



Interim Report 2000

## Partners for Child Passenger Safety

**M**otor vehicle crashes remain the leading cause of death and acquired disability in children over age 1 in the United States.

In an effort to improve this situation, The Children's Hospital of Philadelphia joined with State Farm Insurance Companies and the University of Pennsylvania in 1997 to create the first comprehensive investigation of how and why children are injured or killed in crashes: The Partners for Child Passenger Safety Study. Now in its fourth year, the study remains the largest single research project in the country devoted exclusively to pediatric motor vehicle injury.

For more than a decade, safety advocates have stressed the use of appropriate child restraints, including car seats, booster seats and seat belts, to protect children in motor vehicle crashes. However, findings to date from the Partners for Child Passenger Safety study show that an overwhelming number of children continue to be unrestrained or inappropriately restrained in vehicles. One of this year's most significant findings is that the number of appropriately restrained children declines drastically between the ages of 3 and 8. Many of these children, who should be using car seats or belt-positioning booster seats, are instead being inappropriately graduated to the adult seat belt. Through these findings, the Partners study has helped bring the promotion of appropriate restraint use for all children to the forefront of the national agenda on child passenger safety.

### *Partners for Child Passenger Safety*

State Farm Insurance Companies  
The Children's Hospital of Philadelphia  
Neighbors working together





## Research Team

Partners for Child Passenger Safety is led by a multidisciplinary research team of internationally recognized experts in medicine, biomechanics, engineering, health education, advocacy and behavioral science and overseen by an internationally represented advisory board. By including such a wide array of disciplines, the research team has ensured that the results of the study will be applicable to the broadest possible audience who can effect change. The co-principal investigators from The Children's Hospital of Philadelphia, Flaura Koplin Winston, M.D., Ph.D., and Dennis Durbin, M.D., M.S.C.E., are considered world leaders in the field of child occupant protection. Dr. Winston is a pediatrician, engineer, clinical researcher and director of TraumaLink: The Interdisciplinary Pediatric Injury Control Research Center at The Children's Hospital of Philadelphia. She is also an assistant professor of pediatrics at the University of Pennsylvania School of Medicine. Dr. Durbin is a pediatric emergency medicine physician at Children's Hospital, and a clinical epidemiologist and assistant professor of pediatrics at the University of Pennsylvania School of Medicine.

Research team members have been asked to serve on national and international committees on child occupant protection and invited to present their findings at numerous medical, engineering and advocacy meetings including the American Academy of Pediatrics, the American Public Health Association and various meetings held by the Society of Automotive Engineers. Findings from the Partners study have been published in many prestigious academic and scientific journals, including the *Journal of the American Medical Association*, *Pediatrics* and *Archives of Pediatrics & Adolescent Medicine*.

The research team is consulted regularly by leading governmental agencies on issues related to child passenger safety and the Partners study. In the past year they have presented findings on the effectiveness of child safety seats to the National Highway Traffic Safety Administration; the incidence of child safety seat misuse to the National Transportation Safety Board; and the prevalence of child occupant injuries to the Japan Traffic Welfare Association.

In recognition of the importance of the Partners study, Drs. Winston and Durbin were honored by Advocates for Highway and Automotive Safety with the prestigious Highway Safety Hero award.

## Study Design

The Partners study is unprecedented in size and scope. Using child-focused, state-of-the-art methodologies, including crash database analysis, in-depth telephone interviews, on-site crash investigations and computer crash simulations, the research team is using new data to answer old questions and asking new questions using tools created specifically for this purpose.

Unlike the majority of child occupant research to date, the Partners study examines the entire range of crash and injury severity, from the most minor to the most severe. This unique approach allows the research team to identify not only what injuries children are sustaining, but also the factors that influence why they are injured in some crashes but not in others. Previous studies have been of limited value in exploring these issues, due to the relatively small number of children—particularly uninjured children—included, and the lack of child-specific data collected.

The unique study design also allows for near real-time crash investigation and analysis, enabling the research team to study the impact of rapidly changing automotive technology.

