

CHILD OCCUPANT PROTECTION: CURRENT ISSUES

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Introduction

This is a version of an article prepared for the [University of California Berkeley Traffic Safety Center Newsletter](#). The article discusses current trends and issues related to child safety seat technology, legislation, and use.

Background

One of the most important things adults can do to protect themselves in a car is to buckle up their seatbelts. This single thing has resulted in many saved lives and injuries over the past few decades, despite legislative and design setbacks along the way. Occupant protection for children, however, has not proven as simple.

Seatbelts are not designed to protect children, particularly those under the age of 9. According to a 2002 report issued by Public Citizen, a nonprofit consumer interest organization, lap/shoulder belts are currently designed to be effective and comfortable for the average (50th percentile) adult male, and the typical belt system is not designed to accommodate an occupant shorter than 4'9" and weighing less than 80 pounds.

Along with children's small size and stature, their immature neck and spinal cord structures make them more vulnerable when restrained by a seatbelt alone. In a 1997 study conducted by Hummel, et al at the Institute for Vehicle Safety GDV, Germany, children ages 0-11 who were restrained with any type of belt were shown to suffer injury 58% more frequently than children in child restraint systems. Child restraint systems, namely, child safety seats, offer children better age- and development-appropriate protection during a crash. According to the National Highway Traffic Safety Administration (NHTSA), child safety seats reduce the risk of fatal injury by 71% for infants between the ages of 0-1 and 54% for children between the ages of 1-4.

In 1978, the first state law requiring mandatory use of a child restraint system was passed in Tennessee. Other states followed suit, and as of 1985, all states required children to be restrained in a device other than the adult seatbelt. Ages covered by these laws vary significantly from state to state, however, with some states allowing seatbelt use for children as young as one or two years old. As of September 2002, 34 states allowed the use of seatbelts alone for children under the age of 8, and 17 states allowed the use of seatbelts alone for children as young as 4.

"The Forgotten Child"

Generally, infants from birth to one year old or weighing less than 20 pounds should be placed in a rear-facing infant seat and children over one year old and weighing between

20-40 pounds should be placed in a forward-facing or convertible seat. When children outgrow these safety seats but are still too small for seatbelts, belt-positioning booster seats are recommended.

Booster seats are typically appropriate for a child who, regardless of age, weighs between 40-80 pounds and stands less than 4'9" tall. The seats are designed to basically "boost" kids up and forward so that the seatbelt system in a car fits appropriately. According to a study by the Partners for Child Passenger Safety, smaller children who are placed in seatbelts before they fit correctly are four times more likely to suffer head, brain, and other serious injuries.

The age group for whom booster seats are recommended, usually children between the ages of 5 and 9 years old, has recently been the focus of more intense child occupant protection efforts. A child belonging to this age group is often referred to as "the forgotten child" because she is not covered by restraint laws mandating anything other than the use of adult seatbelts, which are increasingly recognized as being ineffective for this age group.

Despite decreases in motor vehicle deaths among other age groups, NHTSA estimates that between 1982 and 1998, there was a 23% *increase* in motor vehicle deaths among 5- to 9-year-olds. The occupant fatality rate per 100,000 population for children between the ages of 0 to 4 has decreased significantly over the past couple decades, from 4.68 in 1977 to 2.84 in 2000. The fatality rate for children between the ages of 5 and 9 has stayed roughly the same in the past 25 years, and in 2000 was actually higher than it was in 1982.

Specific risks for children in this age group who are only restrained by an adult seatbelt include abdominal injuries, face and neck injuries, spinal cord injuries, or full or partial ejection from the belted position. In addition, due to the discomfort of a poorly fitting belt, children may move the shoulder strap behind their backs or under their arms, which can result in severe injuries or make ejection more likely.

NHTSA estimates that only 6% of the children who should be in a booster seat are actually using them, and this may be due to the fact that only a few states require booster seat use. However, states are slowly developing and passing legislation that would require the use of booster seats. States that currently have booster seat laws include Washington, California, Maine, Colorado, South Carolina, and Oregon. Among all states, Maine carries the strongest booster seat and child restraint laws. Effective January 1, 2003, children weighing between 40-80 pounds and less than 8 years old must be in a restraint system that elevates the child for proper adult seatbelt fit, and seatbelts alone are only permissible for children 8 years or older or less than 18 and more than 4'7". The maximum fine for first time violations is \$500 -- the highest of all states (the second highest is \$200, in Texas).

Continued Need to Increase Restraint Use

Increasing the use of child restraint systems, especially for children over five, would help reduce the higher rates of death experienced by children after infancy. Several studies have shown that as a child's age increases, the use of any restraint decreases. Even with imperfect child restraint systems, it is still far more dangerous to use no restraint: an unrestrained child's risk of suffering fatal and serious injuries has been shown to be approximately seven times higher than the risk for restrained children.

Getting parents to buckle up is an important first step. According to the American Academy of Pediatrics, adult safety belt use is the best predictor of child occupant restraint use. A driver who is buckled up is three times more likely to restrain a child in a vehicle. Ensuring that existing child restraint laws carry weight is another step to take towards increasing restraint use. This may be done through strengthening of the laws, for instance, having a wider range of ages covered or imposing heavier fines for violators, and having consistent and visible enforcement of the laws. A 1998 Harris poll found that 90% of Americans support increased police enforcement of child restraint laws.

Child Safety Seat Design and Standards

Children in safety seats, especially booster seats, are unfortunately still at risk of injury and fatality due to the less than ideal safety design of many child safety seats and seatbelts, as well as mismatches between after-market safety seats and vehicles.

