

The Danger of Premature Graduation to Seat Belts for Young Children

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ABBREVIATIONS

MVC	motor vehicle crash
CRS	child restraint systems
CSS	child safety seats
AIS	Abbreviated Injury Scale
RR	relative risk
CI	95% confidence interval

FROM ABSTRACT

Objective.

To determine the risk of significant injury associated with premature graduation of young (2- to 5-year-old) children to seat belts from child restraint systems (CRS).

Background.

Advocates recommend use of child safety seats for children younger than age 4 and booster seats for children age 4 and older.

Despite these recommendations, many children are prematurely taken out of these child restraints and placed in seat belts.

Although data exist to support the use of child restraints over nonrestraint, no real-world data exist to evaluate the risk of significant injury associated with premature use of seat belts.

Design/Methods.

Partners for Child Passenger Safety includes a child-focused crash surveillance system based on a representative sample of children ages 0 to 15 years in crashes involving 1990 and newer vehicles reported to State Farm Insurance Companies in 15 states and the District of Columbia.

Driver reports of crash circumstances and parent reports of child occupant injury were collected via telephone interview using validated surveys. Results were weighted based on sampling frequencies to represent the entire population.

Results.

Between December 1, 1998, and November 30, 1999, 2077 children aged 2 to 5 years were included and were weighted to represent 13,853 children.

Among these young children, 98% were restrained, but nearly 40% of these children were restrained in seat belts.

Compared with children in CRS, children in seat belts were more likely to suffer a significant injury (relative risk: 3.5).

Children in seat belts were at particular risk of significant head injuries (relative risk: 4.2) when compared with children in CRS.

Conclusions.

Premature graduation of young children from CRS to seat belts puts them at greatly increased risk of injury in crashes.

A major benefit of CRS is a reduction in head injuries, potentially attributable to a reduction in the amount of head excursion in a crash.

THESE AUTHORS ALSO NOTE:

“Motor vehicle crashes (MVCs) are the leading cause of death and acquired disability for children older than age 1.”

In 1998, 697 children younger than age 6 years died as occupants in MVCs and nearly 100,000 were injured.

The current recommendation for appropriate child restraint is:

- (1) Infant and convertible child safety seats (CSS) for children younger than age 4.
- (2) Booster seats for children from age 4 until they fit properly in the vehicle seat belt (usually age 9).

Despite these recommendations, many preschoolers are prematurely taken out of these child restraints and placed in seat belts.

The purpose of this study was to quantify the nature and risk of significant injury associated with premature graduation to seat belts in preschool-aged children.

METHODS

Data were collected from State Farm Insurance Companies in 15 states and the District of Columbia.

For each child occupant the State Farm information was coupled with information concerning:

- (1) Seating position (eg, front row, right passenger position)
- (2) Restraint use (restrained versus unrestrained)
- (3) Restraint type (child safety seat, booster seat, lap only seat belt, lap/shoulder seat belt)

Injury assessment by body region and severity was based on the Abbreviated Injury Scale (AIS) system, which is the most widely used severity scoring system based on anatomic injury data.

The AIS rates the severity of an injury from 1 (eg, contusions and minor lacerations) to 6 (uniformly fatal) for each of 7 body regions.

Significant injuries were defined as AIS 2 or more, and included concussion and more severe brain injuries, internal organ injuries, and most fractures.

RESULTS

Between 12/01/98, and 11/30/99, 56,053 State Farm crash claims involving 59,643 child occupants who met the inclusion criteria were assessed.

[One year, one insurance company that insures 20% of the market, and nearly 60,000 claims involving child occupants whom met the study inclusion criteria. Therefore a conservative rough estimate of the child MVC injury is 600,000 per year.]

Restraint usage among all children was 95%.

Most children than 8 years and older were in compliance with current recommendations (use of a seat belt).

Most children younger than age 3 were also in compliance with current recommendations (use of a child safety seat, rear-facing for infants).

"However, few children between 4 and 8 years of age were properly restrained for their age, because of their failure to use a booster seat."

"Booster seat use in our population peaked at age 3 (29% of 3-year-olds) and declined dramatically with each succeeding year so that <1% of children older than age 5 were restrained in booster seats."

APPROXIMATE COMPLIANCE WITH RECOMMENDED RESTRAINT USE:

Infant	70%	rear facing safety seat
1yr	82%	safety seat
2yr	90%	safety seat
3yr	50%	safety seat or bucket if over 40 lbs.
4yr	15%	booster
5yr	7%	booster
6yr	<1%	booster
7yr	<1%	booster
8yr	<1%	booster
9yr	92%	adult seat belt
10yr	95%	adult seat belt
11yr	92%	adult seat belt
12yr	91%	adult seat belt
13yr	90%	adult seat belt
14yr	90%	adult seat belt
15yr	85%	adult seat belt

Among 2-5-year-old children, restraint usage was 98%. [This does not mean they were restrained properly, but they were using a restraint].