## Project Impact

The primary objective of the Partners study is to dramatically augment what is currently known about child passenger safety. As a result of this study, the research team is gaining a new understanding of how child occupant injuries relate to specific characteristics of the vehicle, the restraint system (including use and misuse), the crash dynamics and the child.

The information being collected has great potential to influence the safer design of vehicles, child restraints and restraint systems, and even pediatric trauma care. These results are being shared with medical providers, automobile and restraint manufacturers, public policy makers, legislators, advocates and parents, who can use the findings as a springboard for action to protect child passengers.

“The data and documentation of circumstances surrounding child passenger safety practices and injury outcomes in this study is unique, and helps build the case in legislatures, indeed throughout society, for better protection of children in motor vehicles.”

—Judith Lee Stone, President,  
Advocates for Highway and Auto  
Safety and Partners for Child  
Passenger Safety Advisory Board  
member



## New Findings from the Partners for Child Passenger Safety Study

Each day, the Partners for Child Passenger Safety research team collects data, with privacy safeguards in place, from State Farm Insurance Companies on nearly 200 children in crashes in 15 states and the District of Columbia—that translates nationally into 240,000 State Farm-insured children under age 16 involved in crashes each year.

### How are children being restrained?

**Thirty percent of infants are incorrectly turned forward facing in their car seat before 1 year.**

According to best practice, children should be restrained in the back seat in a rear-facing car seat until 1 year of age AND 20 pounds.

Infants should ride rear facing because the back of the car seat will support their head, neck and back and prevent spinal cord injuries in a frontal crash. It is also important for infants to ride semi-reclined at a 45 degree angle to keep their heads from pitching forward, which could potentially close off their airways.

**Twenty-nine percent of 3-year-olds are inappropriately graduated from car seats to booster seats and 16 percent of 3-year-olds are inappropriately moved from car seats to adult seat belts.**

According to best practice, 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 are inappropriately restrained in adult seat belts.**

According to best practice, children who have outgrown their car seats (usually around age 4 and 40 pounds) should move into belt-positioning booster seats until they are at least 4' 9" and 80 pounds, at which point the adult seat belt should fit them properly.

While seat belts are safer than no restraint at all, most children will not fit in them properly. Lap belts can ride up onto the abdomen, putting children at risk for intestinal, liver, spleen and spinal cord injury ("seat belt syndrome") in a crash. The shoulder belt can cross the neck, often causing children to place that portion behind their backs or under their arms. This decreases the seat belt's effectiveness and increases the risk of head and brain injury from children's heads striking their knees or the vehicle interior.

**Sixteen percent of children age 12 and under are inappropriately seated in the vehicle front seat.**

All children age 12 and under should ride in the back seat of the vehicle, not only to reduce their risk of injury from a deploying air bag, but also because children in the front seat are at greater risk of injury than those in the back.

### How are car seats being misused?

**Eighty-two percent of car seats are being misused in some way.**

Misuse lowers the effectiveness of car seats primarily by increasing the movement of a child's head in a crash, thereby increasing the likelihood of head and brain injury. The most common car seat mistakes are:

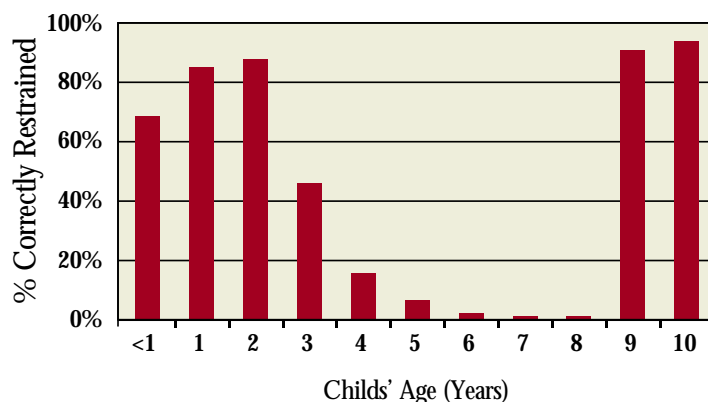
1. Failure to attach the seat tightly to the vehicle (the seat should move no more than one inch from side to side when pulled along the belt path).
2. Failure to fasten the harness tightly enough (only one finger should fit between the child's collarbone and the harness strap).
3. Failure to use the chest clip or using the chest clip incorrectly (if the manufacturer requires a chest clip, it should be positioned at armpit level).

