The State of Child Occupant Protection

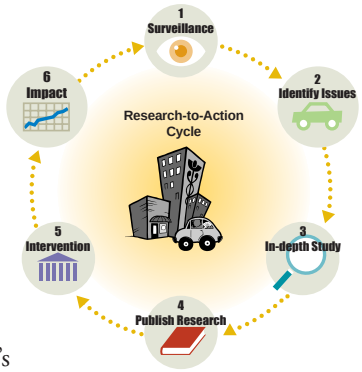
Interim Report
2003

Partners for
Child Passenger Safety
State Farm Insurance Companies
The Children's Hospital of Philadelphia
Neighbors working together

Monitoring Trends

In its fifth year of data collection, the Partners for Child Passenger Safety (PCPS) research team works simultaneously in each phase of the research-to-action-cycle with a continued focus on saving children from injury and death in motor vehicle crashes. The team has gone beyond identification and in-depth study of crashes involving children to development and implementation of interventions. Monitoring trends over time is a vital next step to evaluate the success of these efforts.

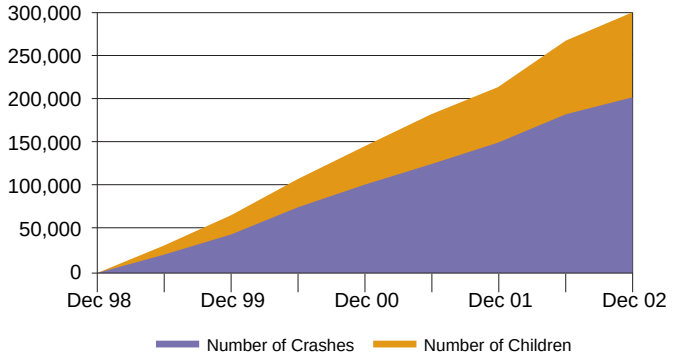
The field of child occupant protection has experienced a recent infusion of new technology, laws and targeted educational campaigns fueled, in part, by PCPS research findings. Further, there are approximately 4 million births in the United States each year. Each day, new parents learn about child passenger safety (CPS) issues for the first time.



PCPS' continued surveillance of children in automobile crashes serves as a unique national resource that helps set the agenda for improving the protection of children. Real-world current data provide a snapshot of how our nation's children fare in motor vehicle crashes, and in-depth engineering studies by the research team identify how their protection can be improved.

Recognizing the importance of continued monitoring, State Farm Insurance Companies® and The Children's Hospital of Philadelphia have renewed their commitment to child passenger safety by extending PCPS to at least 2005.

Nation's Largest Child-specific Crash Surveillance System



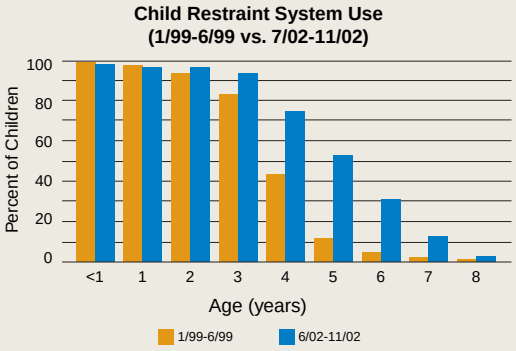
As of December 31, 2002, nearly 204,000 qualifying claims had been included in the PCPS study...that's more than 308,000 children!

INSIDE

Review current recommendations to optimize safety for child occupants.
See page 7

Surveillance: Trends 1999-2002

Four years of comprehensive surveillance data on children in motor vehicle crashes have provided PCPS researchers with a unique opportunity to analyze trends in child passenger restraint beginning in 1999 — its first full year of data collection. PCPS first shared surveillance data with the child passenger safety community in its 2000 Interim Report. PCPS can now compare its initial data with recent data from 2002.



