehicles; seat belts; accidents, traffic; wounds and injuries (Am J Prev Med 2001;21(4S):48–65)

Introduction

Although safety belt use has risen dramatically in the United States over the past two decades, increasing belt use remains an important public health priority.[1,2] As recently as 1983, observational studies showed that only 14% of motor vehicle occupants wore safety belts. That number rose to 49% in 1990.[3] By 1995, both observational data collected in 49 states[4] and telephone surveys in all 50 states[5] reported approximately 68% use. Overall, 71% of motor vehicle occupants in 2000 wore safety belts,[6] but certain groups (e.g., teenagers, drinking drivers) consistently report lower than average usage rates.[7–9]

The use of safety belts is the single most effective means of reducing fatal and nonfatal injuries in motor vehicle crashes. In all types of crashes, manual lap–shoulder belts are approximately 45% effective in reducing fatalities in passenger cars and 60% effective in light trucks.[10,11] They are estimated to reduce the risk of serious injury to the head, chest, and extremities by 50% to 83%.[11] Lap belts alone, used most often by rear seat occupants, are estimated to be 17% to 58% effective in preventing death compared with no restraints.[12–14]

Although airbags are in wide use, they provide supplemental protection to lap–shoulder belts. Airbags alone are 10% and 14% effective in reducing deaths and injuries, respectively,[11] whereas airbags and lap–shoulder belts together reduce the risk of death by 50% and injury by 66% in front seats. Thus, increasing and maintaining high levels of safety belt use are essential.

Safety belt use is estimated to have saved 123,000 lives between 1975 and 1999.[15] More lives could be saved if

From the Division of Unintentional Injury Prevention (Dinh-Zarr, Sleet, Shults, Elder) and Office of the Director (Sosin), National Center for Injury Prevention and Control, and Division of Prevention Research and Analytic Methods, Epidemiology Program Office (Zaza), Centers for Disease Control and Prevention, Atlanta, Georgia; Office of Research and Traffic Records, National Highway Traffic Safety Administration (Nichols), Washington, DC; Task Force on Community Preventive Services and the Department of Preventive Care, Group Health Cooperative of Puget Sound (Thompson), Seattle, Washington

Address correspondence and reprint requests to: David A. Sleet, PhD, Division of Unintentional Injury Prevention, Centers for Disease Control and Prevention, 4770 Buford Highway, MS K-63, Atlanta, GA 30341. E-mail: dds6@cdc.gov.

The names and affiliations of the Task Force members are listed in the front of this supplement and at www.thecommunityguide.org.

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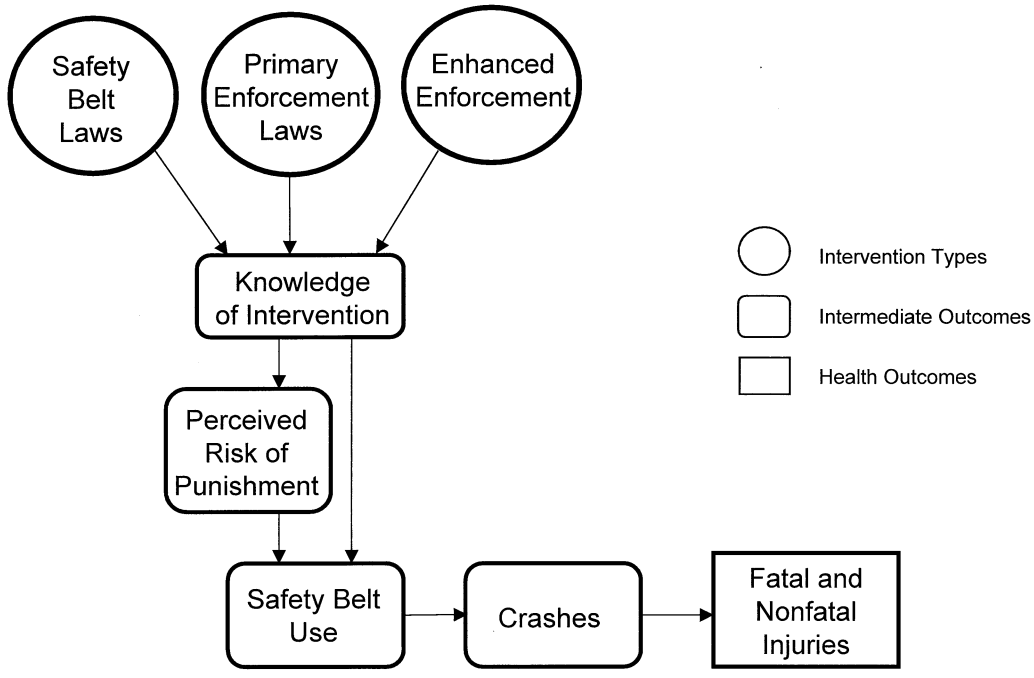

Figure 1. Logic framework for safety belt use interventions.

safety belt use were higher. If all motor vehicle occupants consistently wore safety belts, an estimated 9553 deaths would have been prevented in 1999 alone.[15]

As part of the *Guide to Community Preventive Services* (the *Community Guide*), this review evaluates the effectiveness of three community-based interventions to increase safety belt use: safety belt laws, primary enforcement laws, and enhanced enforcement.

Conceptual Approach

The three interventions reviewed are thought to increase safety belt use by increasing the perceived risk of detection and punishment, as well as establishing the norm that safety belts should be worn. The logic framework shown in Figure 1 depicts the conceptual approach that we developed for the systematic review. This figure illustrates the hypothesized links between the three interventions and the outcomes of interest. Because the effectiveness of safety belts in decreasing fatal and nonfatal injuries is well established, safety belt use alone was considered an acceptable outcome, as were crash-related morbidity and mortality. Vehicle engineering strategies to increase safety belt use, such as automatic safety belts and visual or auditory reminders, were excluded from this review.

Methods

An explanation of the general methods used to conduct these systematic reviews of motor vehicle occupant-related interventions appears elsewhere in this issue.[16] Specifically, for the systematic review of interventions to increase safety belt use, studies were included if: (1) they were published between January 1, 1980, and June 30, 2000, as a journal article or technical report in English; (2) they evaluated safety belt laws in the United States or enhanced enforcement strategies in any country; (3) the intervention was designed to increase safety belt use; and (4) outcome measures included safety belt use, injuries, or fatalities.

