

# Incidence and Description of Stroller-Related Injuries to Children

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**ABSTRACT.** *Objective.* To describe the incidence, circumstances, and types of stroller-related injuries among US children.

*Design.* Retrospective review of data for children 3 years old and younger from the National Electronic Injury Surveillance System of the United States Consumer Product Safety Commission for 1994–1998.

*Results.* There were an estimated 64 373 stroller-related injuries (95% confidence interval [CI]: 49 223–79 514) to children 3 years old and younger treated in hospital emergency departments in the United States during the 5-year study period. The median age at the time of the injury was 11 months; 51% were males. The annual rate of injury among children <1 year old was 184.4 per 100 000. Seventy-six percent of injuries resulted from a fall from the stroller. A motor vehicle was involved in <1% of cases. Most injuries involved the head (44%) or face (43%). Injury diagnoses included contusions or abrasions (38%), lacerations (24%), closed head injury (22%), and extremity fractures (3%). Two percent of injured children, an estimated 992 (95% CI: 428–1556), were admitted to the hospital during the study period, an annual admission rate of 1.3 per 100 000. Seventy percent of admissions were for head trauma.

*Conclusions.* Injuries related to strollers are common, particularly among children in the first year of life. They often result from falls from the stroller. The data suggest that restraint use would prevent many stroller-related injuries. *Pediatrics* 2002;110(5). URL: <http://www.pediatrics.org/cgi/content/full/110/5/e62>; *injury, infant, stroller, falls.*

ABBREVIATIONS. CPSC, US Consumer Product Safety Commission; NEISS, National Electronic Injury Surveillance System; CI, confidence interval.

Strollers are commonly used to transport young children. They are helpful under any circumstance when carrying a young child would be cumbersome or tiring: outdoors for walks or to complete short errands, or indoors to shop or tour museums. Stroller designs vary, as do their cost, which ranges from quite modest (\$20) to expensive. Because of their low cost and convenience, most US families with young children have one.<sup>1</sup>

Strollers allow children to be propelled across hard

surfaces with speed. Not surprisingly, injury may result if a young child falls from a stroller. Although many injuries are minor, serious trauma, including closed head injuries, have been reported in case series.<sup>2,3</sup> Australian surveillance data suggested that stroller injuries were the most frequent nursery product-related injuries, exceeding those related to infant walkers, high chairs, changing tables, beds, and infant exercisers.<sup>4</sup>

Because epidemiologic data are lacking, we undertook this study to describe the incidence, types, and circumstances of injuries associated with strollers among US children.

## METHODS

Data were obtained from the US Consumer Product Safety Commission (CPSC) Injury Information Clearinghouse for 1994–1998 concerning injuries to children associated with the use of infant carriages (product category 1505) and infant strollers (product category 1522).

Data included injury date, age, sex, diagnosis, most severely injured body part, disposition, site of injury event, other products involved (including motor vehicles), and a descriptive comment for each injury. We combined some diagnosis codes for this report. We combined internal injury to the head with concussion and designated them to be closed head injuries. We combined hematoma with contusion/abrasion and designated them to be contusions/abrasions, and we combined puncture and avulsion with laceration and designated them to be lacerations. The National Electronic Injury Surveillance System (NEISS) codes the site of injury event to be home if the injury occurs in the patient's own house, in someone else's house, in rooms inside a house, a porch or patio, in a garden or yard, or in the adjacent garage, driveway, or sidewalk; NEISS codes the site as street or highway if the injury occurs on a highway, alley, dirt road, or public thoroughfare of any kind. NEISS codes the injury event site to be other property if the injury occurs in a store, an office building, a restaurant, a church, a hotel or motel, or a hospital or other health care facility. Other sites of injury event include apartment/condominium, mobile home, farm, industrial place, school, place of recreation or sports, and unknown. NEISS codes disposition as treated and discharged, admitted to the hospital, transferred to another hospital, died, or not recorded.<sup>5</sup> For ease in reporting the data, cases transferred were combined with those admitted and all were designated as admitted. Using information from the descriptive comments, we characterized the circumstances of injury as stroller tipped, child fell from the stroller, a body part was entrapped, the stroller malfunctioned or collapsed, the child tripped on the stroller, or circumstances unclear. We also reviewed the descriptive comments for information about restraint use.

NEISS receives reports from a probability sample of hospital emergency departments in the United States and uses the information to estimate national patterns of product-related injuries.<sup>6,7</sup> Each emergency department participating in NEISS carries a statistical weight that reflects how representative it is of all US emergency departments. We used the NEISS data and weightings to calculate injury estimates. Calculation of a 95% confidence interval (CI) for the estimated number of injuries was based on the generalized estimated sampling error for NEISS data provided by the CPSC.<sup>8</sup> US Census estimates for 1994–1998 were used to calculate injury incidence rates.<sup>9</sup>

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We used SPSS (PC+ statistical package, SPSS, Inc, Chicago, IL) for data management and statistical analysis. The  $\chi^2$  test was used to compare injury diagnoses by injury mechanism and by age.

