



TECHNICAL REPORT

Shopping Cart–Related Injuries to Children

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ABSTRACT

An estimated 24 200 children younger than 15 years, 20 700 (85%) of whom were younger than 5 years, were treated in US hospital emergency departments in 2005 for shopping cart–related injuries. Approximately 4% of shopping cart–related injuries to children younger than 15 years require admission to the hospital. Injuries to the head and neck represent three fourths of all injuries. Fractures account for 45% of all hospitalizations. Deaths have occurred from falls from shopping carts and cart tip-overs. Falls are the most common mechanism of injury and account for more than half of injuries associated with shopping carts. Cart tip-overs are the second most common mechanism, responsible for up to one fourth of injuries and almost 40% of shopping cart–related injuries among children younger than 2 years. Public-awareness initiatives, education programs, and parental supervision, although important, are not enough to prevent these injuries effectively. European Standard EN 1929-1:1998 and joint Australian/New Zealand Standard AS/NZS 3847.1:1999 specify requirements for the construction, performance, testing, and safety of shopping carts and have been implemented as national standards in 21 countries. A US performance standard for shopping carts (ASTM [American Society for Testing and Materials] F2372-04) was established in July 2004; however, it does not adequately address falls and cart tip-overs, which are the leading mechanisms of shopping cart–related injuries to children. The current US standard for shopping carts should be revised to include clear and effective performance criteria for shopping cart child-restraint systems and cart stability to prevent falls from carts and cart tip-overs. This is imperative to decrease the number and severity of shopping cart–related injuries to children. Recommendations from the American Academy of Pediatrics regarding prevention of shopping cart–related injuries are included in the accompanying policy statement.

BACKGROUND

Injuries associated with shopping carts are an important cause of pediatric morbidity, especially among children younger than 5 years.^{1–6} An estimated 24 200 children younger than 15 years, 20 700 (85%) of whom were younger than 5 years, were treated in US hospital emergency departments in 2005 for shopping cart–related injuries. Fifty-one percent of these injured children were female.⁷ The most common anatomic site of injury is the head and neck region, accounting for 74% of shopping cart–related injuries among children younger than 15 years, 79% among children younger than 5 years, and 92% among children younger than 1 year. Injury to a finger represents 10% of injuries, and injury to another site on the upper or lower extremities accounts for 12% of the cases. Among children



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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words

injury, pediatric, children, trauma, falls, shopping cart, restraint, seat belt, prevention

Abbreviations

CPSC—US Consumer Product Safety Commission
ASTM—American Society for Testing and Materials
AAP—American Academy of Pediatrics
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younger than 15 years who are treated and released home from the emergency department, contusions and abrasions (43%) and lacerations (22%) are the most common injuries. Approximately 4% of children younger than 15 years treated in an emergency department for a shopping cart–related injury require admission to the hospital. Children younger than 5 years account for 93% of these hospital admissions. Fractures are the most common injury resulting in admission, representing 45% of all hospitalizations.¹ Deaths have been reported from falls from shopping carts and cart tip-overs.^{8,9}

The height of a fall and the energy-absorbing capacity of the surface on which a child lands are major determinants of the likelihood and severity of injury. In one study of shopping cart–related injuries to children, more than two thirds of children landed on hard surfaces such as linoleum (53%) or asphalt or concrete (15%). Although most injuries occurred inside stores, 16% of cases occurred in store parking lots.²

Injuries to children associated with shopping carts occur via several mechanisms: falling from carts, carts tipping over, and other mechanisms such as becoming entrapped in a cart, falling off a cart while riding on the outside, striking against a cart, and being run over by a cart.² The most common mechanism is a fall from a shopping cart, representing 58% of the cases in one study.² Another 26% of children are injured when a cart tips over. This is the second most common mechanism of injury and occurs primarily among children younger than 2 years.² In one emergency department–based study, tip-over injuries accounted for 38% of all shopping cart–related injuries among children younger than 2 years.²

The mechanism of injury is associated with the child's position in the cart. Falls from the cart are associated with the child standing in the cart basket, and tip-over injuries are associated with the sitting position. Siblings often contribute to cart tip-overs when attempting to climb in or out of a cart or when standing up in a cart. In one study, 56% of cart tip-over injuries involved the action of a sibling.² Parents are present at the time of injury in more than 90% of episodes. Shopping cart–related injuries rarely are caused by a malfunction of the cart.²

PREVENTION

Shopping cart–related injuries to children are common and can result in severe injury and death. Prevention efforts should focus on falls from carts and cart tip-overs.

