Center for Child Injury Prevention Studies (CChIPS)

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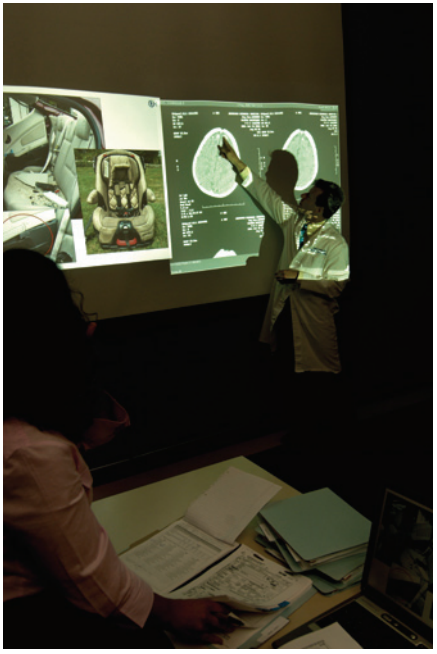
Telecenter: Collaborative Review of Children's Injuries in Motor Vehicle Crashes



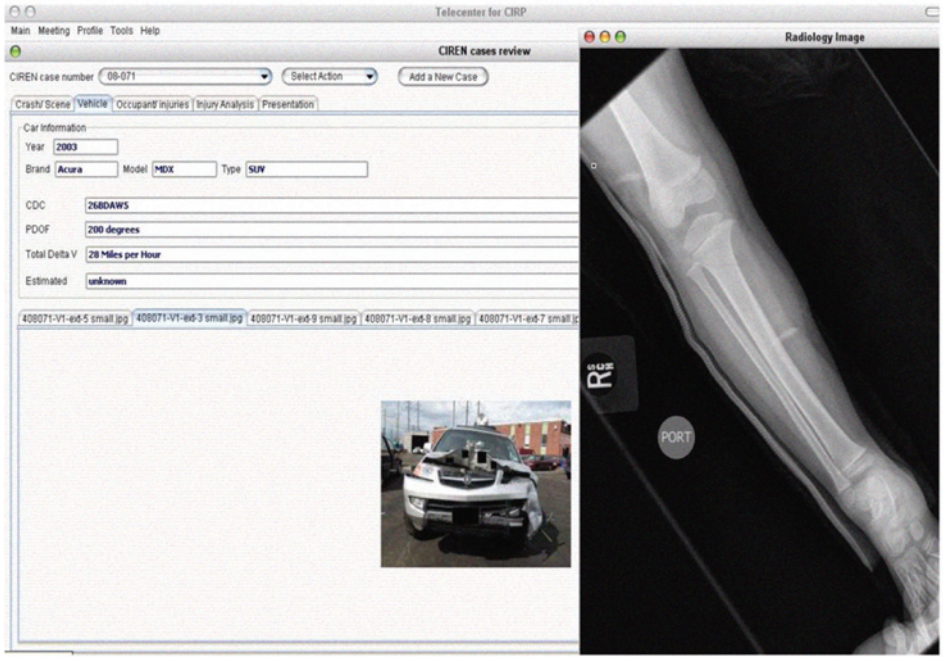
Telecenter conferences enable experts from multiple sites to share sensitive information from multiple sources via secure transmission lines with strictly controlled access. The web-based conferences help improve prevention efforts by aiding in the determination of mechanisms of injury.

Road traffic injury remains the leading cause of children's death and acquired disability. Multidisciplinary teams of university-based engineers, scientists, and physicians must collaborate with peers in government and industry to investigate crashes, determine mechanisms of injury, and develop safety technology to prevent similar injury in the future. To review the circumstances of each crash, multidisciplinary expertise is essential. Such expertise is seldom available at any one institution. This results in the need for remote collaborations, which require the ability to share sensitive information from multiple sources via secure transmission lines with strictly controlled access.