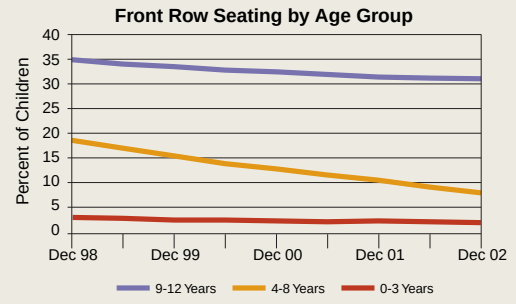
Child Safety Seat and Booster Seat Use

PCPS has seen a marked increase in child restraint system use for every year of age among 3-to 8-year-olds. By the end of 2002, 49 percent of children between the ages of 3 and 8 who were restrained were in child restraints as compared with 25 percent in early 1999. The transition from child safety seats to booster seats is more commonly occurring at age 4 rather than age 3. Booster seat use saw promising increases — particularly among children 5 and 6 years old.

IMPLICATION:

As a nation, we are moving toward optimal restraint of children in motor vehicles. Over the past five years, increased attention in the highway safety community has been directed toward public awareness about age-appropriate restraint. PCPS data have demonstrated that many parents are appropriately delaying the transition of children from child restraints to adult seat belts and keeping children in the recommended restraint for the child's age and weight.

Despite these gains, half of children between the ages of 3 and 8 are still inappropriately restrained in adult seat belts rather than in child restraints. If resources for child passenger safety programs are decreased, future gains may not be realized. Also, dangerous patterns of inappropriate restraint may re-emerge in new or existing families who do not receive a consistent safety message.



Front Row Seating

The vast majority of children who are less than 4 years of age sit in the rear seat; this has remained constant for the duration of the PCPS study. There has been a significant decrease in front row seating among 4-to 8-year-olds. One-third of children ages 9 to 12 years (who should be restrained in the rear seat according to current recommendations) sit in the front seat. This trend has not changed significantly since 1999. Overall, there has been a decrease in the percentage of children under age 13 years sitting in the front seat — from 17 percent in January 1999 to 12 percent in December 2002.

IMPLICATION:

Increases in age-appropriate restraint by 4-to 8-year-old children appear to be accompanied by increases in rear-seating. PCPS research has found that this combination — age-appropriate restraint and rear-seating — provides the best protection for children in most crashes. Educational messages regarding 4-to 8-year-olds should continue to emphasize both rear-seating and age-appropriate restraint. The continued practice of front row seating by a third of 9-to 12-year-olds points to the need to develop strategies to highlight the importance of rear-seating for this age group.

"Research projects like Partners for Child Passenger Safety play an important role in advancing our efforts to protect children involved in car crashes. Thanks to their work, we are now in a better position to understand injuries that children sustain when they are not properly restrained in motor vehicles.

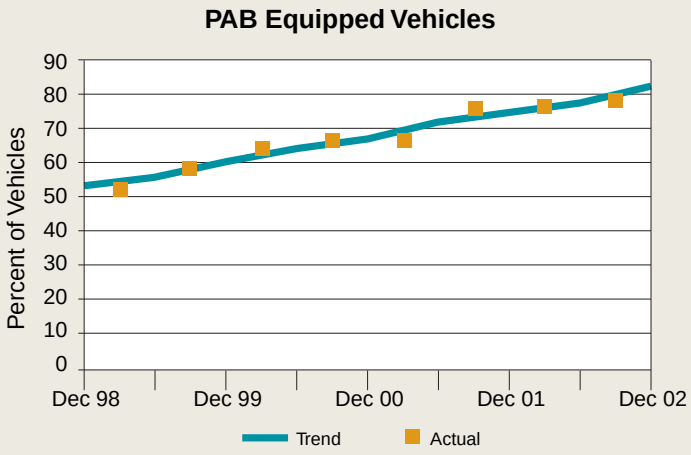
Norman Y. Mineta, U.S. Secretary of Transportation

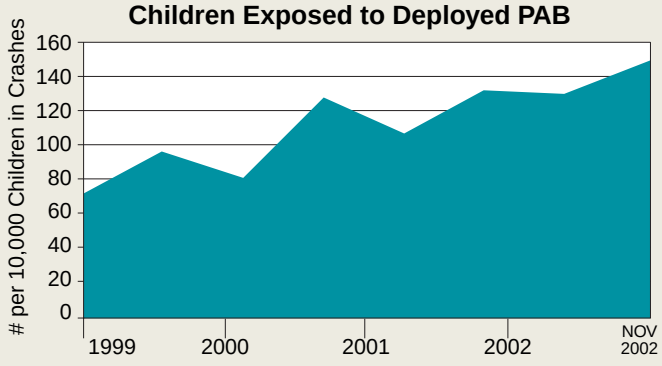
Airbag Exposure

In early 1999, approximately half of vehicles involved in PCPS crashes were equipped with passenger airbags (PAB). By the end of 2002, this number rose to 82 percent. That means the number of children at risk of exposure to PAB has increased. For example, in early 1999, for every 10,000 children in crashes, 73 children were exposed to an airbag deployment. By the end of 2002, this figure rose to 148 per 10,000 children.