19% of restrained children were using only the lap belt.

[This is bad because of jackknifing propensity in these children].

Among injured children, significant injuries occurred to all body regions with head injuries the most common (58% of all significant injuries).

Young children in seat belts were more likely to suffer a significant injury than young children in CRS, especially with respects to risk of significant head injuries.

The only significant abdominal injuries were found in 8 young children restrained in lap/shoulder belts, and, 3 of these children had placed the shoulder portion of the belt behind their backs. **[Don't let kids do that].**

DISCUSSION

"This study provides the first real-world evidence for an increased risk of injury in preschool-aged (2- to 5-year-old) children attributable to inappropriate restraint in vehicle seat belts rather than CRS."

"Despite high restraint usage, more than one-third of children in this age range were inappropriately restrained by vehicle seat belts."

"This inappropriate restraint resulted in a 3.5-fold increased risk of significant injury and a more than fourfold increased risk of significant head injury."

"These data bolster the recent emphasis on the proper restraint of children to prevent injuries in crashes, in particular the use of booster seats for children 4 years and older."

"A vehicle seat belt fits correctly when the lap portion of the belt rides low over the hips and is held in place by mature anterior superior iliac spines."

"A well-fit shoulder portion of the belt crosses the sternum and shoulder."

"Correct seat belt fit is not usually achieved until a child is 9 years old, the age at which the child's femur length is long enough for the child to sit against the back of the seat, the anterior superior iliac spines are sufficiently developed to anchor the belt, and the child's sitting height is sufficient for the shoulder belt to fit properly over the shoulder and sternum."

"By these guidelines, virtually no child younger than the age of 6 is large enough to be properly restrained in a seat belt."

"When a child is prematurely graduated to a seat belt from a CSS, the lap portion of the belt rides up over the abdomen and the shoulder portion crosses the neck or face."

"This places the child at risk for submarining or sliding out of the lap belt during a crash."

Also, jackknifing about an abdominal seat belt increases the risk of intraabdominal and spinal cord injuries, known as seat belt syndrome, and increases brain injury resulting from the impact of the head with the child's knees or the vehicle interior.

"Although abdominal injuries were not common, they only occurred in children in seat belts not those in CRS. Of note, the risk of injury was similar for children

in lap belts and lap/shoulder belts, suggesting that the addition of a poorly fitting shoulder portion of the belt offers no added protection for young children.”

A shield booster has a shield that crosses in front of the child to restrain the child's hips instead of using the vehicle seat belt. 50% of the booster seats used in this study were shield booster seats.

A belt- positioning booster, either with or without a high back, raises the child up to improve the fit of both the lap and shoulder portions of the seat belt.

Shield boosters are not recommended for use because the risk of submarining and ejection associated with their use.

Use of belt-positioning boosters rather than shield boosters would further reduce injury.

CSS with a loose fitting harness is misuse of the device, allowing excessive excursion of the child and increased head excursion with the potential for head injury.

CONCLUSIONS

“Premature graduation of young children from CRS to seat belts puts them at greatly increased risk of significant injury in crashes.”

“A major benefit of CRS is a reduction in head injuries, potentially attributable to a reduction in the amount of head excursion in a crash.”

“Results of this study support public health efforts directed toward ensuring appropriate restraint of children, particularly the use of belt-positioning booster seats by children who have outgrown CSS.”

“To reduce the risk of injury, children should remain in CSS until they are at least 4 years old and weigh 40 pounds (18 kg), at which point children should be placed in belt-positioning booster seats.”

“Children should remain in booster seats until they are the appropriate height and weight for seat belts.”

FROM DAN MURPHY

I believe that the major points from this article include:

- (1) Motor vehicle crashes (MVCs) are the leading cause of death and acquired disability for children older than age 1.
- (2) A conservative estimate of the child MVC injury is 600,000 per year.
- (3) Premature graduation of young children from CRS to seat belts puts them at greatly increased risk of significant injury in crashes, especially to the head.
- (4) Children should remain in CSS until they are at least 4 years old and weigh 40 pounds (18 kg), at which point children should be placed in belt-positioning booster seats.
- (5) Older children (4-9) should remain in booster seats until they are the appropriate height and weight for adult seat belts.
- (6) A correctly positioned seat belt rides low over the hips and is held in place by mature anterior superior iliac spines, and the shoulder portion of the belt crosses the sternum.
- (7) This correct seat belt fit is not usually achieved until a child is 9 years.
- (8) Children should not place the shoulder portion of a belt behind their back.
- (9) The popular shield booster seats are not recommended.
- (10) The use of belt-positioning boosters rather than shield boosters are best at reducing injury in 4-9 year olds.