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Child Passenger Safety

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FIRST IN AN OCCASIONAL SERIES ON CHILD PASSENGER SAFETY-RELATED ISSUES

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In Collaboration with

American Academy
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™



BELT-POSITIONING BOOSTER

SEAT BELT ALONE

This simulation depicts a 6-year-old in a 35 mph frontal crash restrained in a belt-positioning booster seat versus a seat belt alone. Note the dramatic forward excursion of the seat-belted child.

The FORGOTTEN CHILD

Children
Who Move
to Seat Belts
Too Soon

Motor vehicle crashes remain the leading cause of death and acquired disability for children between the ages of 4 and 8 years. Safety advocates call this group the "Forgotten Child" because, until recently, public policy did not adequately protect them. As of April 2004, nearly half of state laws require child restraints only through age 4. The American Academy of Pediatrics and the U.S. National Highway Traffic Safety Administration have long recommended belt-positioning booster seats for children who have outgrown child safety seats with harnesses, but state laws have led many parents to believe that seat belt restraint is sufficient once the child reaches 4 years. Many parents are not aware of the importance of belt-positioning booster seats in protecting their children. *Story continues on Page 3*



driver's SEAT

CPS Issue Report: Belt-Positioning Booster Seats is the first in an occasional series of reports to be published by Partners for Child Passenger Safety (PCPS), a research partnership of The Children's Hospital of Philadelphia and State Farm® that collects data on children involved in crashes reported to State Farm.

PCPS has been publishing and presenting research relevant to belt-positioning booster seats since 1999. This report compiles PCPS's research, and that of other scientists, in order to present this body of work in a context relevant to the current public discourse on booster seats.

PCPS and the American Academy of Pediatrics join together for this first report to engage all pediatricians in the effort to transition children directly to booster seats from child safety seats and to keep them in booster seats until the adult seat belt can fit properly.

As Beth Ebel, M.D., M.Sc., M.P.H., FAAP, comments in "Barriers to Booster Seats" (Page 6), pediatricians played a major role in the movement to get infants and toddlers into appropriate child safety seats. Today, PCPS data show that more than 90 percent of children under age 4 are now using child safety seats.

Pediatricians need to extend their anticipatory guidance to address the unique safety needs of older children. Motor vehicles crashes remain the leading cause of death for children of every age group from age 2 to 14 in the United States.

The teaching tool located on Page 7 translates this report into simple messages and tips for parents and caregivers. The tool is designed for easy reproduction on the office photocopier.

PCPS has developed a multimedia Web site for parents that provides video, audio and text instruction on the basics of appropriate restraint and installation. You can refer parents to www.chop.edu/carseat. To explore other lines of research from the PCPS project, visit traumalink.chop.edu.

We appreciate your comments. If you would like to receive future *CPS Issue Reports*, please e-mail your mailing address to Suzanne Hill at hillsu@email.chop.edu. Reports can be downloaded from <http://traumalink.chop.edu>.

Sincerely,
the PCPS research team

DATA SOURCES

National Highway Traffic Safety Administration. *Fatality Analysis Reporting System*. Online at www.nhsta.dot.gov.

Winston FK, Chen IG, et al. "Recent Trends in Child Restraint Practices in the United States." *Pediatrics*. May 2004.

Nance ML, Lutz N, et al. "Optimal Restraint Reduces the Risk of Abdominal Injury in Children Involved in Motor Vehicle Crashes." *Annals of Surgery*. Jan 2004.

Durbin DR, Elliott M, et al. "Belt-positioning Booster Seats and Reduction in Risk of Injury Among Children in Vehicle Crashes." *JAMA*. June 4, 2003.

Ebel BE, Rivara FP, et al. "Too Small for a Seat Belt: Predictors of Booster Seat Use By Child Passengers." *Pediatrics*. April 2003.

Ebel BE, Rivara FP, et al. "Use of Child Booster Seats in Motor Vehicles Following a Community Campaign." *JAMA*. Feb 19, 2003.