IMPLICATION:

The rate of exposure of children to airbags doubled from early 1999 to late 2002. Although airbags reduce injuries to adults in crashes, PCPS research indicates that children who are exposed to airbags are twice as likely to be injured (see page 4). The need persists for continued education about improved design and regulation to decrease the risk of airbag-induced injuries in children.





Back issues of PCPS Interim Reports (2000-2002), fact sheets, study abstracts and details regarding previous research are available at traumalink.chop.edu.

"PCPS has provided our product development team with valuable biomechanical data on how children move in real-world car crashes. This helpful information has led to the development of improved child restraint design."

Kathleen Williams, President, Graco Children's Products

In-depth Study: Research Findings 2002-2003

Airbags and Risk of Injury

While the number of children killed by passenger airbags (PAB) has declined dramatically in recent years, PCPS data show that 1 of every 7 children exposed to a PAB sustained a significant injury.

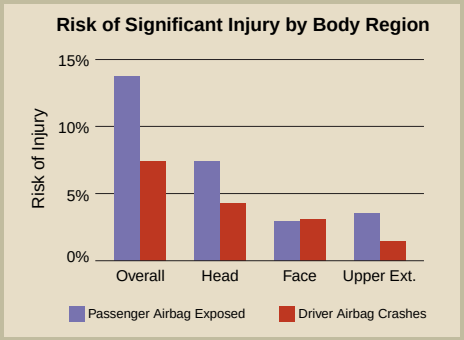
KEY FINDINGS:

- 12 percent of all children involved in motor vehicle crashes were riding in the front seat of a PAB-equipped vehicle, thus at risk of exposure to an airbag.
  - 8.5 percent of these children at risk were actually exposed to the deploying airbag, representing approximately one percent of all children in crashes.
  - 54 percent of those exposed were less than 13 years of age.
- Children exposed to deployed airbags were twice as likely to suffer a significant injury than those not exposed.
- Abrasions to the face and chest, as well as upper extremity fractures, were more common in airbag-exposed children.

"Risk of Injury to Restrained Children from Passenger Airbags," *Proceedings of Association for the Advancement of Automotive Medicine*, September 2002.

Recommendations :

- Rear-seating for children less then 13 years of age should be reinforced.
- Current efforts to redesign PAB to reduce the risk of both fatal and nonfatal injuries to children are well justified.
- Reintroducing education programs regarding the risks and benefits of airbags is warranted given the large number of children at risk of exposure to deploying PAB.



Upper Extremity Injuries and Airbags

PCPS research is the first to document the incidence of upper extremity fractures in restrained children who are exposed to a deploying passenger airbag. PCPS data show that 3.5 percent of restrained children exposed to airbags sustained an upper extremity fracture.

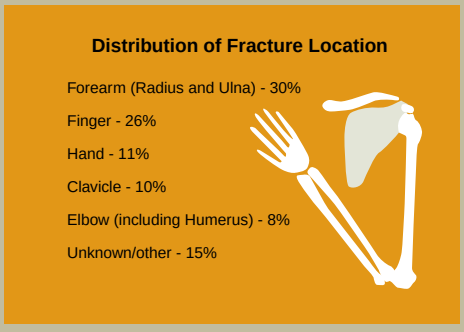
KEY FINDINGS:

- PCPS identified a higher risk of upper extremity fracture for children with PAB exposure than for children in similar crashes who were restrained but not exposed to a PAB.
- The rate of upper extremity fracture with airbag deployment was twice as high in female child occupants than in males. This may be related to strength and geometry of the female arm.

