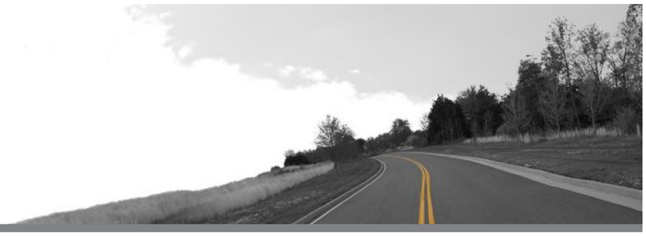

Seat belt law calculator background and methodology

The Insurance Institute for Highway Safety (IIHS) developed an online calculator to show individual states the safety gains or losses that would be expected to result from adopting specific changes in their current seat belt use laws. The calculator is based on published research examining changes in seat belt use rates and in passenger-vehicle occupant fatalities associated with the relative strength of specific aspects of seat belt laws. These aspects include the seating positions covered and the type of enforcement. Laws governing these aspects vary across states. These laws have also varied over time within states.

Background

The first statewide mandatory seat belt law went into effect in New York in 1984. By 1996, all states except New Hampshire required seat belt use in the front seat. Laws requiring seat belt use in the rear seat have followed more slowly. Enforcement of belt use laws also varies by state. In states that allow primary enforcement of belt use laws, a police officer may stop a vehicle and issue a citation solely for failure to use a seat belt. However, in states with secondary enforcement of these laws, police can only enforce the seat belt law if a motorist has been pulled over for another violation.

Seat belt laws are effective at getting people to buckle up, and primary laws are more effective than secondary laws. Early studies of states switching from secondary to primary enforcement reported increases in belt use rates of about 14 percentage points (Shults et al., 2004) and reductions in fatality rates of 7% (Farmer & Williams, 2005). But studies of more recent law changes report a smaller effect (Harper, 2019; Kirley et al., 2023). The effect of switching from secondary to primary enforcement seems to depend upon the belt use rate at that time. A new analysis by IIHS, described below, allows for estimating seat belt law effects that vary over time.

Methods

Data on front-seat belt use rates before and after changes in the laws were gathered from various sources. Campbell (1988) reported before and after belt use rates for 25 states with front-seat belt laws that took effect between 1984 and 1987. Data for states with laws that took effect between 1988 and 1997 were taken from other published studies (Illinois Department of Transportation, 2021; Lestina et al., 1991; Preusser & Preusser, 1997; Stricklin & Wright, 2023; Ulmer et al., 1994).

In 1998, the federal government established a grant program for states conducting annual seat belt observational surveys. The National Center for Statistics and Analysis (NCSA) developed a uniform set of criteria for states to follow in their survey designs. Front-seat belt use rates related to state laws that first took effect after 1997 were drawn from the annual summaries of these state seat belt surveys (e.g., NCSA, 2025).

Linear regression was used to relate rates of seat belt nonuse before each law change to rates after the law change. Modeling nonuse rates rather than use rates prevented unrealistic projections of use rates greater than 100%. And a linear relationship between before and after nonuse rates is equivalent to a quadratic relationship between before and after use rates, as presented below.

Two regression analyses were conducted. The first analysis was for 18 states that changed from no seat belt law to a law with secondary enforcement. Assuming a baseline use rate, u, the projected use rate after changing from no law to secondary enforcement would be $u^* = 0.21694\ u^2 + 0.42728\ u + 0.35578$. So, a state with a baseline use rate of 50% (i.e., 0.50) would have a projected use rate of 62% after the law takes effect. And a state with a baseline use rate of 90% would have a projected use rate of 92% after the law takes effect.

The second analysis was for 27 states that changed from a secondary seat belt law to a law with primary enforcement. Assuming a baseline use rate, u, the projected use rate after changing from a secondary law to a primary law would be $u^* = -0.05069\ u^2 + 0.73641\ u + 0.31428$. And a state with a baseline use rate of 90% would have a projected use rate of 94% after the law takes effect.

The calculator uses the latest data on baseline front-seat belt use by state, but there is no complete data on rear-seat belt use by state. It has been shown, however, that rear-seat belt use is correlated with front-seat use. Hedlund (2020) calculated front- and rear-seat belt use rates by state for passenger vehicle occupants involved in fatal crashes in 2018. He estimated that "a front-seat use rate of 60% is associated with a rear-seat rate of about 53%, while a front-seat use rate of 80% is associated with a rear-seat rate of about 70%." So, assuming a linear relationship between front- and rear-seat rates, Rear = 0.85 Front + 0.02. A front-seat use rate of 90% would be associated with a rear-seat rate of about 78%.