Selecting Interventions

A consultation team of subject-matter specialists (see Acknowledgments) generated a comprehensive list of community-based interventions to increase safety belt use and created a priority list of interventions to be reviewed after surveying consultants and other experts. Those consultants and experts polled were asked to consider the following criteria when ranking interventions as priorities for systematic review: Is the intervention (1) thought to be effective but underused; (2) thought to be ineffective but overused; (3) popular, although its effectiveness is not well established; (4) costly, and its effectiveness is not well established; (5) targeted to a specific population of interest (e.g., youth); or (6) broad reaching, and with the potential to achieve large increases in safety belt use? Rankings were compiled, and the six interventions with the most votes were considered to be priorities for this review. Included on the list were the three interventions reviewed in this article plus incentives, mass media, and education programs to increase safety belt use. Reviews of the latter three interventions will be published as they are completed.

Selecting Summary Effect Measures

The primary health outcomes assessed in this literature are safety belt use and fatal and nonfatal injuries resulting from

motor vehicle crashes. Studies used three types of safety belt use data: observed, self-reported, and police-reported. For observed safety belt use, researchers or law enforcement officials directly observed safety belt use by motor vehicle occupants. Self-reported use was determined in telephone surveys, and police-reported use was available from police incident reports of crashes. Police officers record safety belt use on the basis of direct observation and interviews with crash victims. We reported each of these types of safety belt use data separately. For fatal injury data, information about all fatal crashes that occur on public roads in the United States is available in electronic form through the Fatality Analysis Reporting System (FARS) maintained by the National Highway Traffic Safety Administration (NHTSA).[17] There is no comparable national source of electronic information that includes all nonfatal crashes. Studies that reported nonfatal injuries obtained their data from state motor vehicle crash databases and hospital records. Some studies combined fatal and nonfatal injuries into one measure. We reported each of the three types of outcomes (fatal injury, nonfatal injury, and combined) separately.

The methods used to summarize the findings about the effectiveness of an intervention across multiple studies are also described in this issue.[16] Briefly, we graphically displayed the outcomes from individual studies and reported the median effect measure for each outcome. To account for the historically upward trend in safety belt use over time, the latest measurement before the implementation of an intervention was used to estimate the most conservative "before" condition in time series studies, as defined by the *Community Guide*.[a] In addition, the last "post" measurement after the implementation of a law was used when measurements at several time points were available. Because most enhanced enforcement programs have a predetermined end date (unlike ongoing laws), the latest measurement during the enforcement period was used in calculating the effect size. This calculation allowed for the most accurate measure of the cumulative effect of the enhanced enforcement program. In studies with more than one intervention site, we calculated separate effect measures for each site and then took the overall mean for the effect measure. Long-term effects of enhanced enforcement were estimated by using the last measurement taken after the enforcement period ended. Follow-up time was defined as the time between the end of the enforcement period and the last measurement.

Interventions to Increase the Use of Safety Belts

Safety Belt Laws

Safety belt laws mandate the use of safety belts by motor vehicle occupants. All current U.S. laws cover front seat occupants, but other provisions such as rear seat coverage, fines, affected age groups, type of enforcement, and exempted vehicles and drivers vary by state.

Safety belt laws have been a critical component of efforts to increase safety belt use. In the United States, these laws are the purview of the states, but federal standards have played an important role in the enactment of such laws. A 1984 amendment to Federal Motor Vehicle Safety Standard 208 required automobile manufacturers to install automatic restraint systems (airbags or automatic seat belts) unless two thirds of the nation's population was covered by safety belt laws.[18] This amendment stimulated many states to pass laws. By the end of 1999, a total of 49 states, the District of Columbia, Puerto Rico, and all U.S. Territories had adult safety belt laws in place, typically for front seat occupants.

Public awareness of a safety belt law, particularly when accompanied by a perceived risk of detection and punishment, is hypothesized to increase safety belt use. On the basis of studies of motor vehicle crash data, increased use of safety belts results in decreased fatal and nonfatal injuries. Documenting the effectiveness of safety belt laws may prevent their repeal and help strengthen current laws by supporting greater age-range and seating position coverage and removing unnecessary exemptions to the law.

Reviews of evidence

Effectiveness. We identified 46 studies of the effectiveness of safety belt laws, described in Table 1.[19–64] Eight additional studies[65–72] were identified after the systematic review had been completed. Although not included in this review, a preliminary analysis revealed that all reported a beneficial effect of safety belt laws. Details of the 33 qualifying studies are provided at the website (www.thecommunityguide.org).

The 33 qualifying studies revealed consistent increases in safety belt use and consistent decreases in fatal and nonfatal injuries after the enactment of safety belt laws. Table 2 summarizes the effects of safety belt laws on various outcomes. Figure 2 presents the results of studies reporting safety belt use outcomes. Figure 3 presents the results of studies assessing fatal and nonfatal injury outcomes. With the exception of one study, which examined the number of patients with motor vehicle-related injuries admitted to the emergency department of a metropolitan hospital,[29] these data consistently show reductions in fatal and nonfatal injuries, with a median post-law decline of 5%.

Applicability. The study population of this review consisted of individuals older than 5 years. Twelve studies[22,24,27,32,33,35,38,45,50,51,53,57] reported data for populations assumed to be aged 16 years or older (i.e., drivers, university students, employees). One study included only individuals older than 10 years[60] and another only those older than 11 years.[23] Therefore, the applicability of the results of this review may be more relevant to adolescent and adult populations than to older children.

[a]We use the *Community Guide*'s definition of "time series study," which includes any study that obtains multiple measurements before, during, or after an intervention, as well as those using traditional time series analysis. Multiple measurements are equated with a better accounting for trend and are thus given a "moderate" rating in study quality (compared with a "least" rating for before–after studies).

Table 1. Safety belt laws: descriptive information about included studies

	Number of studies
Papers meeting inclusion criteria	46[19–64]
Papers excluded, limited execution quality	11[19,20,30,34,36,37,43,44,46,47,49]
Qualifying papers	35[21–29,31–33,35,38,39–42,45,48,50–64]
Papers reporting on an already-included study	2[31,64]
Actual number of qualifying studies	33[21–29,32,33,35,38–42,45,48,50–63]
Study designs	
Time series with concurrent comparison group	7[25,26,32,40,42,60,63]
Time series, no conccurrent comparison group	17[22,24,27,28,35,38,41,45,50,52,55–59,61,62]
Before–after with concurrent comparison group	1[57]
Before–after, no concurrent comparison group	6[21,23,29,39,48,51]
Cross-sectional	2[33,53]
Outcomes reported	
Fatal injuries	6[38,42,52,55,56,60]
Nonfatal injuries	6[21,23,29,54–56]
Fatal and nonfatal injuries combined	9[25,26,28,39–41,45,52,61]
Observed safety belt use	10[22,24,27,35,50–52,58,59,62]
Police-reported safety belt use	2[48,63]
Self-reported safety belt use	4[32,33,53,57]