**Three percent of children are riding in a car seat that is "grossly" misused.**

Gross misuse decreases a car seat's ability to protect a child in a crash. A car seat is "grossly" misused if one or more of the following mistakes are made:

1. The car seat is not attached to the vehicle.
2. The car seat harness is not fastened around the child.
3. A rear-facing car seat is placed in front of an airbag.
4. An infant-only car seat is used forward facing.

### Recommended Restraint Use



*Proper restraint use varies widely with age. Generally, parents do a good job of restraining children who are under age 3 and over age 8. However, as this graph shows, the number of appropriately restrained children drops significantly between ages 3 and 8. Many of these children, who should be using car seats or belt-positioning booster seats, are instead being inappropriately restrained in the adult seat belt.*

Through these data the research team has learned how children are being restrained, what type of injuries they receive and what they are likely to hit inside the vehicle during a crash. The following findings represent an in-depth analysis of 30,000 crashes involving 48,000 children of State Farm policyholders who consented to participate in the study between December 1, 1998 and November 30, 1999.

## What types of injuries are children sustaining?

**Fifteen percent of children involved in car crashes are injured in some way. Children who are not restrained are three times more likely to sustain a significant injury in a crash when compared to children who are restrained.**

Significant injuries include concussions and more serious brain injuries, fractures, severe lacerations and damage to the internal organs. Appropriate restraint is essential to reduce a child's risk of being seriously injured in a crash.

**Sixty-four percent of significant injuries sustained by children in a crash are to the head.**

Children do not heal as easily from brain injuries as they do from injuries to other parts of their bodies.

**Fifteen percent of children come into contact with something inside their vehicle during a crash (some children experience contact with multiple objects).**

These contact points include:

1. Back of seat in front of child—40 percent
2. Door or side panel or window—34 percent
3. Broken glass—20 percent
4. Loose object inside the vehicle—15 percent
5. Dashboard/windshield—13 percent
6. Another occupant—13 percent



## Conclusions

While the majority of children in the Partners for Child Passenger Safety study are restrained, they are not appropriately restrained for their age. In nearly half of all cases, restraint use and seating position do not conform to current best practice. Restraining children according to best practice is crucial to preventing head, brain and other devastating injuries. Auto manufacturers, car seat manufacturers, legislators, health educators, safety advocates, physicians and parents have made amazing strides over the past years in their efforts to protect children in crashes. However, our research is evidence that there is still much more to be done.

“The Partners for Child Passenger Safety study provides an important opportunity to focus attention on the particular characteristics, circumstances, and injury outcomes of children in motor vehicle crashes. This, in turn, should lead to improved protection for children in the future.”

—Sue Ferguson, Ph.D., Vice President,  
Insurance Institute for Highway Safety and  
Partners for Child Passenger Safety Advisory  
Board member



## Guidelines for Restraining Children According to Best Practice

**T**he back seat is generally the safest place for children. If your vehicle has a passenger air bag, it is essential for children age 12 and under to ride in the back seat. Infants should ride in a rear-facing restraint (either in an infant-only seat or a convertible seat used in the rear-facing position), until at least age 1 AND 20 pounds.

Children over age 1 AND 20 pounds should ride facing forward in a convertible car seat or in a forward-facing-only car seat.

Children between 40 and 80 pounds (usually from about ages 4 to 8) should be restrained in a belt-positioning booster seat with the vehicle's lap and shoulder belt.

The adult lap and shoulder belt system will not fit most children properly until they are at least 4' 9" and weigh at least 80 pounds. The lap portion of the belt must fit low and tight across a child's upper thighs and the shoulder portion of the belt should rest over the child's shoulder and across the chest. Children should never put the shoulder belt under their arms or behind their backs.