National Highway Traffic Safety Administration. "A National Strategy: Increasing Booster Seat Use for 4- to 8-year-old Children." U.S. Dept of Transportation. Oct 2002.

Simpson EM, Winston FK, et al. "Barriers to Booster Seat Use and Strategies to Increase Their Use." *Pediatrics*. Oct 2002.

Durbin DR, Arbogast KB, et al. "Seat Belt Syndrome in Children: A Case Report and Review of the Literature." *Pediatr Emerg Care*. Dec 2001.

Rivara FP, Bennett E, et al. "Booster Seats For Child Passengers: Lessons for Increasing Their Use." *Injury Prevention*. July 2001.

Winston FK, Durbin DR, et al. "The Danger of Premature Graduation to Seat Belts for Young Children." *Pediatrics*. June 2000.

Automotive Coalition for Traffic Safety. "Blue Ribbon Panel II: Protecting Our Older Child Passengers" Mar 1999. Online at www.actsinc.org.

ART SOURCES

Partners for Child Passenger Safety, The Children's Hospital of Philadelphia – Front cover and Pages 3-6.

Transportation Safety Training Center, Virginia Commonwealth University – Page 7.

National SAFE KIDS Campaign – Back cover.

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American Academy
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

Belt-positioning booster seats have been around since the 1970s. Today, there are more than 40 different models. Most are readily available for purchase at stores carrying juvenile products and via the Web. Prices range from as low as \$20 for a basic backless booster, to more than \$200 for a combination child safety seat/belt-positioning booster seat with extra features. Despite affordable options, approximately 62 percent of children ages 4 to 8 in the United States remain restrained in only adult seat belts, putting them at unnecessary risk of injury and death.

“It is devastating for me, as a pediatric surgeon and father, to tell a family that their child has been seriously injured or killed in a motor vehicle crash,” says Michael Nance, M.D., FACS, FAAP, surgeon and director of the Pediatric Trauma Program at The Children’s Hospital of Philadelphia. “I know that in many cases, the tragedy could have been prevented by proper use of restraints.”

Approximately 1.5 million children are passengers in automobile crashes every year in the United States. In 2002, more than 400 U.S. children between the ages of 4 and 8 were killed and an additional 71,000 were injured in motor vehicle crashes. Of those injured, 7,316 sustained incapacitating injuries.

Seat Belt Syndrome-related Injuries



▲ Intestine contusion

▶ Splenic laceration

Experts agree that belt-positioning booster seats are extremely effective at preventing serious injury to children in crashes by correctly positioning the adult lap and shoulder seat belt over an older child. In fact, the risk of injury is lowered by 59 percent compared to seat belts used alone. (See article on Page 4.)

“While any restraint is better than no restraint at all, we know that a booster seat provides optimal protection,” states Marilyn Bull, M.D., FAAP, medical director of the Automotive Safety Program at Riley Children’s Hospital at Indiana University. “A booster positions a child so that the belt fits his anatomy more like it would fit an adult’s anatomy.” Most children are between 9 and 13 years old before they grow into the height range in which seat belts achieve a safe fit, says Dr. Bull.

Properly fitting seat belts provide excellent protection in a crash. The lap portion fits low on the hips and is held in place by the anterior superior iliac spines. The shoulder portion crosses the middle of the shoulder and the sternum, thus taking advantage of the human body’s bony structures to help absorb crash forces.

When children are prematurely transitioned into adult seat belts, the lap portion of the belt rides up over the soft abdomen and the shoulder portion crosses the neck or face, causing many children to place the shoulder belt behind them or under their arm.