Some studies analyzed subpopulations. Women consistently demonstrated a greater increase in safety belt use and usually began at a higher baseline rate of use than did men. Likewise, older drivers tended to exhibit higher use rates.[62] Although adolescents had a lower baseline, their percentage point increase in safety belt use after enactment of a law was similar to increases among all drivers.[50]

Other positive or negative effects. Adults who do not use safety belts are less likely to buckle up the children they transport than adults who use safety belts.[53,60,73,74] Thus, laws that increase safety belt use among adults are also likely to result in increased use among child passengers. One study reported that a law mandating the use of safety belts in the front seat increased use by children aged 2 to 10 years in all positions within the vehicle.[53]

The decrease in fatal and nonfatal injuries associated with increased safety belt use is not as large as might be expected given the known effectiveness of safety belts in decreasing the risk of injury and death.[75,76] One explanation for this is that drivers who are more likely to be involved in serious crashes (e.g., young men, drinking drivers) are least likely to buckle up, especially with relatively weak safety belt laws. In addition, some laws do not apply to all vehicles and others exempt back seat occupants, which could dilute their effects. Another explanation of the discrepancy between predicted and actual reductions in fatalities and injuries is suggested by the concept of risk compensation,[77,78] which postulates that under certain conditions individuals compensate for reduced risk by acting more recklessly. According to this concept, when drivers wear safety belts, they feel safer and exhibit more risky driving behaviors than they otherwise would, thereby reducing the beneficial effects of belt use. Several studies[76,79,80] have sought to determine whether injury reductions resulting from safety belt use are offset by injury increases caused by risky driving after the enactment of a safety belt law, but the evidence remains equivocal. In addition, no studies showed a correlation between increased safety belt use and increased risky driving.[81–83] Thus, the available evidence does not support the concept of risk compensation as it applies to safety belt laws.

Economics. No studies were found that met the requirements for inclusion in a *Community Guide* review.[16]

Table 2. Effectiveness of safety belt laws on various outcomes: summary effects from the body of evidence

Outcome	Number of studies	Median change	Range[a]
Fatal injuries	6[38,42,52,55,56,60]	9% decrease	2%–18% decrease
Nonfatal injuries	6[21,23,29,54–56]	2% decrease	15% decrease to 11% increase
Fatal and nonfatal injuries combined	9[25,26,28,39–41,45,52,61]	8% decrease	3%–20% decrease
Observed safety belt use	10[22,24,27,35,50–52,58,59,62]	33% increase	20%–36% increase
Police-reported safety belt use	2[48,63]	NA	26% increase[b]
Self-reported safety belt use	4[32,33,53,57]	16% increase	13%–19% increase

[a]When 7 or more studies were available, an interquartile range is presented.
[b]One study reported data in a form that could not be converted to our summary effect measures.
NA, not applicable.

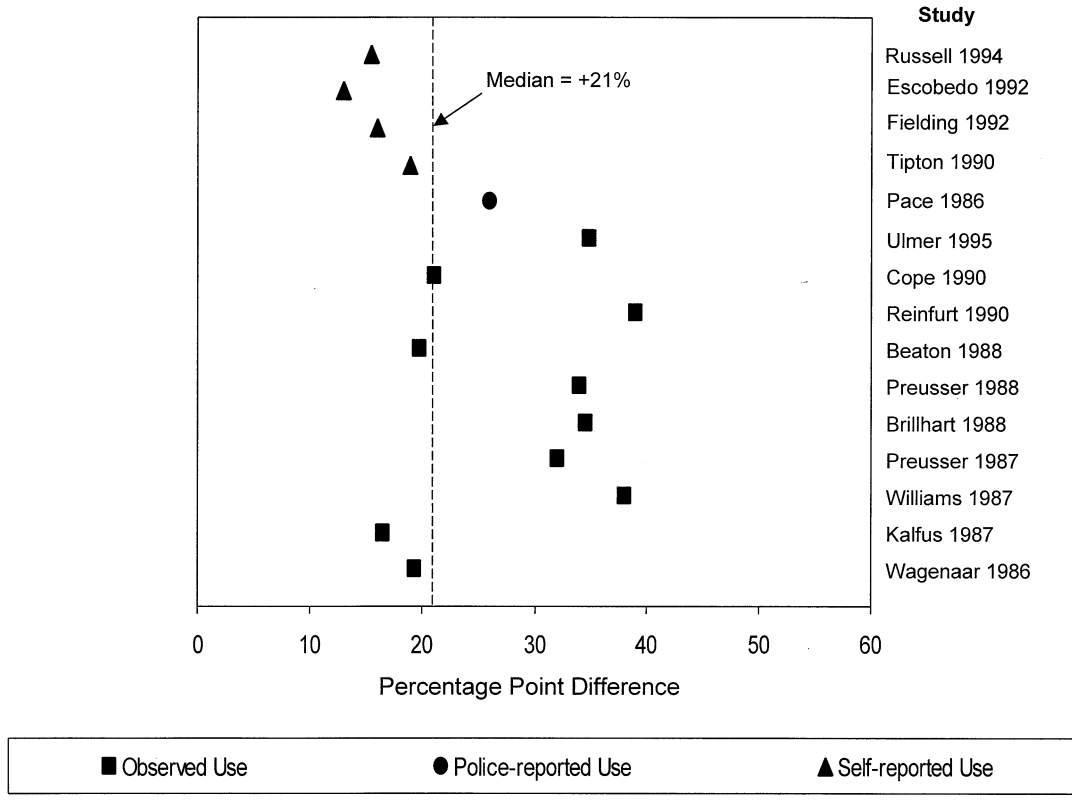

Figure 2. Percentage point difference in safety belt use with safety belt use laws.

Barriers to intervention implementation. As with many legislative interventions, public opposition is a potential barrier to effective implementation. The political climate influences the enactment of laws and their level of enforcement.[84] When states first began enacting safety belt laws, the argument that these laws interfered with personal freedom was common. However, recent surveys conducted by NHTSA report that 86% of individuals aged 16 years and older support safety belt laws, with 63% supporting them "strongly" and 23% supporting them "somewhat."[2]

Conclusion. According to the *Community Guide*'s rules of evidence, available studies provide strong evidence that safety belt laws are effective in increasing safety belt use and decreasing injuries and deaths.

Primary Enforcement Laws

Primary enforcement laws allow a police officer to stop a motorist solely for not wearing a safety belt. In contrast, secondary enforcement laws only allow a police officer to issue a safety belt citation after the motorist has been stopped for another reason.