"Upper Extremity Fractures in Restrained Children Exposed to Passenger Airbags," *Society of Automotive Engineers World Congress Proceedings*, March 2003.

Recommendations :

- The risk of upper extremity fractures associated with airbag deployment must be weighed against the benefits of PAB.
- Currently, the 6-year-old test dummy does not have the means to evaluate the risk of arm fracture. In order to translate these field data into the laboratory, an instrumented arm is necessary to measure the forces encountered in a typical PAB exposure.



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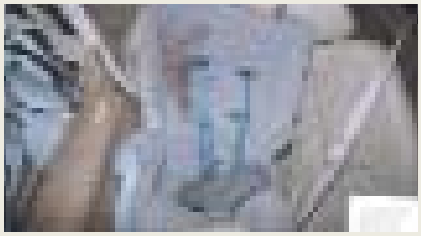
Injuries in Forward-facing Child Restraints

PCPS studied more than 1,700 children (aged 12 to 47 months) who were restrained in forward-facing child restraints (FFCRS) when a crash occurred. PCPS evaluated characteristics of children with serious injuries while in FFCRS.

KEY FINDINGS:

- Children in FFCRS are well-protected in crashes. PCPS estimated that for every 10,000 children restrained in FFCRS in crashes, only 17 suffered a significant injury.
- Serious injuries to children in FFCRS typically involved the head, neck and legs.



"Injuries to Children in Forward-facing Child Restraints," *Proceedings of Association for the Advancement of Automotive Medicine*, September 2002.

Recommendation :

- Minimizing forward head movement and acceleration would decrease injury risk. The potential for head contact with the rear of the front seat and other interior vehicle structures should be considered.
- Evaluating ease-of-use, with regard to harness tightness and CRS tightness in vehicles, could reduce common misuses that lessen effectiveness of CRS design.
- More research is critical to understand the movement of the child's neck in traumatic events and the likelihood for injury before enacting regulatory standards.
- Incorporate pediatric leg kinematics when measuring injury risk in FFCRS.

Pelvic Fractures

PCPS surveillance revealed that the majority of pelvic injuries to children occurred in side-impact crashes. Mechanisms of injury and child characteristics were explored through in-depth crash investigations.

KEY FINDINGS:

- Only 14 percent of children enrolled in the PCPS study were in a side-impact collision, yet 62 percent of pelvic fractures occured in side-impact crashes.
- The typical child with a pelvic fracture was a 12-to 15-year-old female seated in the front row of a passenger car involved in a struck-side collision with intrusion.
- Additional factors associated with pelvic fracture: 1) biomechanical changes to the pelvis throughout the pediatric age range; 2) pattern of vehicle side structure intrusion caused by impacting vehicles, such as SUVs and trucks which are stiffer and ride higher than passenger cars.

"Pediatric Pelvic Fractures in Side-impact Collisions," *Stapp Car Crash Journal*, November 2002.

Recommendations :

- Pediatric dummies should be developed to incorporate the unique differences of the pediatric pelvis.
- Attention should be paid to improve vehicle structure, including seat design, particularly in lateral collisions that occur at angles other than 90 degrees.

Abdominal Injuries

While optimal restraint has been shown to reduce the risk of injuries overall, its effect on specific types of injuries, in particular abdominal injuries, has not been demonstrated. PCPS surveillance data were used to determine the effect of optimal restraint on the pattern of abdominal injury.

KEY FINDINGS:

- While abdominal injuries are relatively rare, children sub-optimally restrained were 3.5 times more likely to suffer an abdominal injury compared to optimally restrained children.
- In this study there were NO reported abdominal injuries among children 4-to 8-years-old who were restrained in booster seats.
- Optimal restraint affected the type of abdominal injury. Among restrained children with an abdominal injury, those with sub-optimal restraint were more than four times as likely to suffer a hollow visceral injury (intestine, bladder) versus a solid organ injury (liver, spleen) when compared to optimally restrained children.

"Sub-optimal Restraint Affects the Pattern of Abdominal-Injury in Children Involved in Motor Vehicle Crashes," *Journal of Pediatric Surgery*, in press.

"Optimal Restraint Reduces the Risk of Abdominal Injury in Children Involved in Motor Vehicle Crashes," *American Academy of Pediatrics 2002 National Conference and Exhibition*, October 2002.