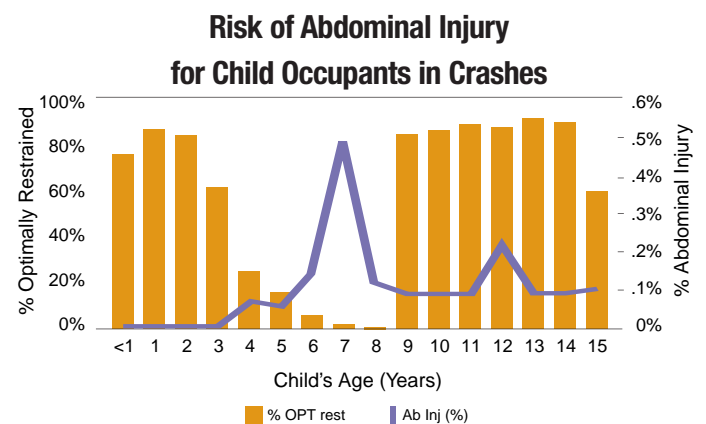
Seat Belt Syndrome

In a 2000 *Pediatrics* study, Partners for Child Passenger Safety (PCPS), an on-going research study at The Children’s Hospital of Philadelphia in partnership with State Farm®, confirmed that in real-world car crashes involving children there was a sudden drop in appropriate restraint use beginning at age 3. By age 6 few children remained in child restraints or booster seats. “Children were prematurely graduated to adult seat belts,” says Flaura K. Winston, M.D., Ph.D., FAAP, principal investigator for PCPS. “This put them at significantly increased risk of injury when compared to appropriately restrained children.”

Children in a 2001 PCPS study who were suboptimally restrained were at greatest risk for a constellation of injuries known as “Seat Belt Syndrome,” a pattern of intra-abdominal and spinal injuries, as well as lower extremity injuries.

In a recent analysis of abdominal injuries for *Annals of Surgery*, Dr. Nance and the PCPS researchers looked at a study population of 204,028 restrained child occupants involved in motor vehicle crashes. Among this restrained group, 59 percent were optimally restrained in age- and size-appropriate restraints. Forty-one percent were not in optimal restraints.

The lowest optimal restraint use was recorded for children from ages 4 to 8. In this age group, children with suboptimal restraint were more than three times as likely to sustain an abdominal injury than optimally restrained children. There were no reported abdominal injuries among the optimally restrained children (those using the belt-positioning booster seats). This was good news to Dr. Nance, a pediatric trauma surgeon busy caring for these serious injuries.

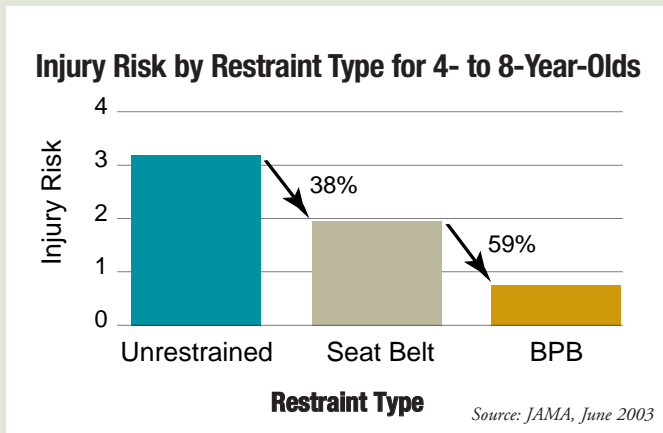


Percentage of child occupants optimally restrained (left-hand axis) by age and percentage of children with an abdominal injury (right-hand axis) by age.

Source: *Annals of Surgery*, January 2004

Belt-positioning booster seats lower the risk of injury to children in crashes by 59 percent compared to the use of vehicle seat belts alone. This finding comes from a study of children ages 4 through 7 by Partners for Child Passenger Safety (PCPS).

The study, published in the June 2003 issue of the *Journal of the American Medical Association*, provides the first real-world evidence of the added safety benefits of belt-positioning booster seats compared with seat belts alone. In addition, the study demonstrates that proper positioning of the belt by booster seats virtually eliminates injuries associated with seat belt syndrome, including injuries to the abdomen and spine. In contrast, children in the study who were restrained in seat belts alone suffered injuries to every body region.