Australia, New Zealand, Great Britain, and some European countries pioneered the enactment of safety belt laws. All allowed for primary enforcement. In the United States, primary enforcement laws have been the exception rather than the rule. In 1984, New York became the first state to enact a safety belt law. This law contained a primary enforcement provision. New Jersey passed the second safety belt law, but it carried a secondary enforcement provision. In 1993, California became the first state to change from a secondary to a primary enforcement law. Several states followed California's lead and, as of May 2001, a total of 17 states, the District of Columbia, and Puerto Rico had enacted primary enforcement laws.

Police officers find it more difficult to enforce secondary laws than primary laws and are sometimes reluctant to issue tickets because secondary status implies that these laws are of lower priority to legislators, judges, and the general public.[85] Compared with secondary laws, primary laws are hypothesized to have a greater effect on motorists' perceived risk of detection and punishment as well as on the public's view of the importance of safety belt use. Therefore, primary laws may lead to higher rates of safety belt use and lower rates of crash-related fatal and nonfatal injuries.

A previous systematic review[86] evaluated the effectiveness of primary laws implemented in various countries and secondary laws implemented in the United States. All but two of the studies in the review compared the effect of primary or secondary laws with the absence of a law. The investigators concluded that primary laws were likely to be more effective than secondary laws but that more studies directly comparing the effect of

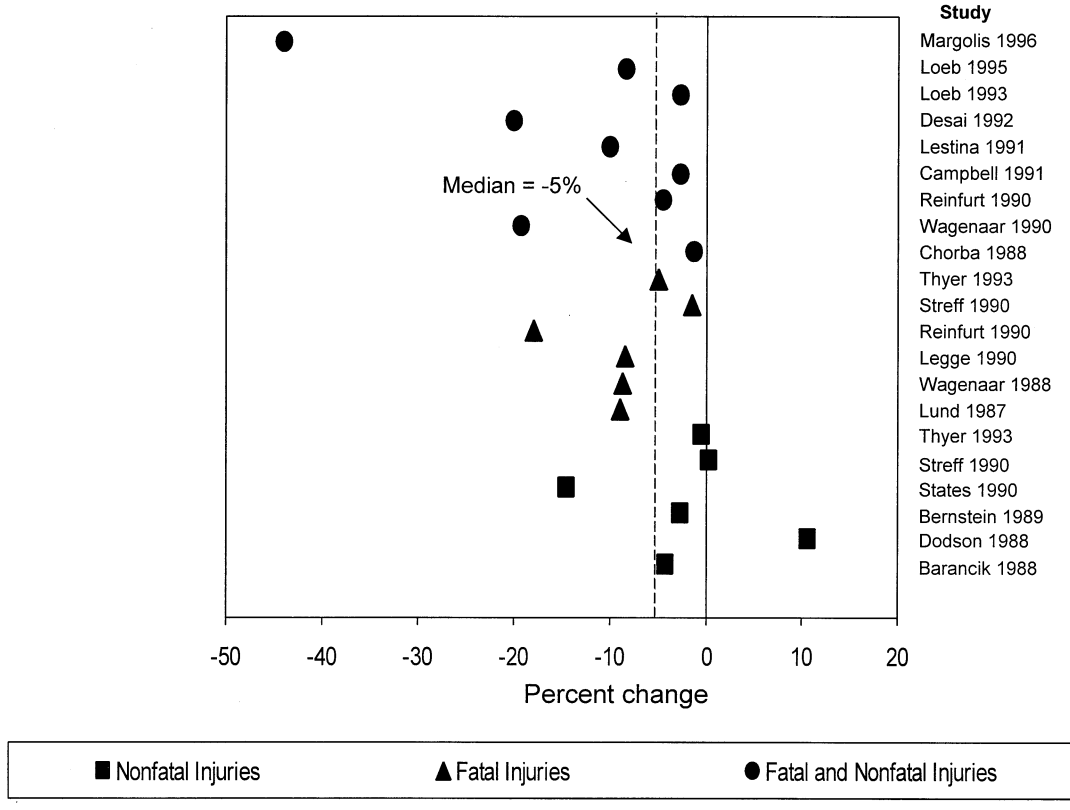

Figure 3. Percent change in fatal and nonfatal injuries with safety belt use laws.

primary laws with secondary laws were needed. The present systematic review only includes studies that directly compare the effects of primary and secondary laws in the United States.

Reviews of evidence

Effectiveness. We identified 19 studies examining the effectiveness of primary enforcement laws, described in Table 3.[8,9,31–33,44,47,58,60,63,76,87–94] Details of the 13 qualifying studies are provided in the Appendix and at the website (www.thecommunityguide.org). Nine studies contained in eight reports[32,33,60,63,76,87–89,94] compared states with primary laws to those with secondary laws, and four studies[8,58,90,91] evaluated the effect of changing from a secondary to a primary law. There were no studies of states changing from a primary law to a secondary law.

Table 4 summarizes the evidence of effectiveness of primary safety belt laws for various outcomes. Figure 4 presents the results of studies containing safety belt use

Table 3. Primary enforcement safety belt laws: descriptive information about included studies

	Number of studies
Papers meeting inclusion criteria	19[8,9,31–33,44,47,58,60,63,76,87–94]
Papers excluded, limited execution quality	2[44,47]
Qualifying papers	17[8,9,31–33,58,60,63,76,87–94]
Papers reporting on an already-included study	5[9,31,89,92,93]
Papers reporting on more than one study	1[63]
Actual number of qualifying studies	13[8,32,33,58,60,63,76,87,88,90,91,94]
Study designs	
Time series with concurrent comparison group	7[32,60,63(two studies),76,87,88]
Time series, no concurrent comparison group	4[8,58,90,91]
Cross-sectional	2[33,94]
Outcomes reported	
Fatal injuries	5[60,63,76,87,88]
Observed safety belt use	5[8,58,90,91,94]
Police-reported safety belt use	1[63]
Self-reported safety belt use	2[32,33]

Table 4. Incremental effectiveness of primary enforcement relative to secondary enforcement safety belt laws on various outcomes: summary effects from the body of evidence

Outcome	Number of studies	Median change	Range[a]
Fatal injuries	5[60,63,76,87,88]	8% decrease[b]	3%–14% decrease
Observed safety belt use	5[8,58,90,91,94]	14% increase	12%–23% increase
Police-reported safety belt use	1[63]	NA	NA[c]
Self-reported safety belt use	2[32,33]	NA	1% and 22% increase

[a]When 7 or more studies were available, an interquartile range is presented.
[b]Two studies reported data in a form that could not be converted to our summary effect measures.
[c]Reported data in a form that could not be converted to our summary effect measures.
NA, not applicable.

outcomes. All 13 included studies showed greater benefits associated with primary laws compared with secondary laws.