Higher belt use rates lead to fewer crash fatalities. Kahane (2015, 2017) concluded that seat belts reduce fatality risk to front-seat occupants by 45%–60% and to rear-seat occupants by 54%–75%. It can be shown mathematically (Evans, 1991) that the proportional change in fatality risk when seat belt use rates change from u to u* is approximately $F = e\ (u^* - u) / (1 - e\ u)$, where e is the effect of belt use on fatality risk.

Using e = 50% for front-seat belt use, $F = 0.5\ (u^* - u) / (1 - 0.5\ u)$. In other words, an increase in front-seat belt use from 90% to 94% should lead to a 3.6% reduction in fatality risk. Using e = 60% for rear-seat belt use, $F = 0.6\ (u^* - u) / (1 - 0.6\ u)$. An increase in rear-seat belt use from 78% to 82% should lead to a 4.5% reduction in fatality risk.

Finally, the overall change in occupant fatality risk is calculated as the average of the change in front-seat risk and rear-seat risk, weighted by the baseline proportion of occupant deaths occurring in the front seat. A state with 80% of its occupant deaths occurring in the front seat, a 4% reduction in front-seat risk, and a 5% reduction in rear-seat risk would have a 4.2% reduction in overall occupant risk (i.e., $0.8 \times 0.4 + 0.2 \times 0.5$).

References

Campbell, B. J. (1988). *Report to Congress on provisions of state safety belt use laws and other programmatic factors related to increasing safety belt use levels.* National Highway Traffic Safety Administration.

Evans, L. (1991). *Traffic safety and the driver.* Van Nostrand Reinhold.

Farmer, C. M., & Williams, A. F. (2005). Effect on fatality risk of changing from secondary to primary seat belt enforcement. *Journal of Safety Research, 36,* 189–194. https://doi.org/10.1016/j.jsr.2005.03.004

Harper, S. (2019). Would stronger seat belt laws reduce motor vehicle crash deaths? A semi-Bayesian analysis. *Epidemiology, 30,* 380–387. https://doi.org/10.1097/EDE.0000000000000990

Hedlund, J. (2020). *Rear seat belt use: Little change in four years, much more to do.* Governors Highway Safety Association. https://www.ghsa.org/resource-hub/rear-seat-belt-use-little-change-four-years-much-more-do

Illinois Department of Transportation. (2021). *Seat belt use in Illinois: June 2021 observational results.* https://idot.illinois.gov/content/dam/soi/en/web/idot/documents/transportation-system/reports/safety/evaluations/safety-belt-observation-reports/2021-technical-results.pdf

Kahane, C. J. (2015). *Lives saved by vehicle safety technologies and associated Federal Motor Vehicle Safety Standards, 1960–2012 — passenger cars and LTVs — with reviews of 26 FMVSS and the effectiveness of their associated safety technologies in reducing fatalities, injuries, and crashes* (Report No. DOT HS 812 069). National Highway Traffic Safety Administration.

Kahane, C. J. (2017). *Fatality reduction by seat belts in the center rear seat and comparison of occupants' relative fatality risk at various seating positions* (Report No. DOT HS 812 369). National Highway Traffic Safety Administration.

Kirley, B. B., Robison, K. L., Goodwin, A. H., Harmon, K. J., O'Brien, N. P., West, A., Harrell, S. S., Thomas, L., & Brookshire, K. (2023). *Countermeasures that work: A highway safety countermeasure guide for State Highway Safety Offices* (11th ed., Report No. DOT HS 813 490). National Highway Traffic Safety Administration.

Lestina, D. C., Williams, A. F., Lund, A. K., Zador, P., & Kuhlmann, T. P. (1991). Motor vehicle crash injury patterns and the Virginia seat belt law. *JAMA, 265*, 1409–1413.

National Center for Statistics and Analysis. (2025). *Seat belt use in 2024 — use rates in the states and territories* (Report No. DOT HS 813 766). National Highway Traffic Safety Administration.

Preusser, D. F., & Preusser, C. W. (1997). *Evaluation of Louisiana's safety belt law change to primary enforcement* (Report No. DOT HS 808 620). National Highway Traffic Safety Administration.

Shults, R. A., Nichols, J. L., Dinh-Zarr, T. B., Sleet, D. A., & Elder, R. W. (2004). Effectiveness of primary enforcement seat belt laws and enhanced enforcement. *Journal of Safety Research, 35*, 189–196. https://doi.org/10.1016/j.jsr.2004.03.002

Stricklin, R., & Wright, K. D. (2023). *Evaluation of "Click It or Ticket" 2023* (Report No. FHWA/CA/OR-). Alabama Transportation Institute.

Ulmer, R. G., Preusser, C. W., & Preusser, D. F. (1994). *Evaluation of California's safety belt law change to primary enforcement* (Report No. DOT HS 808 205). National Highway Traffic Safety Administration.