

The Future of Child Passenger Safety Surveillance

A feasibility and justification report by The Children's Hospital of Philadelphia

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In the wake of deaths to children due to air bags, Partners for Child Passenger Safety (PCPS) was created to provide child-focused crash surveillance data. Since December 1998, PCPS has been an essential source of data for the nation's child passenger safety policy upon which priorities, regulations, new products, laws and programs were based and later evaluated. For a decade, high quality, reliable data on injuries to children in motor vehicle crashes combined with crash, vehicle and restraint information were made available through analyses by the PCPS research team.

During this time, the following successes were achieved:

Impartial, respected source of data

PCPS is widely accepted for its rigor and is considered the preeminent resource to define and study issues of relevance in child occupant protection, to guide policy directed towards protecting our children in motor vehicles, and to educate consumers about best practices.

Influence on state laws and federal regulations

Since 2001, two federal laws and 42 state laws have been enacted that utilized PCPS data to improve federal motor vehicle safety regulations and state child occupant restraint laws. The depth and breadth of the PCPS data, combined with the scientific rigor of the analyses, served as compelling justifications for these legislative and regulatory advancements.

Impact on consumer behavior through outreach and education

Outreach efforts jointly implemented by The Children's Hospital of Philadelphia (CHOP) and State Farm demonstrate the extraordinary power of this type of data to provide measurable impact on behavior change. Between 1999 and 2007, age-appropriate restraint use among children under 9 years of age in the PCPS study population increased from 51 percent to 78 percent, and booster seat use increased from 4 percent to approximately 36 percent. The CHOP outreach team further translates its published findings into easy-touse educational tools such as fact sheets, press releases, crash model videos, interim reports and parent-oriented interactive Web sites (www.chop.edu/carseat and www. chop.edu/injury) that provide current information on optimal child protection in motor vehicles. In 2006 alone, presentations promoting these tools to highway safety, public health, public policy, media and industry audiences have resulted in more than 64,300 downloads of educational tools and videos and 102,669 visits to our Web sites.

Foundation for important biomedical research projects and priority setting for industry's efforts in child passenger safety

PCPS data serve as the foundation for many research projects. Initial findings have produced new areas of investigation that provide more detailed assessments of the causes and consequences of injury to children. Auto safety researchers and members of the auto safety industry used these data to determine priorities for future biomedical research and product development. As an example, PCPS surveillance and crash investigation results have stimulated research in automotive test dummy development for the abdomen and the spine.

Reductions in motor vehicle injuries and fatalities for children

We ultimately measure the impact of the project by the number of children's lives saved and injuries prevented. Since the project began, more than 1,100 fewer children have died in crashes and thousands more have been spared serious injury due to advancements in legislation, public education, and vehicle and restraint system design resulting from information generated and disseminated by the project. Data of this depth and breadth are critical to continue to positively impact child motor vehicle safety in these ways.

As of December 2007, PCPS ended due to changes in funding priorities by the corporate sponsor. As a result, today there is no child-focused crash surveillance in the United States.

Children are not small adults. Children have unique needs for safety that cannot be extrapolated from data on adults. With the increasing complexity of vehicles and restraint systems, the need to ensure the safety of children is greater today than ever in the past. Therefore, this report provides:

- A vision for the future of child-focused, crash surveillance in the U.S. based on a novel, economical, high-quality and sustainable proposed system that would leverage the existing infrastructure of NHTSA's National Automotive Sampling System (NASS). We propose to call this system NASS-KIDS.
- A report on the feasibility of NASS-KIDS from a completed study funded by a National Science Foundation Industry/University Cooperative Research Center, The Center for Child Injury Prevention Studies (CChIPS).