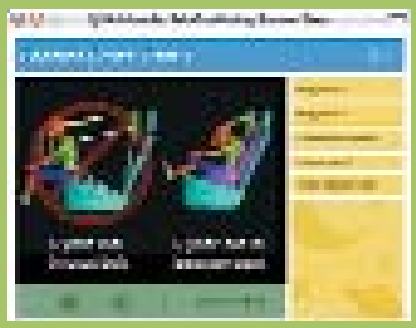
▼ Intestine contusion

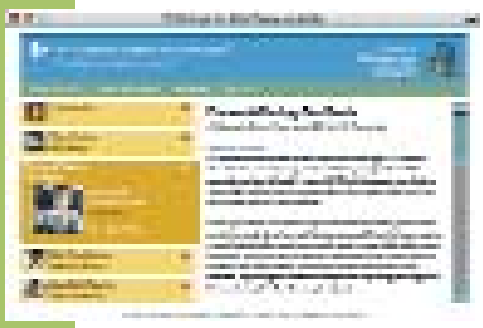
Splenic laceration ▲

Recommendations :

- "Buckle Up" is no longer an adequate message — age appropriate restraint must be highlighted.
- Emergency physicians and trauma surgeons need to inquire about type of restraint and consider the appropriateness of that restraint when evaluating children at risk for abdominal injury following a crash.

Intervention





State Farm Zones: LEAP

Legislate
Educate
Advocate
Publicize

Through its message of "LEAP," State Farm is providing PCPS educational tools to State Farm public affairs staff throughout the country to mobilize on the issue of child passenger safety. Already, State Farm public affairs specialists have used PCPS educational tools to advocate successfully for stronger laws in California, New Jersey, Maryland, Maine, Pennsylvania and Virginia. In 2003, State Farm is hard at work in several other states including Illinois, New York, New Hampshire, Ohio, Vermont, Alabama and North Dakota.

State Farm reaches out to consumers through its annual Child Safety Day (join us on May 17, 2003) and related advertising. Additionally, State Farm customers have access to brochures and a CPS-dedicated Web page on **statefarm.com®** that encourage appropriate restraint for child passengers. PCPS' monitoring of trends indicates that State Farm's educational efforts are effective at increasing appropriate restraint among its policyholders.

www.chop.edu/carseat

In response to a growing need by parents to have a current, easy-to-use, accessible source for child passenger safety information, PCPS launched a multimedia interactive Web site in June 2002 entitled "Car Seats, Booster Seats and Seat Belts: Increasing Awareness to Protect Children." A series of short videos help parents visualize and hear the basic elements of appropriate restraint according to their child's age and size, as well as correct installation. Scrollable, printable text and a Quick Tips review of each section make the site user-friendly. The site underwent testing in the Usability Lab at State Farm, and content was reviewed by leading CPS advocates. PCPS encourages links to the site.

Web-based Educational Materials: traumalink.chop.edu

In response to numerous requests, PCPS has created visual demonstration materials highlighting the importance of appropriate restraint. These images are available for download and can be used as tools for legislative action and to enhance existing CPS education. The images have been utilized in state and federal initiatives focused on strengthening child restraint laws. These images can be downloaded from traumalink.chop.edu and enlarged. They include:

- Booster seat crash model (still photos)
- Skeletal image of proper seat belt-positioning
- Chart of recommended restraint use among children

Formal Comments to Federal Agencies

Since PCPS submitted its first comments to the National Highway Traffic Safety Administration (NHTSA) in 1998 regarding advanced air bags, PCPS researchers have submitted comments to this federal regulatory agency on an additional eleven occasions. Topics addressed include: tethering of child restraints (9/99); seat belt-positioners (10/99); advanced air bags (12/99, 8/01); Child Restraint Systems Safety Plan (1/01); head restraints (2/01); development of a national booster seat education plan (8/01); booster seat use and effectiveness (9/01); child restraint rating system (1/02); and upgrades to Federal Motor Vehicle Safety Standard 213 (6/02).

"Partner's state-specific data and risk of injury data provided myself and my colleagues with the scientific foundation for passing booster seat legislation in Pennsylvania. Partners' visual materials such as the booster vs. seat belt crash models helped to demonstrate why boosters are so important. I hope other states use this readily available information to upgrade their laws to better protect children in crashes."

