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When "Buckle Up" Is Not Enough: Enhancing the Safety of Children in Motor Vehicles

Editor's Note: Motor vehicle crashes are the leading cause of death and acquired disability in children over age 1 in the United States. In 1998 alone, 697 children under age 6 died as occupants in motor vehicles, and nearly 100,000 were injured. This Issue Brief describes findings from Partners for Child Passenger Safety, the nation's largest surveillance system of children in car crashes, and points to improvements in child restraints that can reduce the risk of serious injury in the event of a crash.

Partners for Child Passenger Safety

Since 1997, Partners for Child Passenger Safety (PCPS) has used a surveillance system to investigate the nature and extent of childhood injuries due to motor vehicle accidents. PCPS is a collaborative effort among The Children's Hospital of Philadelphia, the University of Pennsylvania, and the State Farm Insurance Companies. The ongoing study is unprecedented in size and scope.

- PCPS collects State Farm claims data on children ages 0-15 involved in crashes in 15 states and the District of Columbia.
- In-depth telephone interviews, conducted immediately following the crash, provide additional information on restraint use and the severity of the child's injuries. On-site crash investigations provide further detail regarding exact injury mechanisms.
- Unlike previous studies, PCPS examines the entire range of crash and injury severity, from the most minor to the most severe. This allows the researchers to examine the relationships between restraint type, a child's age and size, and the type of crash.

Although most children are being restrained, they are not appropriately restrained for their age

From December 1998 through November 1999, Dr. Winston and colleagues collected information on more than 8,000 children involved in crashes. Nearly all (95%) of the children in cars insured by State Farm were restrained in child safety seats, shield or belt-positioning booster seats, or adult seat belts. However, in nearly half of all cases, restraint use and seating position did not conform to current best practice.

- Thirty percent of infants were incorrectly turned forward facing in their car seats before one year of age. Due to their relatively large head size and underdeveloped cervical spine, infants up to age 1 are at particular risk of cervical spine injuries in

frontal crashes. By placing infants rear-facing, the back of the car seat supports their head, neck, and back and prevents not only spinal cord injuries but also head and brain injuries in frontal crashes. For these reasons, infants should ride rear-facing until they are at least 1 year and 20 pounds.

- Twenty-nine percent of 3-year-olds were inappropriately graduated from car seats to booster seats and 16% of 3-year-olds were inappropriately moved to adult seat belts. According to current guidelines, children should continue to ride in a forward-facing car seat until they reach 40 pounds, usually around age 4.
- Eighty-three percent of children between the ages of 4 and 8 were inappropriately restrained in adult seat belts. Although seat belts are safer than no restraint at all, they are not designed with a child's measurements in mind. According to current guidelines, children who have outgrown their car seats should move to belt-positioning booster seats until they are at least 4'9" and 80 pounds (usually about age 9). However, less than 1% of children older than age 5 used booster seats in this study.
- When children are "prematurely graduated" to adult seat belts, the lap portion of the belt rides up over the abdomen, putting children at risk for intestinal, spleen, and spinal cord injury ("seat belt syndrome") in a crash. Also, the shoulder portion crosses the child's neck or face rather than the shoulder or chest. As a result, the child's upper body is not well-restrained in a crash, placing the child at increased risk for brain injury due to impact of the head with the child's knees or the vehicle interior. Recognizing the poor fit, parents or children often place the shoulder belt under the child's arm or behind the child's back, further increasing a child's risk of seat belt syndrome and brain injury. Booster seats work by positioning the child so that the adult seat belt fits optimally across the child's hips and chest.

Misuse of car seats is a common problem

Misuse lowers the effectiveness of car seats, primarily by increasing the movement of a child's head in a crash.

- Eighty-two percent of car seats were misused in some way. Common mistakes include not attaching the seat tightly to the vehicle, not fastening the harness tightly enough, or not using the chest clip (if the manufacturer recommends it).
- Three percent of children were riding in a car seat that was "grossly" misused. Gross misuse occurs when seats are not attached to the vehicle, harnesses are not fastened to the child, rear-facing seats are placed in front of an airbag, and infant-only car seats are used in the forward-facing position.