Applicability. The studies evaluated primary and secondary safety belt laws in 49 states and the District of Columbia. Primary laws may have a greater effect on high-risk drivers than on low-risk drivers. In California, for example, one study found that the safety belt use rates of drivers with blood alcohol concentrations of 0.10 g/dL or higher increased 39 percentage points after the change to primary enforcement, compared with an overall increase of 23 percentage points.[90] Although belt use in general is higher among whites than nonwhites, two studies showed that with primary enforcement safety belt use increased more among African Americans and Hispanics than among whites.[8,58]

Other positive or negative effects. The positive effects of primary laws should be similar to those of safety belt laws in general (see Safety Belt Laws). If primary safety belt laws are more effective than secondary laws in increasing usage rates among adults, they may also be more effective in increasing usage among their child passengers. Differential enforcement is a potential concern because African Americans and Hispanics may be more likely than whites to be stopped for a safety belt violation. Studies in several states that changed from a secondary to a primary enforcement law, however, found either no difference in the rate of white versus nonwhite ticketing or they found a greater increase in the proportion of whites ticketed after enactment of a primary law.[8,91]

Economics. No studies were found that met the requirements for inclusion in a *Community Guide* review.[16]

Barriers to intervention implementation. Perceived public opposition to primary safety belt laws is a potential barrier to their implementation. Infringement on personal freedom and the potential for differential

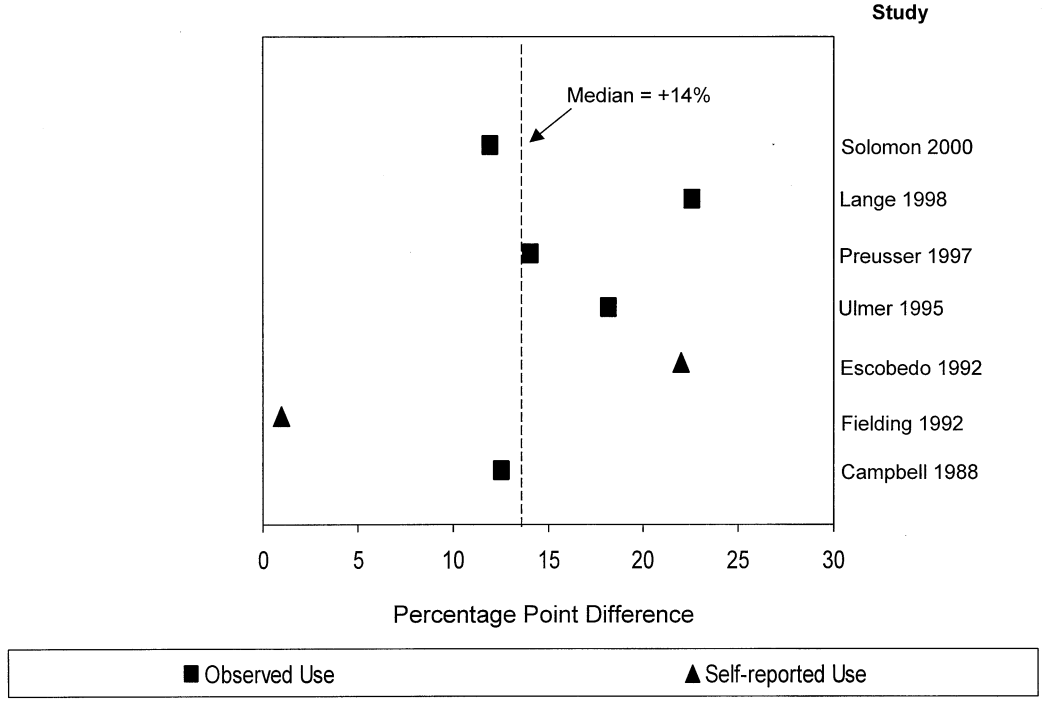

Figure 4. Incremental percentage point difference in safety belt use for primary compared with secondary enforcement laws.

Table 5. Enhanced enforcement: descriptive information about included studies

	Number of studies
Papers meeting inclusion criteria	18[97–114]
Papers excluded, limited execution quality	2[101,114]
Qualifying papers	16[97–100,102–113]
Papers reporting on an already-included study	1[113]
Actual number of qualifying studies	15[97–100,102–112]
Study designs	
Time series with concurrent comparison group	4[99,102,104,106]
Time series, no concurrent comparison group	6[97,98,103,107,108,112]
Before–after with concurrent comparison group	4[100,105,109,111]
Before–after, no concurrent comparison group	1[110]
Outcomes reported	
Fatal and nonfatal injuries combined	2[100,110]
Observed safety belt use	15[97–100,102–112]

enforcement are the most frequently voiced concerns. To increase public acceptance, several states have added anti-harassment language to their primary safety belt legislation to reduce potential for differential enforcement and most have highlighted the potential safety benefits.[85] As with safety belt laws in general, public support for primary laws appears to be strong. In 1998, 58% of U.S. residents supported primary laws, with support higher in states with primary laws (68%) than in states with secondary laws (50%).[95]

Conclusion. According to the *Community Guide*'s rules of evidence, available studies provide strong evidence that primary safety belt laws are more effective than secondary laws in increasing safety belt use and decreasing fatalities.

Enhanced Enforcement

Enhanced enforcement of safety belt laws can involve increasing the number of officers on patrol, increasing citations for safety belt violations during regular patrols, use of safety belt checkpoints, or a combination of these efforts. These programs are conducted in addition to a state's normal enforcement practices and are coupled with publicity to promote increased compliance with a state's safety belt law. For comparative purposes, we refer to increases in the number of officers on patrol as "supplemental patrols" and efforts to increase citations during regular patrols as "targeted patrols."

Enhanced enforcement programs may vary with respect to timing. They may be intense efforts of short duration (called waves or blitzes) that last for days or weeks and may be repeated periodically, or they may attempt to maintain continuous enforcement levels over several weeks, months, or years. Enhanced enforcement programs are often referred to as Selective Traffic Enforcement Programs (STEPs) or Special Traffic Enforcement Programs (sTEPs).[96]

Enhanced enforcement programs are designed to increase public awareness of efforts to enforce safety belt use laws through accompanying media campaigns and direct encounters on the road. This increased awareness is expected to increase the perceived risk of being detected and punished for failing to wear a safety belt, resulting in increased safety belt use and fewer injuries and deaths. Both the level of publicity and visibility of enforcement may influence the risk perception and behavior of motorists. This review focuses on enhanced enforcement programs that specifically target safety belt use and excludes studies of programs that target multiple unsafe driving practices.