Public Education

When used alone, public education and warnings are not adequate to prevent shopping cart–related injuries to children. One study demonstrated that an intensive educational effort with flyers, signs, and audiotaped messages over the public address system in stores resulted in limited change (from 1% to 14%) in shopping cart seat belt use by shoppers, and when a study representative

approached shoppers with young children to encourage use of seat belts, belt usage increased to 51%.¹⁰ Another study found that shopping cart–restraint usage increased from 15% to 49% when study personnel greeted shoppers with young children at the entrance to stores and recommended the use of appropriate shopping cart restraints if they were going to transport a child in a cart. Although there was a significant improvement in restraint use, half of the children were still being transported in shopping carts without adequate restraint.¹¹

Adult Supervision

It is difficult to browse shelves in a store and closely supervise a child in a shopping cart at the same time. More than 80% of adults leave their children unattended at least once during a shopping trip.¹² Shopping cart–related injuries can and do occur in the time it takes to reach for something on a shelf. The fact that more than 90% of parents are present at the time of injury indicates that adult supervision will not reliably prevent these injuries.

Separating the Child From the Hazard

Providing adult caregivers with alternatives to placing a child in a cart while they shop can effectively prevent shopping cart–related injuries. Some stores provide supervised play areas for children. Parents may be able to arrange for another adult to accompany them and watch the child during a shopping trip. Other parents may be able to transport a young child in a stroller, wagon, frontpack, or backpack. An older child can be asked to walk. Some parents may be able to leave their child at home with an adult while they shop, but this is not an option for many others. Some stores offer shopping via the Internet with or without home delivery.

Shopping Cart Safety Design and a National Performance Standard

The most effective injury prevention strategies are those that do not require frequent human action and vigilance.¹³ Therefore, modifying the design of shopping carts to automatically prevent falls and tip-overs offers the best preventive solution for shopping cart–related injuries. Adequate safety design must provide for effective child restraint to prevent falls from the cart and must also ensure adequate shopping cart stability to prevent tip-overs.

Child-restraint systems for shopping carts can be active or passive. Active restraint systems require action by the parent to secure the child in the restraint and are, therefore, less effective. The most commonly used active restraint is a lap belt. In some shopping carts, 3-point or 5-point harnesses are used in the cart seat area, in infant carriers attached to the cart basket, or in combination with an attachment to shopping carts that places toddler-aged children on plastic seats between the shopper and the rear of the cart. All of these systems require the

shopper to initially secure the child correctly in the restraint and to remain vigilant to ensure that the child stays in the restraint. As previously noted, attempts to modify shoppers' safety behaviors to increase the number of children appropriately restrained while being transported in shopping carts have had limited success.^{10,11}

A passive (or automatic) child-restraint system for shopping carts could also be used that would result in increased restraint use. Such a system could be designed to automatically secure the child in place when the child is seated in the cart. It could also be designed to prevent the cart from moving while carrying a child passenger unless the automatic restraint was engaged. In 1994, the inventor of an automatic child restraint for carts petitioned the US Consumer Product Safety Commission (CPSC) to require automatic restraints on shopping carts, but this petition was denied.¹⁴

Not all types of buckles on child-restraint systems are equally child resistant. Nineteen (27%) of 70 children 2 to 3 years of age in one study were able to open 1 of 3 types of buckles.¹⁵ The CPSC was petitioned in 1999 to require that buckles that fasten child-restraint systems in various products, including shopping carts, meet a child-resistance standard. The petition requested that the buckles be required to use a double-action release mechanism in which 2 distinctly separate actions are necessary for buckle release. Currently, infant crib side rails, medicine bottles, and some stroller and high chair buckles use double-action safety mechanisms to prevent children from defeating them. Citing a lack of evidence to support the petition and recognizing that buckles are only one part of a restraint system, the CPSC denied this petition in August 2000.¹⁶

In February 2002, the CPSC issued a report with findings from its 2-year Child Restraint Project.¹⁷ The report analyzed why restraint systems fail and made recommendations for voluntary standards that would address these failures. It focused on high chairs and strollers, because these products account for most incidents of reported restraint failure among juvenile products. The findings of the Child Restraint Project can help direct the development of a performance requirement for a child-restraint system in shopping carts.