With funding from the National Science Foundation and guidance from the I/UCRC Industrial Advisory Boards, a team of researchers from two IUCRCs, the Center for Child Injury Prevention Studies (CChIPS) at The Children's Hospital of Philadelphia, the University of Pennsylvania, and the Center for Autonomic Computing (CAC) at the University of Florida developed a collaborative review networking system. This system makes it possible for remote, collaborative reviews of mechanisms of injury to children in motor vehicle crashes. Referred to as Telecenter, this innovative application of information technology enables: 1) distributed, asynchronous collection of digital content needed for crash case reviews, with consistent organization of content across cases; 2) secure, Web-based, remote participation in review meetings characterized by multimedia sharing of case content via visual images, real-time written and oral communication and various Web resources; and 3) archiving for post-review access and follow-up involving statistics, search, and networking.

The Telecenter system's design supports conferencing and remote image-sharing. Its capabilities extend beyond existing solutions via: workflow and content organization well-suited to traffic injury reviews, spatio-temporal, role-based access control, distributed content management, and seamless integration of services.

To further leverage the investment in Telecenter, an adaptation was developed within the public health sector. Telecenter was reconfigured to meet the needs of state-mandated Child Death Review teams. Similar to crash investigation reviews, Child Death Review teams require multidisciplinary expertise in order to determine how and why children die, as well as how to prevent future child deaths, even when the needed expertise may not be available locally. Initial real world results demonstrated that Telecenter for Child Death Review could help states enhance the quality of reviews without the financial burden of travel for experts. Telecenter also helped states increase efficiency in the timely transfer of information to those that can implement actions to improve the health and safety of children. The collaborative nature of this project spurs innovation, as it promotes involving the appropriate multidisciplinary experts on specific projects.



Telecenter screen of in case review mode showing textual and pictorial information about a case.

Economic Impact: Telecenter was pilot-tested to enhance the quality and value of National Highway Traffic Safety Administration (NHTSA) crash injury case reviews by virtually bringing together remotely located experts without the burden of additional travel costs. Telecenter allows investigators to complete multidisciplinary reviews of crashes in order to ultimately improve engineering-related prevention and medical treatment of crash injuries. These in-depth investigations require input from multiple individuals, including physicians, epidemiologists, engineers, govern-

ment regulators, vehicle and child restraint manufacturers, and insurance company representatives. Use of the secure, customized, Telecenter technology eliminates the need for time and resource-intensive in-person collaboration. It also provides for significant cost savings for travel and housing for these collaborators. In addition, Telecenter makes possible more reviews of particularly unique or complicated crashes in rural or international regions. Additionally, by advancing the field of child occupant protection, Telecenter contributes to the reduction of future costs from fatal and non-fatal injuries as well as savings from acute and chronic medical care expenses, wage and productivity losses, and reduced quality of life costs.

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Identification of Common Serious Teen Driver Crash Scenarios

Motor vehicle crashes are the leading cause of death and acquired disability among teenagers in the United States. Despite the societal burden of these events, how and why teens get into crashes has not been well understood on a scientific level. The previous state of practice was to have engineers develop driver assistance technology based on performance of adult drivers.

How and why do teen drivers get in serious motor vehicle crashes? By identifying the most frequent crash scenarios and causal factors of crashes, researchers provide key information to develop more effective crash avoidance technologies.

Researchers from the Center for Injury Research and Prevention Studies (CChIPS) at The Children's Hospital of Philadelphia and the University of Pennsylvania School of Nursing have analyzed data from the National Highway Traffic Safety Administration's (NHTSA) National Motor Vehicle Crash Causation Survey (NMVCCS) to determine the leading scenarios of serious crashes among teen drivers and the primary causal factors leading up to those crashes. With results from this breakthrough research engineers finally have the needed knowledge to target crash prevention efforts specifically toward young drivers, the group at highest crash risk.

The multidisciplinary team of researchers has documented the five most frequent crash scenarios for teen drivers involved in serious motor vehicle crashes. They are: rear-end crashes, two types of left turn intersection crashes that occurred when the teen was turning left into or across the path of another vehicle, and two types of running-off-the-road events that occurred after either negotiating a curve or after going straight. Rear-end and left turn intersection crashes were primarily due to recognition errors, which include poor driver surveillance and distraction, and decision errors, which include following too closely and traveling too fast for conditions. The majority of run-off-road events, however, resulted from decision errors or poor driver performance (e.g., overcompensating) or from non-performance errors (e.g., fatigue).

This research is helping to identify how and why teen drivers get in serious motor vehicle crashes. By identifying the most frequent crash scenarios and causal factors leading up to a crash, this study provides key information to engineers and automobile companies on how to better develop crash avoidance technology for teen drivers.