Reviews of evidence

Effectiveness. We identified 18 studies of enhanced enforcement programs that specifically target safety belt use, described in Table 5.[97–114] The reported outcomes in the 15 qualifying studies were observed safety belt use and a combined measure of fatal and nonfatal injuries. Summary effects are shown in Table 6. Details of the 15 studies are provided at the website (www.thecommunityguide.org). Figure 5 presents the results of studies of observed safety belt use. The evidence indicates that enhanced enforcement programs are associated with an increase in safety belt use and a decrease

Table 6. Effectiveness of enhanced enforcement on various outcomes: summary effects from the body of evidence

Outcome	Number of studies	Median change	Range[a]
Fatal and nonfatal injuries combined	2[100,110]	NA	7% and 15% decrease
Observed safety belt use	15[97–100,102–112]	16% increase	8%–24% increase

[a]When 7 or more studies were available, an interquartile range is presented.
NA, not applicable.

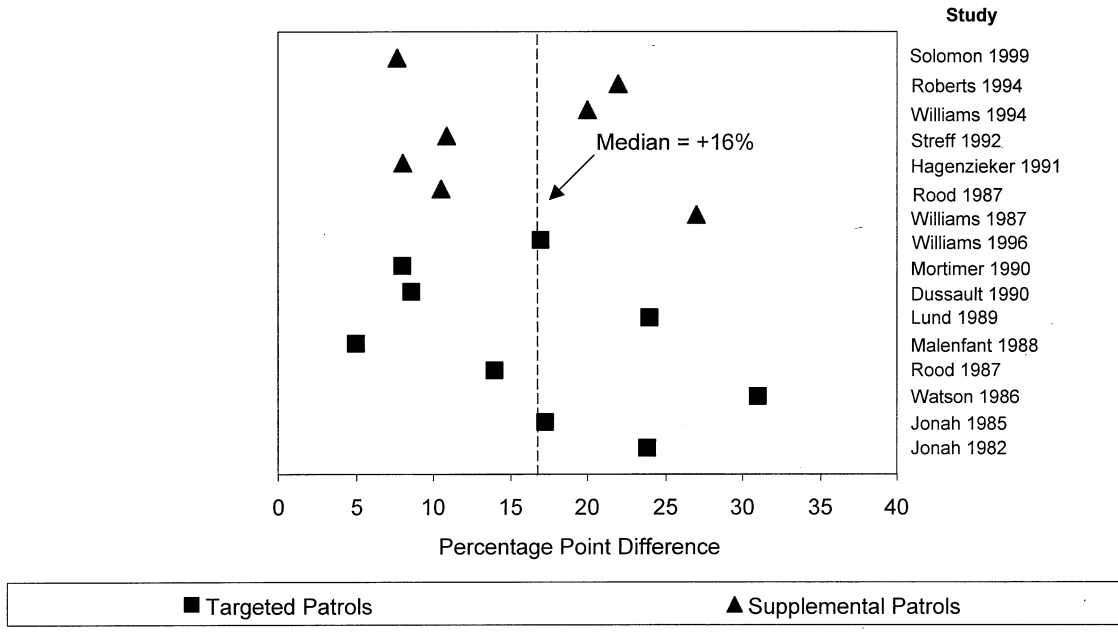

Figure 5. Percentage point difference in observed safety belt use for two methods of enhanced enforcement.

in injuries. Increases in safety belt use were similar for targeted patrols and supplemental patrols (Figure 5).

Two enhanced enforcement programs[97,112] included an incentive component for which the effect could not be measured independently. The increases in safety belt use associated with these programs (9% and 20%, respectively) were similar to the overall effect of enhanced enforcement on safety belt use. Some studies reported the number of citations that were issued during the enhanced enforcement period compared with other periods. These data were difficult to aggregate because of their heterogeneity, but details of the reported citation information are available at the website (www.thecommunityguide.org). One study[105] reported that increases in safety belt use were related to the ratios of both officers-to-residents (r=0.70; p<0.027) and citations-to-residents (r=0.86; p<0.003).

On the basis of information from 11 programs that collected follow-up data (contained in 10 reports),[97–99,102–104,106,108,110,111] safety belt use rates declined somewhat in the months after enhanced enforcement programs ended (median change in safety belt use rates at final follow-up, −6%; interquartile range, −8% to 0%). As has been observed elsewhere,[107] however, belt use rates consistently remained above pre-intervention baseline levels (median change, +9%; interquartile range, 7% to 14%) despite these declines (Figure 6). Although long-term effects remain open to question, some investigators have suggested that optimal rates may be achieved by combining continuous enforcement with waves or blitzes of enhanced enforcement.[106]

Applicability. The studies evaluated enhanced enforcement programs conducted in a variety of settings in the United States and Canada. They included programs implemented at city, county, state, provincial, and national levels, involving varying levels of publicity and enforcement climates. Two U.S. studies that stratified results by population density found greater increases in safety belt use in suburban and rural areas than in urban areas.[106,110]

Other positive or negative effects. Enhanced enforcement of safety belt laws may lead to increased arrests for other crimes such as possession of weapons or drugs, impaired driving, or license violations. For example, the North Carolina "Click It or Ticket" programs, which operated for 2 months in 1993 and 1 month in 1994, reported arresting 56 fugitives, recovering 46 stolen vehicles, and stopping 2094 alcohol-impaired drivers.[110]

Economics. No studies were found that met the requirements for inclusion in a *Community Guide* review.[16]

Barriers to intervention implementation. State and community officials may resist implementing an enhanced enforcement program because of concerns that the public might oppose it. However, two statewide telephone surveys conducted in California and North Carolina during such operations[102,110] indicated that 70% and 87% of respondents, respectively, were in favor of enhanced enforcement programs to increase safety belt use. Some police officers may be concerned that participating in enhanced enforcement programs will divert them from investigating more serious crimes. One study included in this review documented crime rates during enhanced enforcement periods and found no increase.[110] Although hesitancy on the part of the police and community officials to implement enhanced

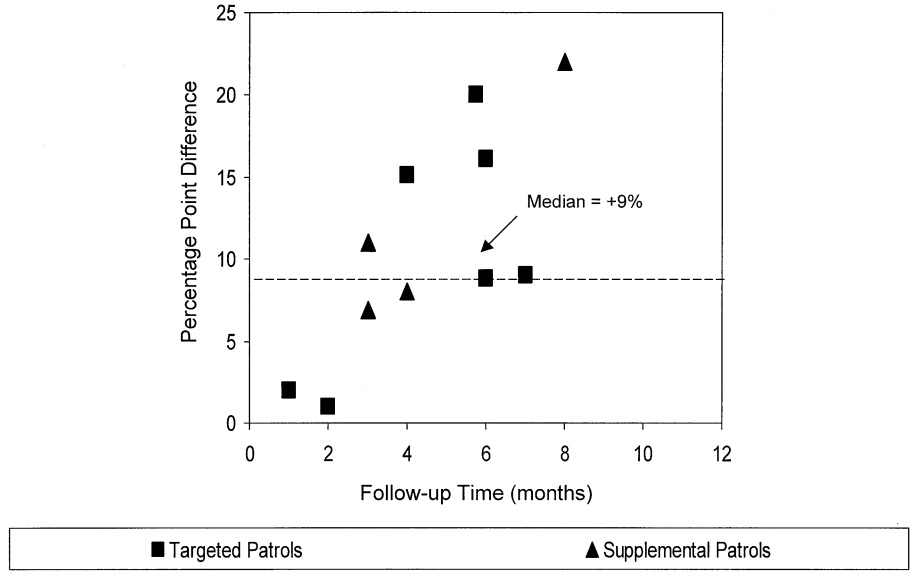

Figure 6. Percentage point difference in observed safety belt use by follow-up time for two methods of enhanced enforcement.