“Now that we have quantified the significant effectiveness of booster seats for children through age 7, I recommend parents and legislators make booster seat use common practice,” states Dennis Durbin, M.D., M.S.C.E., FAAP, the study’s lead author and a pediatric emergency physician at The Children’s Hospital of Philadelphia. “Parents need to transition children from child safety seats directly to booster seats and keep them in booster seats until the lap/shoulder belt fits properly in order to provide optimal safety.”

PCPS conducted in-depth analyses on 4,243 children ages 4 through 7 who were in crashes reported to State Farm from 1998 through 2002. The PCPS data demonstrate that belt-positioning booster seat use, while on the rise, remains quite low. Overall, only 16 percent of 4-year-olds, 13 percent of 5-year-olds, and 4 percent of 6- and 7-year-olds were using booster seats during the time of the study.

Belt-positioning boosters are much easier to use than the child safety seats used for younger children. The booster seat is placed on the vehicle seat without attachment to the vehicle. The child sits on the booster and the vehicle’s lap and shoulder belt are pulled over the child and buckled. A parent should check to see if the shoulder belt is positioned properly over the child — across the middle of the shoulder and sternum — and that the lap belt fits low and tight on the hips touching the thighs and not over the abdomen. If the belt does not fit well while a child is in a booster seat, parents should be referred to the vehicle and booster seat instruction manual as well as PCPS’s interactive Web site — www.chop.edu/carseat.

UPWARD trend

Booster Seat Use Shows Promise

More than ever, parents are willing to extend the number of years they keep their children in child restraints. The PCPS study first documented a rapid increase in booster seat use in the December 2001 issue of *Pediatrics*. Since then, more recent data from the same research project suggest that, with continued educational emphasis, booster seat use may become the norm rather than the exception.

PCPS has been following child restraint use trends since 1998. “Among 4- to 8-year-olds, we have seen belt-positioning booster seat use increase from a low of 3.4 percent in 1998 to 16 percent at the end of 2002,” states Flaura K. Winston, M.D., Ph.D., FAAP, principal investigator of the study. Optimal restraint use has quadrupled for the forgotten child in just four years.

“This rapid increase over such a short period of time indicates a heightened interest and acceptance among parents to optimally restrain their older children,” says Dr. Winston. “Parents appear more receptive to booster seat legislation and other educational efforts.”

The biggest boost has occurred for 5- and 6-year-olds. For that age group, usage rates increased from 1.6 percent to 22 percent in four years. Further good news relates to child safety seat use: more parents are appropriately delaying the transition from child safety seats to belt-positioning booster seats. This is now occurring at an average age of 4 rather than age 3.

Extensive promotion of key findings from the Partners study, as well as educational outreach efforts of the American Academy of Pediatrics, National Highway Traffic Safety Administration, and National SAFE KIDS Campaign, among others, and the debate and publicity surrounding state booster legislation helped to spur the increases in booster seat use.

Dr. Winston cautions that PCPS only looks at children in crashes involving State Farm® insured vehicles. In comparison to the general U.S. population, this population may have an increased awareness of booster seats due to State Farm’s own educational efforts directed at its policyholders. Thus, usage rates may be higher than the actual national average.

The experts agree. The evidence is conclusive.

OLDER CHILDREN WHO HAVE OUTGROWN THEIR CHILD SAFETY SEATS NEED TO USE BELT-POSITIONING BOOSTER SEATS UNTIL THE ADULT SEAT BELT FITS CORRECTLY. SO WHY AREN'T MORE FAMILIES USING THEM?

A group of researchers from Harborview Injury Prevention and Research Center addressed this phenomenon in their local King County, Wash. community. In the July 2001 issue of *Injury Prevention*, they explained that the major reasons for non-use of booster seats involved the parental misconception that their child was large enough for a lap/shoulder belt system. “Parents seemed to be relying on information they received at earlier visits to physicians when their child was an infant or young toddler. They had not updated themselves with information relevant for a 4- to 8-year-old,” says Beth Ebel, M.D., M.Sc., M.P.H., FAAP, the study’s lead author.