NHTSA has acknowledged that per unit manufactured, the number of recalls of child safety seats is high. According to the Public Citizen report, 41% of child safety seats tested since 1990 failed some portion of the government compliance testing. There have been more than 90 recalls of child seats in the past 10 years, but fewer than half of the recalled seats are ever fixed or destroyed.

The performance standard for child restraint systems is limited. It is based on a crash test that simulates a frontal crash only, and according to the Hummel study, regardless of the type of restraint used, children are far more likely to be injured in side collisions than head-on collisions. The injury criteria applied in the standard are also not specifically designed for children, but rather are based on adult injury criteria. For these reasons, even when children are properly restrained, a safety seat's compliance with the minimum standards can allow serious injuries to occur.

The safety regulation of booster seats in particular is limited. Currently the safety testing of booster seats is not federally mandated and there are no federal safety standards for safety seats for children who weigh between 50-80 pounds. (In 1994, the federal standard governing child restraint systems, FMVSS 213, was revised to extend to booster seats for children weighing up to 50 pounds. That same year, NHTSA reported not having a larger child dummy for the testing of booster seats for larger children; the agency still does not.)

In September 1996, the National Transportation Safety Board (NTSB) issued a safety report recommending that the auto industry and NHTSA revise FMVSS 213 to create a performance standard for seats that accommodate children up to 80 pounds. Prompted not

by this safety report but by the requirements of the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, several months ago NHTSA issued a notice of proposed changes to FMVSS 213. The changes included using new and improved test dummies and procedures for testing child restraints, new or revised assessment criteria for child restraint system performance, and revisions of the standard to cover restraint systems for use by children weighing up to 65 pounds.

Other recent progress in federal design and testing standards applies to child safety seats for smaller children. In September 1999, all forward-facing child safety seats were required to comply with stricter head protection safety standards. Tether straps at the top of the seat were added, which then attached to an upper anchorage near the car's rear window. In September 2000, all new passenger vehicles were required to be equipped with a top anchor for the tether straps. As of September 1, 2002, most new child safety seats and vehicles manufactured were required to be equipped with the "LATCH" system (Lower Anchors and Tethers for Children). Under the LATCH requirement, safety seats (but not booster seats) must have two lower universal latches that connect to the vehicle's lower anchorages. This aims to improve the securing of child safety seats to the vehicle and reduce the reliance on seatbelts for anchoring.

Safety Seat Misuse

Even the safest child restraint system design may still not protect a child in a crash, however, as high levels of misuse associated with currently available restraint devices have been shown to contribute to a range of injuries, some of which are fatal.

The misuse of child restraint systems has been documented to be as high as 95%. This can be due to the use of after-market safety seats that are incompatible with a vehicle, adults not following directions on either the installation of the seat or how to restrain the child once the seat is installed, the use of damaged or defective safety seats, or the use of seats that are inappropriate for a child's size. In a 1997 study conducted by Catherine Gotschall, et al at the Children's National Medical Center, it was found that the most common type of restraint misuse was failure to use a restraint system appropriate for a child's weight and height.

Even the most well-intentioned parents, armed with all of the appropriate information for safety seat selection, installation, and proper restraint of their child may find that correctly using the safety seat is not easy. Indeed, courses and programs are currently offered to train and certify child passenger safety technicians on how to properly install safety seats, and the standardized training course lasts four days. Visitors to NHTSA's online dictionary of child safety seat terms will find a total of 75 definitions, including those for terms like "Emergency Locking Retractor (ELR)," "Free Sliding Latchplate," "T-Shield," and "Tilt-lock tether strap adjuster."

The existence of such resources suggests that the current design of child safety seats is not nearly as simple to use as that of other vehicle safety devices, such as seatbelts. In addition to contributing not only to misuse, it is possible that the difficulties associated

with safety seat use may also be associated with the widespread lack of use of child restraint systems: as reported by NHTSA, in 2000, 56% of all children killed in traffic crashes were totally unrestrained.

Emerging Issues and Advancements

Some attention has recently been given to both the risk of child injury from airbags as well as lap-belt only forms of restraint. While both can undoubtedly contribute to injury and even death, the risks of not being restrained properly or not being restrained at all are far greater. As Flaura K. Winston, MD, PhD and Dennis R. Durbin, MD, MSCE of the Children's Hospital of Philadelphia reported, "Between 1993 and 1998, more than 10,000 children were killed in automobile crashes, but only 70 were killed by airbags." According to an article published in *Traffic Safety* written by John Becknell and Lauren Simon Ostrow, most children fully recover from the injuries that can be caused from the use of lap belts, also referred to as lap belt syndrome. Since 1992, lap/shoulder belts have been required in rear outboard seats in U.S. vehicles, and the rear seat remains the safest place for children riding in cars.

To improve the safety of child restraint systems as well as reduce the misuse associated with their installation, the integration of child safety seats into the rear seats of vehicles has been increasingly recommended by safety advocates and traffic safety researchers. The NTSB, for example, recommended in its September 1996 safety report that auto manufacturers offer built-in child restraint seats in domestically sold vehicles. Integrated child safety seats are currently the safest known child safety systems for children between the ages of 4 and 8.

Integrated child safety seats have been available since the 1980s. The first U.S. auto manufacturer to install integrated child safety seats was Chrysler in 1992. Currently, of the 251 different 2002 vehicle makes reviewed by NHTSA for safety features, only 14, roughly 5%, offered built-in child safety seats as an option. Only one vehicle, the 2002 Chevrolet Venture, provided built-in child safety seats as a standard feature.

Developing and making available simpler and safer child restraint systems, such as integrated child restraint systems, is one measure that can be taken to significantly improve current child occupant protection. Some other key steps include: updating government safety standards and testing measures; strengthening existing child restraint laws; increasing public awareness of child restraint laws through education and enforcement; and increasing adult seatbelt use.