Child-restraint systems in shopping carts have limitations. Their effectiveness in preventing falls is unknown, and they do not adequately protect against injuries in shopping cart tip-overs. An infant restrained in a carrier seat bolted across the top of the cart basket or a child restrained in the seating area high in the cart may actually increase the likelihood of a tip-over by contributing to a higher center of gravity. The use of shopping cart restraints may also create a false sense of security among some parents. Because up to 38% of shopping cart-related injuries to children younger than 2 years are associated with cart tip-overs, the use of restraining de-

vices alone will not adequately protect children in this age group unless cart stability is also ensured.

Because the severity of a fall is related to the height of the fall, locating the seating position for a child closer to the ground is a desirable modification of cart design. Cart designs introduced during recent years incorporate this solution by locating the child in a stroller-like seat or a miniature model of a motor vehicle in front of a smaller-sized shopping cart basket.^{18,19} Placing the child lower in the cart lowers the center of gravity and, thereby, decreases tip-over potential. These modifications also accommodate large toddlers and preschool-aged children who are too big to fit in the typical seating position in a cart and, therefore, are often placed unrestrained in the cart basket. Because toddlers and preschool-aged children are commonly injured by a fall from the cart basket, these cart modifications offer an important alternative location for these children to ride more safely.

Shopping carts vary significantly in design characteristics including height, weight, center of gravity, and wheelbase dimensions. Some carts have a relatively narrow wheelbase in relation to their height, which makes them more likely to tip over. An important variable affecting rearward tip-over potential is the location of the handle and child seating area in relation to the rear axle. If a vertical line is dropped from the handle, the horizontal distance between that line and the rear axle can vary significantly. The greater this horizontal distance, the more likely downward pressure on the handle will cause the cart to tip over backward. A vertical force as little as 16 lb applied downward on the handle is all that is required to tip some carts over.²⁰ An average adult can apply this amount of force without difficulty with forearms resting on the top of the cart handle. In addition, if the child seating area is located farther rearward in relation to the rear axle of the cart, or if the child in the seating area leans toward the rear of the cart, the cart will more easily tip over backward.

Parents and other child caregivers cannot be expected to ascertain the relative stability of a shopping cart by visual inspection. Most parents, therefore, are unable to make informed decisions regarding the safety of transporting their child in the cart. For this reason, an effective US performance standard for shopping carts is needed. European Standard EN 1929-1:1998²¹ has been implemented in 19 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Australia and New Zealand also have a joint national standard, AS/NZS 3847.1:1999.²²

European Standard EN 1929-1:1998 was approved by the European Committee for Standardization on April 30, 1998. This is part of a series of standards for shopping carts currently under preparation. It contains requirements for the construction, performance, testing, and

safety specifications for general-purpose self-service shopping carts with or without a child-carrying seat. This standard includes a cart-stability test but does not contain specifications for shopping cart accessories, including child safety restraints.²¹ The joint Australian/New Zealand Standard AS/NZS 3847.1:1999 was approved on behalf of the Council of Standards Australia on October 30, 1998, and on behalf of the Council of Standards New Zealand on October 19, 1998. It was published January 5, 1999. This standard specifies materials, construction, performance, and testing requirements for shopping carts with and without a child-carrying seat for children up to 18 kg in body weight (approximately 3 years of age). It includes a cart-stability test and a child-restraint requirement. However, there is no performance standard for the restraint system. The standard states that the child restraint "may take any form, examples being a strap or straps or a tray table. If straps are provided, the minimum shall be a waist strap or straps."²² A shopping cart-performance standard for the United States should include a clear and comprehensive performance requirement for the child safety restraint system in the cart to adequately address cart-related pediatric injuries.