Economic Impact: The Centers for Disease Control (CDC) has estimated the cost to the nation of teen driver crashes at $33 billion annually. Findings from this and related teen driver studies are providing more nuanced understandings of the circumstances of teen motor vehicle crashes. These new understandings are helping leading to advancement of behavioral and educational crash prevention efforts, including teen driver training curricula, assessment tools such as simulated driving assessments, and more effective in-vehicle driver assistance technologies.

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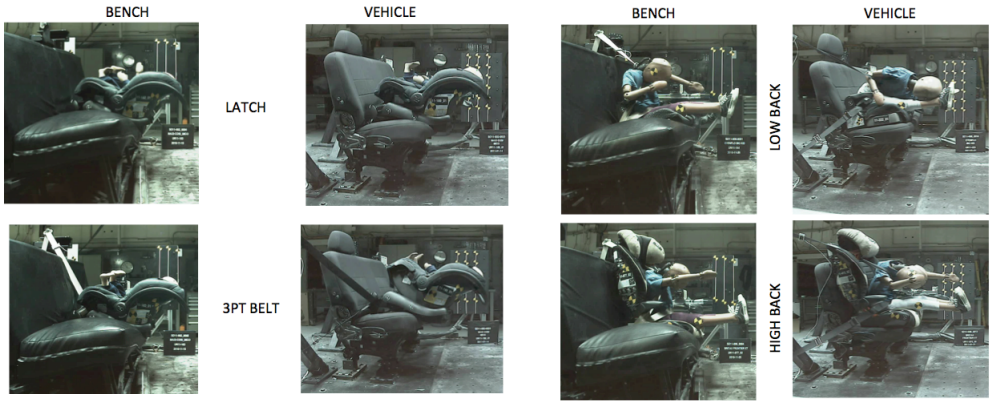
Comparing FMVSS 213 Sled Test to the Full-Scale Vehicle Crash Environment

Through Federal Motor Vehicle Safety Standards Test Requirements, the National Highway Traffic Safety Administration (NHTSA) and Transport Canada have similar longstanding sled test protocols that all child seat manufacturers must pass to sell child restraints in the United States and Canada. This "vehicle seat" or "bench" in the sled test was originally modeled from a General Motors (GM) sedan rear seat from the 1970s.

Developments in both vehicle interiors and seat designs, as well as advancement in child seat design and construction, have significantly changed the safety technologies offered by both industries. However, since the current test bench is based upon old vehicles, its characteristics in today's crashes may not be representative of current real world vehicle seats. This limitation may hinder safety technology advancement of the various forms of child restraint designs and systems.



Rear facing and booster child restraints at maximum excursion on the FMVSS 213 Bench and the Vehicle Seats.

This study, supported by Transport Canada and CChIPS resources, provides a valuable method for comparing and determining the critical factors that should be considered in potentially modifying the current sled bench. The project represents a unique opportunity for the child seat industry and federal government to work together to improve child seat regulation. This type of testing is normally costly and labor-intensive

but is financially feasible through collaboration. Without the benefit of this work the child seat, motor vehicle, and ATD industries would have less applicable regulations to jointly impact and guide such research.

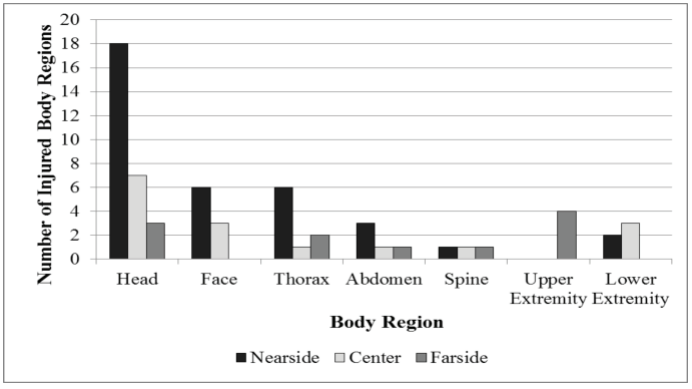
This research will result in recommendations to NHTSA and Transport Canada on crash sled bench testing standards and will help child restraint and vehicle manufacturers interpret the performance of restraints tested under the current child restraint test protocol. This may improve the performance and enhance the safety of child seats in real world motor vehicle crashes.