State Representative **Kathy Watson**, Pennsylvania House of Representatives

Impact

Anton's Law Signed

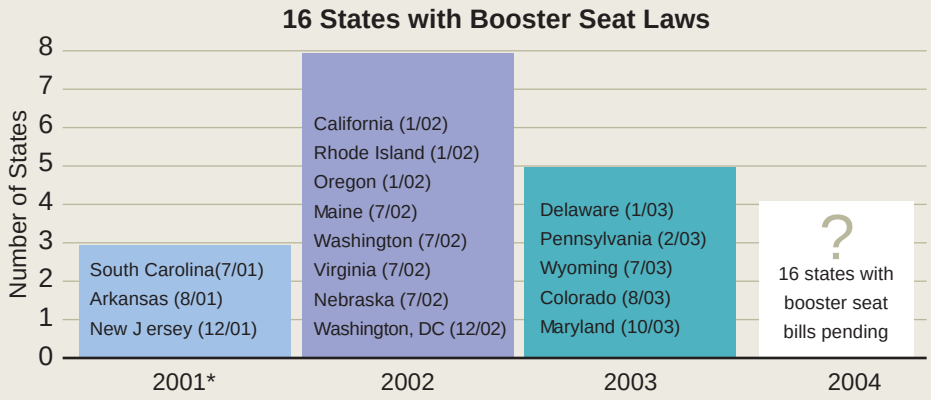
In December 2002, Anton's Law was signed by President George W. Bush before a host of advocates who helped to write and promote the original bill. Representing PCPS was Herman Brandau, Associate General Counsel for State Farm. PCPS provided relevant data through testimony and consultation that gave the bill its scientific foundation.

The law directs NHTSA to improve federal standards for child restraint systems for children who weigh more than 50 pounds, typically children ages 4-to-8-years. Development of a 10-year-old child test dummy and study of the benefits of integrated car seat and booster seats are mandated. Also, auto manufacturers are required to begin installation of lap/shoulder belts in the center rear seat by 2005.

State Booster Seat Laws: Pennsylvania

On February 21, Pennsylvania enacted a law requiring children to remain in child safety seats and booster seats until their 8th birthday. The law went further, requiring older children to use seat belts until age 18. PCPS worked closely with sponsoring legislators and Boost PA, a CPS advocacy group, to educate legislators through a news conference, transportation committee hearings and educational handouts.

State Booster Seat Legislation (as of March 2003)



*Dates in chart reflect when laws went or go into effect.

Source: Advocates for Highway and Auto Safety. Visit www.saferoads.org for more information.

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Optimize Safety in 4 Steps

With each step taken, PCPS data indicate a significant reduction in risk of injury to children in crashes.

1. Restrain children on every trip.
2. Use rear seat for all children under age 13 years.
3. Use appropriate restraint for age and size.
4. Use restraints correctly.

Appropriate Restraint

- Use rear-facing infant seat until child is at least 1 year and at least 20 pounds.
- Use forward-facing child safety seat until child has completely outgrown the manufacturers' maximum weight and height limits for the seat — usually 40-65 pounds.
- Use a belt-positioning booster seat until an adult seat belt fits — usually around 4 foot, 9 inches.
- Use a lap and shoulder seat belt after child reaches 4 foot, 9 inches.

Study Design Review

The PCPS research team at The Children's Hospital of Philadelphia collects information, with privacy safeguards, from State Farm Mutual Automobile Insurance Company on children involved in car crashes in 15 states (AZ, CA, DE, IL, IN, MD, MI, NC, NJ, NV, NY, OH, PA, VA, WV) and the District of Columbia. This claims information represents State Farm-insured children under age 16 who are involved in crashes in vehicles of model year 1990 or newer. In-depth telephone interviews give researchers a comprehensive view of the range of crash and injury severity while on-site crash investigations provide information on injury mechanisms. As of March 2003, PCPS has collected information on more than 219,000 crashes involving more than 332,000 children.