This general lack of understanding about the purpose and benefits of booster seat use and the risks of injuries from seat belts was confirmed in a later study at The Children’s Hospital of Philadelphia. Researchers conducted in-depth focus groups and telephone interviews with parents and with booster-age children to gain an understanding of their child restraint-use behaviors and their perceived barriers to using proper restraint.

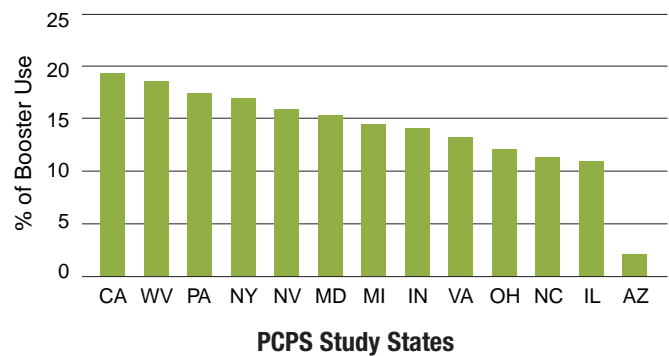
The study, published in the October 2002 issue of *Pediatrics*, found that lack of knowledge was only one of several barriers that hinder parents from following best practices for child passenger safety.

“One key difference between parents who use booster seats and parents who use seat belts for their children is negotiability,” says Flaura K. Winston, M.D., Ph.D., FAAP, a study author and scientific director of TraumaLink: The Interdisciplinary Pediatric Trauma Research Center at The Children’s Hospital of Philadelphia. “Parents who used booster seats drew a distinction between safety, which was non-negotiable, and child actions like eating habits and naps, which were negotiable. For these children, booster seats were accepted as the only option.”

In contrast, parents who prematurely move their children into adult seat belts alone felt that a child’s resistance to booster seats played a major role in the decision to transition a child to a seat belt. For these parents, the advantage of booster seat use was outweighed by the potential protest-to-use by the child. Booster seat use was seen to be as negotiable as non-safety-oriented child actions.

Parents in Children’s Hospital’s study suggested that the development and enforcement of booster seat provisions within state child restraint laws, would be effective strategies to convince parents to use booster seats. Many parents who used seat belts to restrain their children justified their actions based on their state’s child passenger safety law.

Booster Seat Use by State in 2002



Source: Partners for Child Passenger Safety

“Clearly, standardized child passenger safety awareness programs and upgraded state child restraint laws would do much to eliminate parents’ confusion and misperceptions regarding booster seats,” says Dr. Winston.

Harborview researchers recommend that public education messages be tailored to both parents and children — emphasizing the better behavior of restrained children, better visibility offered to children and risks of injury to children inadequately restrained. Harborview researchers published findings of a randomized-controlled trial in the February 2003 issue of *JAMA*, demonstrating that a multifaceted community education campaign with consistent messaging from trusted sources like healthcare providers, legislators and the media is effective at increasing booster-seat use.

“Pediatricians more than one decade ago were instrumental in promoting use of car seats for infants and toddlers,” says Dr. Ebel. “These same efforts should now be expended on promoting booster-seat use by young school-aged children.”

Teaching Tool for Family Counseling

A detachable sheet on Page 7 has been developed by the American Academy of Pediatrics and PCPS to provide an evidence-based teaching tool that can be easily copied for use in parent and caregiver education. Copying and distribution of this tool is permitted for educational purposes.

If your state has a provision for booster seats for older children, alert parents to this provision.

Contact the national AAP or your state chapter to help them keep national and state legislators focused on child passenger safety. If your state does not have a booster seat law, get involved with your chapter's efforts to pass legislation and maintain funding for CPS programs. You can contact the American Academy of Pediatrics Department of Federal Government Affairs at 800-336-5475 and the Division of State Government Affairs at 800-433-9016, ext. 7799. You can contact the National SAFE KIDS Campaign (www.safekids.org) to learn about coalitions in your state.