The CPSC denied petitions to promulgate mandatory standards for shopping carts in 1975,²³ automatic child restraints in carts in 1994,¹⁴ and preventing cart tip-overs in 1998.²⁰ At the time the petition was denied in 1975, the industry indicated that it would pursue development of a voluntary standard for shopping carts, but no action was taken until 2002. Thomas H. Moore, 1 of 3 CPSC commissioners who reviewed the petition in 1998 requesting a performance standard to prevent shopping cart tip-overs, indicated in a written minority opinion that he favored deferring a decision on the petition and pursuing a voluntary standard with the industry.²⁴ The CPSC engineering staff stated at that time that it would be "a relatively straightforward matter" to develop a performance standard for shopping cart stability.²⁵ However, the other 2 commissioners did not agree with Moore, and the petition was denied. In 1995, an industry spokesman articulated the view that "injuries involving shopping carts are due to consumer misuse of the product and are not flaws in the current design or a lack of safety mechanism."²⁶ In September 2002, American Society for Testing and Materials (ASTM) International formed Subcommittee F15.56 on Shopping Carts to develop a voluntary standard for shopping carts. The Standard Consumer Safety Performance Specification for Shopping Carts F2372-04 was published in July 2004.²⁷

However, unlike the standards in 21 other countries, the ASTM standard does not address shopping cart stability. Stating that there were "not sufficient frequencies and severity of 'tip-over' injuries, relating to the cart's stability, to warrant requirements and testing for 'tip-over,'" ²⁸ the ASTM subcommittee voted to overrule the negative vote of the American Academy of Pediatrics

(AAP) against the draft standard and the recommendation of the AAP that a stability performance standard and test procedure be included in the shopping cart standard.

In addition, ASTM F2372-04 states under section 7.4.1, "Buckles or closures shall be tested in parallel with 16 CFR 1700."²⁷ The regulation at 16 CFR 1700 describes the testing procedure for poison-prevention packaging. It is not entirely consistent with the testing needs of shopping cart buckles or closures and would need to be modified to be applicable. Because test procedures must be specified exactly if they are to be applied uniformly and be enforceable, the language in section 7.4.1 is inadequate. It should be revised to describe the test procedure in precise terms as it applies to shopping cart-restraint systems. More importantly, section 7.4.1 only provides for the testing of buckles or closures and does not test the entire restraint system. A child may not be able to defeat the buckle while easily wiggling out of the restraint. A comprehensive test procedure for the entire restraint system, testing its ability to keep children safely restrained, is needed for adequate protection of children. This is critical for preventing falls from carts, which is the leading injury mechanism. The AAP also raised these concerns in its negative vote against the draft standard, but the subcommittee again voted the objections of the AAP as nonpersuasive.

Thus, the ASTM F2372-04 standard does not adequately address falls and tip-overs, the leading mechanisms of shopping cart-related injury to children. Indeed, it does not address cart stability to prevent tip-overs at all. Until a revised standard is adopted that establishes clear and effective performance criteria to protect against both of these injury mechanisms, parents and other caregivers will not be able to make informed decisions regarding injury risk when placing a child in a shopping cart, because the cart may not provide minimum acceptable safety protections under the current standard.

Shopping Cart Safety Legislation

New York state statute currently requires every commercial business that provides its customers with shopping carts with seats for children to equip and maintain not less than 25% of its carts with child restraints.²⁹ Shopping cart child-restraint legislation was introduced in Massachusetts³⁰ and Minnesota³¹ in 1999 but was not enacted. State laws such as these would be strengthened by incorporation of an effective performance standard for shopping cart child-restraint systems and stability. Although state laws have the potential to promote shopping cart safety for children, without an effective shopping cart-performance standard, the existing New York law and the other bills that have been introduced will not be sufficient to prevent shopping cart-related injuries to children. No federal legislation regarding shopping cart safety has been introduced to date.

RECOMMENDATIONS

Recommendations from the AAP regarding prevention of shopping cart-related injuries are included in the accompanying policy statement.³²

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