*Source: National Highway Traffic Safety Administration and American Academy of Pediatrics*

### Significant Injuries by Body Region

The majority of children who are significantly injured in crashes suffer injuries to their heads and brains.



**Head: 64%**

Face: 8%

Neck/Back/Spine: 6%

Upper Extremity: 8%

Chest: 3%

Abdomen: 6%

Lower Extremity: 5%

“The Partners project is a great example of what can happen when industry teams up with an academic institution. The results so far are phenomenal.”

—Susan Baker, M.P.H., Professor of Health Policy and Management, Johns Hopkins University and Partners for Child Passenger Safety Advisory Board member



Case #1



Case #2

## Crash Investigations

### A child's life is saved by her car seat

Two-month-old Elizabeth\* was on a family outing with her parents in the family's four-door sedan. A drunk driver was traveling in the wrong direction on the same road. Elizabeth's father, who was driving the family car, swerved to the left to avoid a head-on collision. Their car left the road, flipped onto its roof and skidded back across the road. Before coming to a complete stop, the family's car struck a station wagon and a cargo van. Still on its roof and sitting in the middle of the road, their car was stuck by a pick-up truck on the driver's side.

Elizabeth's father, who was restrained by a lap and shoulder belt and was in the direct path of the pick-up truck, was killed instantly. Her mother, presumably unrestrained because she was ejected from the car, was hospitalized for almost a month. Amazingly, Elizabeth, who was properly restrained in the back seat in a rear-facing car seat appropriate for her age and weight, received only minor cuts and bruises and was hospitalized overnight for observation.

This case demonstrates that a child in an age- and weight-appropriate, properly installed car seat can survive even the most severe and potentially deadly crash.

### Age-inappropriate restraint puts a child at risk

Five-year-old Jessica\* was traveling to the local mall with her 18-year-old brother in their parents' four-door sedan. Jessica's brother was proceeding through an intersection just a few blocks from their destination when another car ran a red light and hit the right front side of their car. Upon impact both cars rotated counter clockwise and "side-slapped" each other. Jessica's car continued to rotate and struck the left side of a pick-up truck. Both driver- and passenger-side airbags in her car deployed.

Jessica, who was sitting in the right front seat restrained by the car's lap and shoulder seatbelt, sustained a fractured skull, injuries to her brain and cuts and bruises to her abdomen. She was hospitalized for three days. Her brother, who was also wearing a lap and shoulder seatbelt, sustained minor cuts and burns from contacting the car's interior and air bag. He was treated at a local hospital and released that same day.

This case demonstrates the types of injuries children sustain when they are moved from their car seat directly into a lap and shoulder seat belt rather than into a booster seat. It is likely that had Jessica been in the back seat of the car in a belt-positioning booster seat she would have escaped this crash with injuries no more severe than those sustained by her brother.

*\* Children's names and identifying information have been changed to protect confidentiality.*

The results presented in this report are the interpretation solely of the Partners for Child Passenger Safety research team at The Children's Hospital of Philadelphia and are not necessarily the views of State Farm Insurance Companies.

Produced by

 The Children's Hospital of Philadelphia  
A pediatric healthcare network  
34th Street and Civic Center Boulevard  
Philadelphia, Pa. 19104-4399  
www.chop.edu

Partners for  
Child Passenger Safety  
State Farm Insurance Companies  
The Children's Hospital of Philadelphia  
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### Partners for Child Passenger Safety Advisory Board

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Safe Ride News Publication  
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Harlem Hospital,  
Columbia University  
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Prevention and Control,  
Centers for Disease Control  
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General Motors Safety and  
Restraint Center  
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Michael Finkelstein and  
Associates  
**James Nichols**  
Traffic Safety Programs,  
National Highway Traffic  
Safety Administration  
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Century Products  
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Riley Hospital for Children,  
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Center  
**France Legault, P.E.**  
Road Safety and Motor Vehicle  
Regulation Directorate,  
Transport Canada