How to get INVOLVED

To learn more about the current child restraint law in your state, visit these sites:

www.saferoads.org
(Advocates for Highway and Auto Safety)

www.highwaysafety.org
(Insurance Institute for Highway Safety)

Partners for Child Passenger Safety has translated key research findings into easy-to-use legislative education tools. Visit traumalink.chop.edu and click on "downloads."

The AAP Division of State Government Affairs has booster seat advocacy materials available on its AAP Members Only Channel Page (www.aap.org/moc - then click on "State Government Affairs.")

CLOSING THE GAP between current science and public policy

During the past few years, the highway safety and child safety community's attention has been directed at the "forgotten child" (ages 4 to 8) in an attempt to close the gap in public policy that has left this segment of the population vulnerable in car crashes.

A 1997 government report showed that more than half of child occupants ages 4 through 7 who were killed in crashes were totally unrestrained. For fatalities of restrained children, most were restrained in ill-fitting adult seat belts rather than recommended child restraints and belt-positioning booster seats.

"The implication from this report was that we, as a nation, needed to get older kids restrained and get them restrained appropriately in order to prevent or lessen the severity of these tragedies," states Alexander "Sandy" Sinclair, an outreach planning manager for the National Highway Traffic Safety Administration (NHTSA) and NHTSA's liaison to the AAP Committee on Injury, Violence and Poison Prevention.

In 1999, U.S. Transportation Secretary, Rodney Slater, and Ricardo Martinez, M.D., then Administrator of NHTSA, convened a blue-ribbon panel entitled "Protecting Our Older Child Passengers," that recommended strengthening laws and enforcement, building proven education programs, developing better testing standards and field performance testing and surveillance research to improve product design. In a relatively short time, much progress has been made on many of these elements.

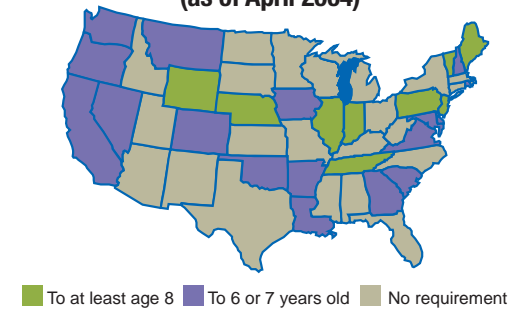
One year later, Partners for Child Passenger Safety began to publish its research in peer-reviewed literature, providing advocates with a springboard for action — scientific evidence to help support their efforts to upgrade 20-year-old state child restraint laws to include booster seat provisions for older children.

PCPS confirmed that child restraints provided significant benefits compared to seat belts for children between the ages of 2 through 5 in the June 2000 issue of *Pediatrics*. Three years later, the effectiveness of booster seats for children 4 through age 7 was confirmed in the June 2003 issue of *JAMA*. Mechanisms of injury, types of injury and restraint use trends have also been described in the PCPS research, providing valuable information for policymakers and industry.

Two federal laws, enacted in 2000 and 2002, mandate improvements to federal standards for child restraints and also require the installation of lap/shoulder belts in the center rear seat by 2005. (Note: belt-positioning booster seats cannot be used with lap-only restraints.)

The first state booster seat law, passed in the state of Washington in late 2000 and implemented in 2002, triggered a wave of booster-seat legislation across the country. As of April 2004, 26 states and the District of Columbia have closed gaps in their child occupant restraint laws to include children ages 4 and older. However, only nine states require children to use booster seats to at least age 8. (See chart.)

**26 Booster Seat Laws Passed
(as of April 2004)**



Public policy is steadily catching up to the current science in measured steps. With each state law debated and passed, significant numbers of parents are learning about the need to protect their older children in car crashes by using belt-positioning booster seats. Trend data from PCPS show consistent and significant jumps in booster seat use.

"Evidence-based legislation free of loopholes — supported by enforcement and consistent public education messages — will likely result in a significantly lower number of fatalities and injuries among older child passengers," says Carol Berkowitz, M.D., FAAP, president-elect of the AAP. Legislative efforts, beginning in the 1980s, resulted in child restraint requirements for very young children in all 50 states. Traffic-related fatalities for children younger than 5 years of age dropped by 30 percent between 1994 and 2002.