Building a National Resource



Importance to Stakeholders

Research and Development:

- Advanced technical knowledge about child safety surveillance and hazards
- Enhancement of the data collection for child passenger safety

Commercialization:

- Improved or new processes for prioritization of company efforts in child passenger safety
- Background statistics for targets and messaging in campaigns to promote occupant safety

Professional Networking:

- Cooperation with other organizations
- Increased opportunities for nonpartisan interactions with federal agencies and legislators interested in transportation safety
- Cooperation with the world's leading scientists in child passenger safety

Organizational Outcomes:

- Partial fulfillment of goal for good corporate citizenship
- Enhanced reputation as a protector of children

Vision for the Future:

NASS-KIDS, Fulfilling a Dire Need for Child Crash Surveillance Data

Despite many achievements in the field of child passenger safety (CPS), motor vehicle crashes continue to be the leading cause of death for children in this country. In 2006, 1,794 children under age 14 died in motor vehicle crashes and an additional 208,000 suffered injuries. Due to the changing landscape of restraint products, vehicle features and CPS social norms, now — more than ever — an enhanced child-focused motor vehicle crash surveillance system is needed to provide evidence-based direction to government, industry and the public on how best to protect our children.

For the past 10 years the Partners for Child Passenger Safety (PCPS) surveillance system at The Children's Hospital of Philadelphia (CHOP) has been the primary data source used to advance the safety of children in motor vehicle crashes. The nation's only large-scale childfocused crash surveillance system, PCPS informed new product development, test protocols and regulations, education, policy and medical practice. More than 60 PCPS papers have been published in scientific journals, demonstrating the system's scientific rigor. After proving its validity and usefulness, PCPS concluded data collection Dec. 31, 2007.

Researchers from the Center for Injury Research and Prevention at CHOP and the National Highway Traffic Safety Administration (NHTSA) established the continued value of a credible, high-quality data source on children in crashes. CHOP and NHTSA recognized that the robust infrastructure for crash surveillance, the National Automotive Sampling System (NASS), in which cases for study are identified from police accident reports, could be leveraged to identify cases for a new child-focused crash surveillance system. This new system would replace previous identification of cases for PCPS through insurance crash claims. And the concept of NASS-KIDS was born, with its goals remaining identical to those of PCPS:

- Monitoring trends of key child occupant protection parameters
- Informing evidence-based public policy and enhancing public education
- Assessing the performance and informing the design of enhanced vehicle safety technology and restraint systems for children, youths and young adults

NASS-KIDS would use elements of the current NASS infrastructure to identify sufficient numbers of children in crashes and then apply the rigorous PCPS data collection methodology to obtain details on crash circumstances, restraint and seating practices, and injuries to children.

The new methodology will ensure a robust data source for child passenger safety program prioritization and evaluation into the future. Without a commitment to continue child occupant surveillance efforts, the traffic safety community would lose its ability to monitor the effects of emerging vehicle and restraint technologies, as well as social norm shifts affecting CPS. The broad, longterm objective of this surveillance system is to enable all stakeholders in the CPS community to save lives, prevent injuries and reduce the economic cost of crashes.

Key Characteristics of NASS-KIDS

- NASS-GES can be enhanced with child-focused data collection to create NASS-KIDS.
- NASS-KIDS operations would require no additional resources or procedures to identify child-involved crashes.
- NASS-GES infrastructure is well-suited to provide cases for the NASS-KIDS surveillance system.
- NASS-CDS could be enhanced by quality review of pediatric cases.

NASS-KIDS is feasible, in demand, economical and sustainable.

In 2007, NHTSA and eight corporations recognized the value of NASS-KIDS but charged CHOP with conducting a study to explore the feasibility of NASS-KIDS in terms of the data collection methods, general interest, and prospects for sustainable and long-term funding. NHTSA and the eight corporations are part of the Center for Child Injury Prevention Studies (CChIPS), a National Science Foundation/Industry/University Cooperative Research Center. CChIPS funded the feasibility study conducted by CHOP researchers.

The specific objectives of the feasibility study were to assess:

- The viability of proposed new methods for child occupant surveillance
- The quality of the potential data
- Stakeholder reaction to proposed changes

Specific accomplishments of the study:

- Reviewed current NASS methodology
- Proposed methodology for NASS-KIDS
- Recommended appropriate pilot studies
- Gained NHTSA involvement
- Began development of a long-term sustainability plan

Details of these accomplishments are discussed throughout this report.