enforcement may be a barrier, interviews with both police and the public have revealed increasingly positive attitudes toward enhanced safety belt enforcement programs.[95]

Conclusion. According to the *Community Guide*'s rules of evidence, available studies provide strong evidence that enhanced enforcement is effective in increasing safety belt use.

Research Issues

Effectiveness

There is strong evidence for the effectiveness of the three interventions reviewed. However, important research issues related to the effectiveness of these interventions remain.

Safety belt laws

- To what extent does the level of enforcement and publicity influence the effectiveness of safety belt laws?
- Does the severity of fines have any bearing on the effectiveness of the laws?
- Do other penalties (e.g., license demerits) add to the effectiveness of the laws?
- Do exemptions for certain vehicles and occupants reduce the effectiveness of the laws?

Primary safety belt laws

- What are the age, gender, and racial differences between violators in primary and secondary law states?
- Are primary enforcement laws more or less effective in certain populations?

Enhanced enforcement

- How does the length and frequency of enhanced enforcement programs influence their effectiveness?
- Does the effectiveness of enhanced enforcement programs vary based on the scale of the interventions (e.g., single community vs multi-community programs)?
- How do publicity, public education, and news coverage affect enhanced enforcement programs?

Applicability

All three interventions appear to be effective in most populations and settings. Although some differences in effectiveness for subgroups have been identified in these reviews, other questions regarding differential effectiveness of these interventions remain.

- What penalties for violations of laws (e.g., fines, license demerits) are most effective among high-risk drivers (e.g., teenagers, drinking drivers)?
- What are the most effective methods of publicizing enhanced enforcement to reach high-risk drivers?

Other Positive or Negative Effects

Research on the positive and negative effects of each intervention might include:

- Do primary safety belt laws increase or decrease risky driving?
- Do enhanced enforcement programs for safety belt use decrease risky driving?
- Do primary laws or enhanced enforcement programs deter alcohol-impaired driving?
- Are primary laws associated with changes in fre-

quency of traffic stops for ethnic and racial minorities relative to the general population?

Economic Evaluations

Little economic evaluation information was available. Research is warranted to answer the basic economic questions: What are the cost-benefit, cost utility, and cost-effectiveness of interventions to increase safety belt use?

Barriers

A number of barriers impede effective implementation of each intervention reviewed. Research into the following areas may help to overcome these barriers.

- How can communities increase public acceptance of primary safety belt laws?
- Do enhanced enforcement programs divert police from other crimes?

Discussion

These reviews examined interventions to increase safety belt use among individuals older than 5 years. An accompanying article in this supplement[115] addresses interventions to increase use of child safety seats by children aged birth to 4 years. A clear gap in these two sets of reviews and in the Task Force's recommendations is for children who are too old or too large to sit in child safety seats but who are too small to wear safety belts without the use of booster seats (generally children aged 4 to 8 years).[116] The literature base regarding the efficacy of booster seats, and particularly that of population-based interventions to improve their use, is still emerging. Future updates of these reviews and recommendations should address this vulnerable population.

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Appendix 1: Studies Measuring the Incremental Effect of Primary Enforcement Laws Relative to Secondary Enforcement Laws on Fatal Injuries

Author, Year Study period Design suitability (design) Quality of execution Evaluation setting	Intervention and comparison elements	Study population description Sample size	Effect measure	Reported baseline	Reported effect	Value used in summary[a]	Follow-up time[b]
Wagenaar 1988 [1] 1976-1986 Greatest (time series with concurrent comparison) Fair 12 states (Primary: IL, NY, TX; Secondary: MI, NE, NJ; No Law: GA, IN, KS, MD, OH, PA)	Age: Not stated (adults) Position: Front Vehicles: Passenger, vans, light trucks, utility vehicles Fines: Not stated Effective Dates: Varied Comparison: Primary vs secondary law states	Front seat motor vehicle occupants age 10 and over in U.S. 12 states	Fatalities per vehicle mile traveled (VMT) (Paper did not state the specific multiple of VMT used in calculating fatality rates)	NA	Percent change in fatalities per VMT: Secondary Law: -6.8 ($p<.05$) Primary Law: - 9.9 ($p<.05$)	-3.1%	9-19 months
Evans 1991 [2] 1975-1987 Greatest (time series with concurrent comparison) Fair 48 U.S. states (MA, NE excluded)	Age: All Position: Not stated Vehicles: Not stated Fines: Not stated Effective Dates: Varied Comparison: Primary vs secondary law states	All motor vehicle occupants in U.S. 48 states	Fatalities per 100 million VMTs	NA	Percent change in rate of fatalities per VMT: Primary Law: -17% ($p<.01$) Secondary Law: -3.1% (N.S.)	-13.9%	0-3 years
Winnicki 1995 Appendix Update of Hoxie 1987 [3] 1975-1994 Greatest (time series with concurrent comparison) Fair [based on Hoxie 1987] 50 U.S. states	Age: Not stated Position: Front Vehicles: Passenger Fines: Not stated Effective Dates: Varied [based on Hoxie 1987] Comparison: Primary vs secondary law states	Front seat motor vehicle occupants in U.S. 50 states	Fatalities	NA	Percent change in rate of fatalities (difference between primary and secondary law states): -7.7% ($p=0.0001$)	-7.7%	0-10 years