"Partners for Child Passenger Safety is an important part of State Farm's auto safety agenda. The partnership's outreach efforts improve state child occupant safety laws, enhance child restraint testing standards, and most importantly, increase appropriate child restraint use to reduce serious injury and death to children. State Farm is proud that PCPS is considered a national resource. I look forward to achieving even higher standards of protection for children as a result of our continued efforts."

Steve Stockton, Vice President, State Farm Mutual Automobile Insurance Company

Research Review

Partners for Child Passenger Safety Advisory Board

Research Publications (2002-2003)

Evaluation of a Child with Pre-existing Disabilities after a Traumatic Event, *Pediatric Emergency Care*, June 2002

Injuries to Children in Forward-facing Child Restraints, *46th Annual Proceedings of AAAM*, September 2002.

The Influence of Harness Type on Child Restraint System Misuse, *46th Annual Proceedings of AAAM*, September 2002.

Risk of Injury to Restrained Children from Passenger Airbags, *46th Annual Proceedings of AAAM*, September 2002.

Pediatric Pelvic Fractures in Side-impact Collisions, *Stapp Car Crash Journal*, November 2002.

Upper Extremity Fractures in Restrained Children Exposed to Passenger Airbags, *Society of Automotive Engineers World Congress Proceedings*, March 2003.

Accuracy of Self-reported Data for Estimating Crash Severity, *Accident Analysis & Prevention*, in press

An Evaluation of the Effectiveness of Forward-facing Child Restraint Systems, *Accident Analysis & Prevention*, in press.

Sub-optimal Restraint Affects the Pattern of Abdominal Injuries in Children Involved in Motor Vehicle Crashes, *Journal of Pediatric Surgery*, in press.

Recent Research Presentations *(partial listing)*

Children in Crashes: Experience from the Partners for Child Passenger Safety Study, Automotive Occupant Restraints Council, Tampa, FL, March 2002.

Partners for Child Passenger Safety Interim Report, 2002, National Highway Traffic Safety Administration, Washington, DC, May 2002.

Characteristics of Trips Resulting in Motor Vehicle Crashes with Child Occupants, Pediatric Academic Societies Annual Meeting, Baltimore, May 2002.

Facial Injury in Young Children Using Seat Belts, 6th World Injury Conference, Montreal, May 2002.

Partners for Child Passenger Safety: Using State-Specific Crash Data for Use in Advocating for Appropriate Child Occupant Restraint, Lifesavers Conference, Orlando, FL. June 2002.

Sharing Data from the PCPS Study with the Automotive Industry, Alliance for Automobile Manufacturers, Southfield, MI, July 2002.

Factors Associated With Front Row Seating of Children in Motor Vehicle Crashes, American Academy of Pediatrics 2002 National Conference and Exhibition, Boston, October 2002.

The Effect of Optimal Restraint and Seating Position on the Risk of Injury to Children, American Academy of Pediatrics 2002 National Conference and Exhibition, Boston, October 2002.

PCPS: An Academic-Corporate Partnership to Protect Children, National Association of Children's Hospitals and Related Institutions, Seattle, WA, October 2002.

Acute Healthcare Utilization By Children After Motor Vehicle Crashes, *American Public Health Association Conference,* Philadelphia, PA, November 2002

Using Data to Develop Injury Prevention Resource Tools, *American Public Health Association Conference,* Philadelphia, PA, November 2002.

Responsibility of Children for Their Seating Position in Vehicles, *American Public Health Association Conference,* Philadelphia, November 2002.

Partners for Child Passenger Safety Manufacturers Briefing Conference, Ford Conference and Exposition Center, Dearborn, Michigan, December 2002.

Let's Talk: Child Passenger Safety, Pennsylvania Chapter of the American Academy of Pediatrics, Audioconference, February 2003.

Recognition

The Governor's Highway Safety Association recognized PCPS for its contributions to highway safety with the Peter K. O'Rourke Special Achievement Award at the association's conference in St. Louis on September 10, 2002.

The Philadelphia Public Relations Society of America recognized PCPS at the PRSA Pepperpot Awards on December 4, 2002 for the media relations campaign, "Risk of Injury to Children in Pickup Trucks." This campaign reached approximately 60 million people with an important public safety message when the study was published in the March 6, 2002 issue of the *Journal of the American Medical Association*.

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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

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