The study determined that NASS-KIDS is:

- Feasible. With support, the proposed new methods would be operational within two years and would collect high-quality and relevant data.
- In demand. Safety engineers, educators, legislators and regulators require the depth and breadth of data that NASS-KIDS would produce.
- Economical. NASS-KIDS would leverage NHTSA's existing infrastructure for the NASS program.

Corporations supporting the NASS-KIDS feasibility study include: Ford Motor Co., Nissan Technical Center North America Inc., Toyota Motor North America Inc., State Farm Insurance Companies, TK Holdings Inc., Britax Child Safety Inc., Dorel Juvenile Group Inc., and Volkswagen Group of America Inc.



NASS-KIDS operations would

require no additional resources or procedures to identify child-involved crashes.

In collaboration with NHTSA, CHOP researchers reviewed NASS case ascertainment and operations to determine their ability to identify sufficient numbers of child-involved crashes and to incorporate enhanced procedures into the current operations and processes. NASS is a national, population-based surveillance system based on a probability sample of police-reported crashes. Two components of NASS provide complementary data sources.

- NASS General Estimates System (NASS-GES) includes a sample of approximately 55,000 cases, but its only data elements are those found on the police reports. Therefore, NASS-GES provides broad estimates of child crash exposures but with little data specific to children, especially on important parameters such as injury and restraint use.
- 2. NASS Crashworthiness Data System (NASS-CDS) includes a sample of approximately 4,500 cases, including 200 cases with children all subjected to detailed on-site crash investigation. NASS-CDS is intended to be representative of all crashes in the U.S., not just those involving a child occupant. Therefore, it often requires several years of data to perform analyses of interest.

Neither NASS-GES nor NASS-CDS provides both the quantity of child-involved crash cases, and the depth and rigor of data needed to achieve the goals of child-focused crash surveillance described above. NASS-KIDS will build on both the NASS-GES and NASS-CDS infrastructures, enhanced with the validated tools and procedures from PCPS.

The feasibility study determined that with relatively minor adaptation, the NASS-GES infrastructure is well-suited to provide cases for the NASS-KIDS surveillance system. The study also found that existing NASS-CDS investigations with quality enhancement are capable of providing NASS-KIDS with in-depth child crash investigation data. NASS-KIDS Surveillance: NASS-KIDS will provide national estimates of child-specific crash surveillance data through enhancement of NASS-GES with childspecific data collection. This effort will maintain national representativeness and achieve the goal of determining exposure and outcome trends and restraint effectiveness assessments.

NASS-KIDS Crash Investigations: NASS-KIDS will improve in-depth understanding of children in crashes through enhancement of NASS-CDS with specialized quality review of child data and targeted analyses of relevance to industry. This will achieve the goal of in-depth study to guide solutions.

The economic efficiency and sustainability of NASS-KIDS result from its ability to leverage NHTSA's investment in the NASS infrastructure to identify a source of childinvolved crashes without altering the initial three-stage sampling procedures of the NASS system. As Figure 1 on page 7 shows, by leveraging NASS-GES operations, NASS-KIDS operations would require no additional resources or procedures to identify child-involved crashes.



Data Collection

After child-involved crashes are identified through current NASS-GES operations at the Zone Centers, a childspecific sampling system would be applied. The driver (or a valid proxy) of the sampled crashes would be invited to participate in the NASS-KIDS survey adapted from the PCPS validated telephone survey. For efficiency and in keeping with state-of-the-art survey design, a multi-modal data collection plan is considered optimal for the NASS-KIDS survey. Participating drivers would be offered a choice of telephone, Web-based or hard copy (available via the Web for printing) version of the survey. Web surveys elicit more valid and complete data due to their more obvious anonymity; however, they often have a lower response rate than telephone-based methods. Planned pilot studies will evaluate and quantify these differences.



Inclusion Criteria

Based on feedback from end-users of the PCPS data, including industry representatives, safety advocacy groups and NHTSA, we plan to continue collecting data on all children ages 0 to 18 riding as occupants (nondrivers). In a staged approach, we will consider extension of the NASS-KIDS program in the future to include novice drivers up to age 19. We will draw a nationallyrepresentative sample that will ensure a broad distribution of vehicle, crash and child characteristics.