Study describes significant injuries to children

The study provides insight into what type of injuries children sustain in car crashes, and what they are likely to hit inside the vehicle during a crash.

- Fifteen percent of children involved in car crashes were injured in some way. Children who are not restrained are three times more likely to sustain a significant injury than children who are restrained. Significant injuries include concussions and more serious brain injuries, fractures, severe cuts, and damage to internal organs.
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- Sixty-four percent of significant injuries sustained by children in a crash are to the head.
 - Fifteen percent of children come into contact with something inside their vehicle during a crash (such as the back of the seat in front of the child, or a door or side panel or window).

Premature graduation of preschoolers to adult seat belts greatly increases the risk of serious injuries in crashes

Because so many children are restrained in adult seat belts by age 5, Dr. Winston and colleagues analyzed the risks of injuries to preschoolers separately. They focused on more than 2,000 children ages 2 to 5.

- Although a booster seat is recommended for this age group, 40% of preschoolers were restrained with an adult seat belt. This varied widely with age: 5.5% of two-year-olds, 16% of three-year-olds, 55% of four-year-olds, and 80% of five-year-olds were in seat belts. Among children in seat belts, 19% were using only the lap belt.
- About 10% of preschoolers involved in car crashes sustained some type of injury, with 1% suffering significant injuries. Nearly 60% of significant injuries occurred to the head.
- Preschoolers in seat belts were three-and-a-half times more likely to sustain a serious injury than preschoolers in child safety seats or booster seats, and four times more likely to suffer a significant head injury.
- Although abdominal injuries were relatively rare, preschoolers in seat belts suffered the only significant abdominal injuries in the study population.

POLICY IMPLICATIONS

To further reduce child occupant injuries, the simple message of “Buckle Up!” is no longer sufficient. This study documents significant misuse of car seats, and the danger posed by premature use of adult seat belts in young children. Enhanced protection of these children will require evidence-based improvements in engineering, education, and legislation.

- In response to misuse of car seats, the National Highway Traffic Safety Administration has recently mandated that by 2002, all passenger cars must have top and lower anchors to which car seats can be attached in a simple, uniform way. This engineering advance should greatly reduce misuse related to the attachment of the car seat to the vehicle. In an effort to continue a dialogue with industry to improve design and use of child restraints, PCPS researchers presented their findings to engineers and representatives of motor vehicle manufacturers, child restraint manufacturers, and vehicle restraint system suppliers in May 2000.
- Public education to promote booster seats is needed. Recently, Ford Motor Company, Nickelodeon, Hertz, and a coalition of partners announced the Boost America! campaign, designed to increase the use of booster seats in children ages 4-8. The campaign will include educational materials targeted to preschools, elementary schools, day care centers, and pediatricians’ offices. As part of the program, Ford will give away one million booster seats, half to low income families. The popular character “Blue” from Nickelodeon’s “Blues Clues” will be used to appeal directly to children.

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POLICY IMPLICATIONS

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- By 1985, all 50 states and the District of Columbia had adopted laws mandating that young children be secured in car seats. While these laws have increased restraint usage, they often fail to conform to the current restraint guidelines. For example, some states permit children as young as 2 years to be restrained in a seat belt if the child is in the rear seat, while other states have no restraint requirements for the rear seat. In most states, children older than 4 are covered by seat belt laws, not child restraint laws.
- Model state legislation has been proposed to promote uniform application of current child-restraint guidelines. Washington state recently enacted the most comprehensive child restraint law in the nation, which will go into effect in July 2002. It is the first state to mandate that children be placed in booster seats, once they have outgrown car seats, until they are 6 years old or 60 pounds.

This Issue Brief is based on the following articles: F.K. Winston, D.R. Durbin, M.J. Kallan, E.K. Moll. The Danger of Premature Graduation to Seat Belts for Young Children. Pediatrics, June 2000, vol. 105, pp. 1179-1183; Partners for Child Passenger Safety, Interim Report. May 2000; F.K. Winston, D.R. Durbin. Buckle Up! Is Not Enough: Enhancing Protection of the Restrained Child. JAMA, June 9, 1999, vol. 281, pp. 2070-2072. For more information, visit www.traumalink.chop.edu.

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