> **Economic Impact**: As all infant carriers, child restraints, and booster seats are tested using this NHTSA-mandated sled bench, this research will impact all such products in the child seat industry. The work will save tens of thousands of dollars in research and testing expenses for each child seat manufacturer that may wish to engage in this type of analysis. It is impossible to even estimate the reductions in health care costs that could be realized and the associated suffering that will be possible to avoid when these safety devices are improved based on results from this work.

For more information, please contact Matthew R. Maltese at The Children's Hospital of Philadelphia, 267.426.7025; maltese@email.chop.edu.

Child Injury Prevention: Enhancing Child Safety In Side-Impact Crashes

Side-impact crashes account for 25% of motor vehicle crashes (MVCs) but represent more than 40% of MVC-related injury costs. To discover better ways to protect children in side-impact crashes, a project at the Center for Child Injury Prevention Studies (CChIPS) sought to document the probable vehicle interior contact points in side-impact MVCs to children in child restraint systems (CRS). Two in-depth crash investigation databases, the Crash Injury Research and Engineering Network and the Partners for Child Passenger Safety Study, were queried for rear-seated, CRS-restrained children ages 0 to 8 years in side impact crashes who sustained clinically important injuries.



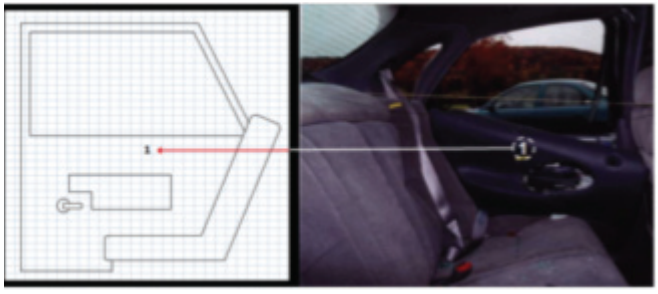
Distribution of body region of injury by seat position for children in side impact crashes highlighting the importance of head injury prevention.

A multidisciplinary team of physicians and engineers reviewed the cases to describe injury patterns, injury causation, and vehicle components contributing to the injuries; 41 occupants met the inclusion criteria (average age 2.6 years), with 24 seated near the side of the crash, 7 seated on the far side, and 10 seated in the center. The most common injuries were to the skull and brain, with a greater proportion of skull frac-

tures occurring with increasing age. Lung contusions and spinal injuries were also reported. Near-side head and face contact points occurred along the rear vertical plane of the window and the horizontal plane of the windowsill. Head and face contact points for center- and far-side occupants were along the edges of the front seat back and front seat head restraint.

Economic Impact: Results of this breakthrough research will inform innovations by the automotive and child restraint industries in vehicle and child restraint design. In particular, the findings will lead to: 1) new generation child restraints with side wings; and, 2) energy management features on vehicle door interiors to reduce head and traumatic brain injuries (TBI) sustained by children in crashes. TBI continues to be a major worldwide health epidemic, with an annual incidence in the United States alone in excess of 1.5 million per year. This leads to an estimated 50,000 fatalities and 3.7 million individuals needing to live with long-term disability. Worldwide, the incidence of TBI has been estimated at 500 million new cases annually (circa 1985). Because of increasing global automobile use and declining deaths due to infectious diseases, TBI is becoming the global dominant source of mortality and morbidity. TBI is particularly devastating to the young. Hospitalization costs associated with pediatric TBI are estimated to exceed $1 billion annually. By implementing design strategies for child restraints and vehicle interiors based on this project's findings that manage the impact energy when head contact occurs in crashes, the potential to reduce these costs is substantial. Furthermore, this technical breakthrough led to the development, in part, of new regulations for the testing of child restraints in side-impact crashes. This advancement is particularly important as side-impact crashes represent a significant portion of MVC-related injuries and fatalities and therefore injury costs.

For more information, contact Kristy Arbogast, 215.590.3118.



Screenshot of program developed to allow researchers to transfer occupant contact points from vehicle photos to a simplified vehicle interior drawing. Typically, contact points are summarized to provide vehicle and child restraint designers with details on which regions of their products need improved energy management for head injury mitigation.