Estimated Sample Size

Based on our experience with the PCPS program, in which we collected data on 2,000 to 2,500 subjects annually among an insured population, we estimate that the NASS-based child surveillance system will collect data on up to 5,000 subjects in police-reported tow-away crashes annually due to its broader geographic scope.

Further Enhancements

In addition to collecting child-specific surveillance data, NASS-CDS pediatric cases could be enhanced by a technical review and feedback from CHOP experts in pediatric clinical medicine and biomechanics. We plan to achieve this by providing enhanced quality review of child-specific data in preliminarily approved cases and provide feedback to the NASS Zone Centers. This multidisciplinary approach to case review would enhance the value of those pediatric cases already collected as part of NASS-CDS. We also plan to conduct industry-relevant targeted analyses to help guide solutions.

NASS-KIDS will build on both the NASS-CDS and NASS-GES infrastructures.

Proposed Operational Flow for NASS-KIDS



The conduct of the childinvolved NASS-CDS crash investigations would proceed as currently implemented. NASS-CDS pediatric cases could be enhanced by a technical review and feedback from CHOP experts in pediatric clinical medicine and biomechanics. In addition, the CHOP team would conduct regular targeted analyses of the child-involved NASS-CDS cases of interest to industry.

Crash

The pilot studies will be a collaborative effort between CHOP and NHTSA.

In order to test the NASS-KIDS protocol and to examine the feasibility of using telephone, hard copy and Webbased modes of data collection (rather than solely relying on telephone interviews), we plan to conduct a pilot study using each format to compare mode differences in areas such as response rates, demographic profiles of responders, missing data and response distributions. Analysis of these data will help demonstrate how well these three modes accomplish the goal of collecting reliable and valid results from survey respondents.

To accomplish the work described, we have identified the following three specific aims:

Aim 1: Modify Data Collection Instrument

The current PCPS survey instrument requires an average of 25 to 30 minutes to administer. CHOP researchers will reduce the instrument's administration time to approximately 15 minutes and create a paper version of the revised instrument.



Today there is no child-focused crash surveillance in the U.S.

Aim 2: Prepare CATI and Web Versions of the Survey Instrument

Working with a survey research contractor, CHOP will oversee development of both a Web-based and computer assisted telephone interview (CATI) survey instrument using the new paper instrument completed in Aim 1 and develop systems requirements, utilizing existing CATI programming to the fullest extent possible.

Aim 3: Develop and Pilot-Test the NASS-KIDS Protocol with NHTSA Zone Centers

For the pilot, CHOP envisions the selection of a restricted sample of crashes involving children using NHTSA NASS-GES data from a selection of primary sampling units (PSUs). For the pilot study, a total of 600 respondents will be randomly assigned to the CATI, Web and hard copy survey instruments (200 respondents each). Then we will evaluate differences in response distributions and completion rates, as well as an assessment of comprehension and ease of completion by subjects.

CHOP will work in collaboration with NHTSA and the selected PSUs to develop an approach to contacting potential respondents.

Timing for NASS-KIDS

The estimated timing for completing the proposed pilot studies for NASS-KIDS is 18 months, beginning in June 2008. This will include finalizing the conduct of the pilot studies described above, the initial months of data collection and outreach and advocacy associated with research findings.



The Benefits of NASS-KIDS

NASS-KIDS would offer these benefits to stakeholders in child passenger safety:

- A platform upon which government, industry, and the auto safety research community would partner to improve motor vehicle safety for children and youth
- A nationally representative resource for child passenger safety data that is diverse in restraint and vehicle characteristics
- Timely, cost-efficient, and uniform collection of data that leverages existing infrastructure
- Direct, independent public access to technical data on child safety trends and emerging hazards that facilitates organizational prioritization and messaging in child passenger safety
- Public access to and improved quality control of a large number of child-specific crash investigations

Critical Pilot Studies for NASS-KIDS

Pilot studies will develop and validate:

- telephone, hard copy and Web-based survey instruments
- the NASS-KIDS recruitment techniques (as adapted from NASS-GES)
- data management processes

Car crashes remain the leading cause of death to children in the United States.



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