Appendix Continued

Author, Year Study period Design suitability (design) Quality of execution Evaluation setting	Intervention and comparison elements	Study population description Sample size	Effect measure	Reported baseline	Reported effect	Value used in summary[a]	Follow-up time[b]
Houston 1995 [4] 1967-1991 Greatest (time series with concurrent comparison) Fair 50 U.S. states	Age: All Position: Front Vehicles: Not stated Fines: Not stated Effective Dates: Varied Comparison: Primary vs secondary law states	All motor vehicle occupants in U.S. 50 states	Fatalities per billion vehicle miles traveled (bVMT)	NA	Change in number of fatalities per bVMT: Primary laws: -3.616 (p<.001), or 3.616 fewer deaths per bVMT compared with no law Secondary laws: -4.252 (p<.001), or 4.252 fewer deaths per bVMT compared with no law	NA[c]	0-7 years
Houston 1996 [5] 1975-1991 Greatest (time series with concurrent comparison) Fair 50 U.S. states	Age: All Position: Front Vehicles: Not stated Fines: Not stated Effective Dates: Varied Comparison: Primary vs secondary law states	All motor vehicle occupants in U.S. 50 states	Fatalities per bVMT	NA	Change in number of fatalities per bVMT: Primary laws: -0.639 (p<.001), or 0.6388 fewer deaths per bVMT compared with no law Secondary laws: -0.002 (N.S.), or .0023 fewer deaths per bVMT compared with no law	NA[c]	0-7 years

[a] Percent change
[b] Period following passage of primary enforcement law
[c] Percent change could not be calculated from the data provided

Abbreviations: bVMT, billion vehicle miles traveled; VMT, vehicle miles traveled

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Appendix 2: Studies Measuring the Incremental Effect of Primary Enforcement Laws Relative to Secondary Enforcement Laws on Safety Belt Use

Author, Year Study period Design suitability (design) Quality of execution Evaluation setting	Intervention and comparison elements	Study population description Sample size	Effect measure	Reported baseline	Reported effect	Value used in summary[a]	Follow-up time[b]
Campbell 1988 [1] 1985-1987 Least (cross-sectional) Fair 20 U.S. states (Primary: CT, HI, IL, IA, NM, NY, NC, TX; Secondary: CA, ID, LA, MD, MA, MI, NE, NJ, OH, UT, WA, and Washington, DC)	Age: All Position: Front Vehicles: Passenger Fines: Varied Effective Dates: Varied Comparison: Primary vs secondary law states	Front seat motor vehicle occupants in 20 U.S. states 20 states	Observed safety belt use	NA	Primary States: Intercept = 44.5% belt use (p<.01) Secondary States: Intercept = 31.9% belt use (p<.01)	+12.6%	NA
Ulmer 1995 [2] 1986-1993 Moderate (time series) Fair Six communities in California (Bakersfield, Fresno, Monterey, Riverside, Salinas, San Bernardino)	Age: All Position: Front Vehicles: Passenger cars (taxi, 6000+ lb trucks, police, postal exempt) Fines: $20-$50 Law went into effect: 1-1-93 Comparison: Change from secondary to primary enforcement within same state	Drivers in six communities in California Not reported	Observed safety belt use	Secondary Law: 58.0%	Primary Law: 76.2%	+18.2%	7 months
Preusser 1997 [3] 1992-1996 Moderate (time series) Fair Five communities in Louisiana (Baton Rouge, Lake Charles, Monroe, Shreveport, St. Tammany Parish)	Age: All Position: Front Vehicles: Passenger cars, light trucks, vans Fines: $25-$50 Effective Date: 11-1-95 Comparison: Change from secondary to primary enforcement within same state	Front seat motor vehicle occupants in five communities in Louisiana N = 45,662 observations	Observed safety belt use	Secondary Law: 51.9%	Primary Law: 66.0%	+14.1%	6 months

Appendix Continued

Author, Year Study period Design suitability (design) Quality of execution Evaluation setting	Intervention and comparison elements	Study population description Sample size	Effect measure	Reported baseline	Reported effect	Value used in summary[a]	Follow-up time[b]
Lange 1998 [4] 1991-1995 Moderate (time series) Fair Two communities in California (Oceanside, Salinas)	Age: All Position: Front Vehicles: Not stated Fines: Not stated Law went into effect: 1-1-93 Comparison: Change from secondary to primary enforcement within same state	Drivers in California N=18,469	Observed safety belt use	Secondary Law (95% CI): 73.0% (71.9, 74.1)	Primary Law (95% CI): 95.6% (95.2, 96.0)	+22.6%	2.5 years
Solomon 2000 [5] 1993-1998 Moderate (time series) Fair MD, OK, Washington, DC	Age: All Position: Front Vehicles: Varied Fines: MD $25 unchanged; OK lowered to $20; DC increased to $50 + 2 points on license. Law went into effect: MD 10-1-97 OK 11-1-97 DC 10-9-97 Comparison: Change from secondary to primary enforcement within same state	Front seat motor vehicle occupants N=3707 (OK) N=4945 (MD) N=unknown (DC)	Observed safety belt use	Secondary Law: MD 71% OK 47% DC 66%	Primary Law: MD 83% OK 56% DC 80%	+12%	9-10 months
Winnicki 1995 [6] 1983-1994 Greatest (time series with concurrent comparison) Fair 50 U.S. states	Age: All Position: Front Vehicles: Varied Fines: Varied Law went into effect: Various dates Comparison: Primary vs secondary law states	Fatally injured occupants of motor vehicle crashes in U.S. 50 states	Police-reported safety belt use	NA	Incremental increase in safety belt use in primary vs secondary law states (percent change estimated from regression model) 14.4% (p=0.0001)	NA[c]	0-10 years

Appendix Continued

Author, Year Study period Design suitability (design) Quality of execution Evaluation setting	Intervention and comparison elements	Study population description Sample size	Effect measure	Reported baseline	Reported effect	Value used in summary[a]	Follow-up time[b]
Fielding 1992 [7] 1988-1989 Least (cross-sectional) Fair 50 U.S. states	Age: All Position: Front Vehicles: Not stated Fines: Not stated Law went into effect: Various dates Comparison: Primary vs secondary law states	Volunteer health profile participants in U.S. whose employers belonged to Johnson and Johnson Health Management N=17,830	Self-reported safety belt use	NA	Primary Law: 78% Secondary Law: 77%	+1%	NA
Escobedo 1992 [8] 1984-1989 Greatest (time series with concurrent comparison) Fair 12 U.S. states (Primary: NC; Secondary: CA, ID, IL, IN, MN, MO, OH, SC, TN, UT, WI)	Age: All Position: Front Vehicles: Not stated Fines: Not stated Law went into effect: NC 10-85 Comparison: Primary vs secondary law states	U.S. residents age 18 and over with telephones N=~100,000	Self-reported safety belt use	Primary Law pre: 21% Secondary Law pre: 22%	Behavioral Risk Factor Surveillance System (BRFSS) "Always use": Primary Law post: 70% Secondary Law post: 49%	+22%	3 years

[a] Percentage point difference
[b] Period following passage of primary enforcement law.
[c] Percent change could not be calculated from the data provided

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