"The challenge will be to keep policymakers focused on child passenger safety until the job is done," states Judith Stone, president of Advocates for Highway and Auto Safety. Half of the country has yet to upgrade state child restraint laws. Many states that did upgrade laws stopped short by requiring child restraints only until age 6. Gaps still remain for the "forgotten child."

FOR YOUR family

Belt-positioning Booster Seats: *Easy to Use, Affordable and Safe*

When your child reaches the top weight or height for his child safety seat, his shoulders are above the harness slots or his ears have reached the top of his child safety seat, he needs a booster seat. A booster seat raises your child up so that the vehicle's lap/shoulder belt fits him correctly.

How do you use a booster seat?

- Read the booster seat and vehicle user manuals.
- Place the booster seat in the back seat in a position with a lap/shoulder belt. Never use a booster seat if there is only a lap belt.
- After your child sits in the booster, pull the lap/shoulder belt across him and buckle the seat belt.
- Check to see if the belt crosses the shoulder between the neck and arm and that the lap belt is low and snug on the hips, just touching the thighs.



What type of booster is best?

- High-back boosters and backless boosters both make the seat belt fit correctly. However, if the back seat of your car does not have head rests or a high seat back, you need to choose a high-back booster seat.
- Prices start at \$20 for a backless booster. More expensive seats are not necessarily safer.

How effective are boosters? Why aren't seat belts good enough?

- Belt-positioning boosters are safest for your school-age child in a crash. Any restraint is better than no restraint, but boosters are 60 percent safer than seat belts alone. In a crash, poor-fitting seat belts can result in serious injury to a child's abdomen, neck and head.
- Seat belts are made to fit adults. Until your child is big enough, he needs a boost.

What to do if your child says, "But I'm a big kid now!"

- Tell your child that the car will not move until everybody is buckled up correctly.
- Let your child select his booster seat, and teach him how to buckle himself up.
- Show your child that the booster will let him see out the window better and help make the seat belt comfortable.
- Tell your child that boosters are for "big kids." Don't call a booster seat a child's seat.



When is it safe to move my child from his booster seat to an adult seat belt?

Your child should stay in a booster seat until the adult seat belt fits — usually when he is about 4'9" in height and is 8 to 12 years old. The seat belt fits properly when:

- The shoulder belt lies across the chest, not the neck or face.
- The lap belt is low and snug across the thighs, not across the stomach; and
- The child is tall enough to sit against the vehicle seat back with his legs bent at the knees and feet hanging down.

The information contained in this publication should not be used as a substitute for the medical care and advice of your pediatrician. There may be variations in treatment that your pediatrician may recommend based on individual facts and circumstances.

- ▶ Detachable Teaching Aid
 - ▶ Intervention and Public Policy
 - ▶ Current Research
 - ▶ Historical Perspective
 - Belt-positioning Booster Seats**
- Inside this Issue:*

ISSUE NO. 1, JULY 2004

Partners for Child Passenger Safety
The Children's Hospital of Philadelphia
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CPS Issue Report

BELT-POSITIONING Booster Seats



High back booster seat

A combination seat or a belt-positioning booster seat should be used when the child has outgrown a convertible safety seat but is too small to use the vehicle's safety belts. Vehicle safety belts are better than no restraint at all, but are not optimal until the shoulder belt can be positioned across the chest and shoulder with the lap belt low and snug across the thighs; the child should fit against the vehicle's seat back with his or her feet hanging down when the legs are bent at the knees. A belt-positioning booster seat should be used until the vehicle safety belt fits well. *AAP Policy Statement "Selecting and Using the Most Appropriate Car Safety Seats for Growing Children: Guidelines for Counseling Parents," Pediatrics, Volume 109 No. 3, March 2002, pp. 550-553.*

Combination booster seat



Backless booster seat