



## Engineering Sciences Section – 2007

### C36 Airbag Injury Risk to Older Children Occupying the Front Passenger Seat

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After attending this presentation, attendees will understand the risks involved for older, pre-teen children riding in the front passenger seat of vehicles equipped with airbags with case studies of injuries sustained due to these risks.

This presentation will impact the forensic community and/or humanity by describing behavior and anatomical risks for older children riding in front passenger seats along with common injuries sustained from airbag deployment when particular risk factors are present.

This presentation identifies unrecognized injury risks from airbag deployment to older children seated in the front passenger seat. According to the National Center for Statistics and Analysis, the number of child fatalities from front passenger seat airbags has decreased since the mid to late 1990s because parents are aware of the risks and place small children, typically 5 years of age and younger, in the rear seats. Additionally, the implementation of depowered airbag inflators as a federal standard in 1998 and, more recently, the development of seat weight sensing devices likely helped to reduce child fatalities from airbag deployment. Unfortunately, first-hand observations made at locations where children are dropped off at school reveal that parents continue to allow older, pre-teen children to ride in the front passenger seat.

Four cases of children, ages 7 to 9 years old, seriously injured as a result of contact with front passenger seat airbags are presented. The injuries sustained in these cases include severe head and brain trauma, eye injury including loss of vision, and cervical distraction with complete spinal cord injury and quadriplegia. These cases involve various seat belt usage conditions, including fully lap and shoulder belted, restrained by a lap belt only with the shoulder belt behind their back, and unrestrained. The change in velocity for each vehicle in these cases ranged from 7 to 15 mph. In general, airbags are designed and configured to initially contact the chest of a 50<sup>th</sup> percentile Hybrid III dummy. This places the head and neck of short statured individuals, including older children, at greater risk of being in the path of the deploying airbag. It is well known that being in the path of an airbag during deployment leads to significant forces that can result in severe and/or fatal injuries. In each of the cases presented, had the child been seated in the rear seat or had the airbag not deployed, their potential for injury would have been significantly reduced and, at most, they would have sustained minor injuries.

This research identifies and addresses various reasons why older, pre-teen children are at risk of front passenger seat airbag injury. Because of their small stature these children tend to sit with their knees bent at the front of the seat bottom. This can result in being closer to the airbag and out-of-position at the time of airbag deployment. Additionally, when pre-impact braking is a factor, the relatively short length of their legs prevents them from bracing on the floor, allowing a greater amount of forward movement and increasing their risk for direct contact from a deploying airbag. Furthermore, during this pre-impact braking, an older child's head/neck has a greater tendency to flex forward given the mass of their head and the relatively weak neck and upper back musculature compared to that of an adult. Behavior issues, such as wearing a backpack while seated, being out-of-position by leaning forward, and temporarily unbuckling their seat belt, can further contribute to an increased risk of injury.

The National Highway Traffic Safety Administration (NHTSA) and vehicle manufacturers recommend that all children under the age of 12 sit in rear seats. When rear seats are not available, it is recommended that the child sit properly restrained and with the seat in the most rearward position, furthest from the airbag. Current real-world observations reveal that many parents do not adhere to these recommendations and are likely unaware of the inherent risks to older children occupying the front passenger seat even when it is described in their vehicle's owners manual. Further public awareness campaigns are needed to inform the public of these risks. Investigation of possible legislation addressing this issue may also help to increase compliance.

#### **Passenger Airbag, Older Children, Injury Risk**