## RESULTS

During the 5-year period reviewed, there were 2014 children 3 years old and younger reported to NEISS who had injuries related to the use of strollers. Using the NEISS weightings, there were an estimated 64 373 injuries (95% CI: 49 233–79 514) treated in hospital emergency departments. Data reported and analyzed in this study will use the national injury estimates. The median age of injured children was 11 months old; 51% were male.

An estimated 36 075 injuries occurred among children 12 months old or younger, an annual average rate of 184.4 per 100 000. There were an estimated 15 480 injuries among those 13 through 23 months old, an annual average of 81.6 injuries per 100 000 children. Stroller-related injury rates among 2 and 3 year olds were 47.2 and 19.2 per 100 000, respectively.

Most of the injuries resulted from a fall from the stroller (76%); in 11% of cases the stroller tipped over and fell, in 6% of cases an extremity was entrapped, in 6% of cases the child tripped on the stroller, and in 1% of cases the stroller collapsed or malfunctioned. Information about restraint use was available for 2% of cases.

A motor vehicle was involved in <1% of cases. Among cases where a location of injury was recorded (53%), most children (61%) were injured in or around the home. Other injury locations included other property (store, restaurant) (27%), a place for recreation (4%), or school (1%); an estimated 7% were injured on a street.

Injury diagnoses are shown in Table 1; most were contusions and abrasions or lacerations. The head (44%) and face (43%) were the most frequent anatomic sites of injury. Extremity injuries (11%) and other injuries (2%) were less common. Extremity trauma accounted for most of the fractures; head or face fractures accounted for 24% of fractures but 1% of injuries overall. Most head and face trauma was described as a closed head injury or as a contusion/abrasion or laceration.

A comparison of injuries among children who fell from a stroller with those among children who tipped over in a stroller showed similar frequencies

of closed head injury, skull fractures, and extremity fractures.

An estimated 992 children (95% CI: 428–1556) were admitted to the hospital during the 5 year study period, an annual admission rate of 1.3 per 100 000 children and a case-hospitalization rate of 2%. Falls from the stroller accounted for 75% of the injuries among hospitalized children. The more common injuries among admitted patients were closed head injury (36%), skull fracture (26%), and extremity fracture (15%).

Overall, 15% of children younger than 1 year old were injured in a stroller tip, whereas 9% of children 1 year old or older were injured in a tip, a significant difference ( $\chi^2$ ,  $P < .01$ ). The younger children were more likely to have a skull fracture, were more often admitted to the hospital, and were less likely to have an extremity fracture ( $\chi^2$  for each,  $P < .01$ ).

## DISCUSSION

These NEISS data indicate an estimated 12 875 US children 3 years old and younger are treated each year in emergency departments for injuries related to stroller use; more than half of the injuries occur during the first year of life. Most injuries involve the head or face, and most are minor. Information about the circumstances of injury indicates that although injuries from falls (76%) exceed those from stroller tips (11%), the injury diagnoses related to each are similar. Motor vehicle involvement is rare. An estimated 2% of children with stroller-related injuries are admitted to the hospital.

We were particularly interested in the circumstances of injury and how they were related to injury diagnosis. It is not surprising that stroller tips more often involved younger children, whose light weight would not balance other loads placed on the stroller. Falls, more common among the older children, might have been anticipated as toddlers like to stand and climb. Although detail about injury circumstances is limited, many young children involved in both stroller tip-related injuries and in falls were probably unrestrained and possibly standing, as others have reported lack of proper restraint use with strollers.<sup>3,4</sup> Moreover, injury diagnoses were similar among children injured in stroller tips and falls.

There is little comparative data about the incidence, circumstances, or types of stroller-related injuries. Injury surveillance data collected in 3 Australia hospitals described injury circumstances to be falls from the stroller (49%), poor stroller stability (7%), digital entrapment (8%), and not specified (36%). Head trauma accounted for 60% of injuries, including skull fractures (1%).<sup>3</sup> The National Injury Surveillance and Prevention Program of Australia reported that 75% of stroller related injuries were attributable to falls.<sup>4</sup> These data are similar to those we report, thus we believe the US NEISS data provide an estimate of national incidence as well as an accurate representation of the frequency of specific injuries. Although head trauma is common, it is usually minor; fractures more often involve the extremities.

In the United States, restraint systems and other

**TABLE 1.** Estimated Injuries Associated With Strollers in the United States, 1994–1998

	N	%
Contusion/abrasion	26 429	41
Laceration	15 781	24
Closed head injury	13 851	22
Extremity fracture	2095	3
Dental injury	872	1
Skull fracture	494	<1
Strain/sprain	493	<1
Other*	4358	7

\* Other includes amputation, crush, dislocation, facial bone fracture, foreign body, and not stated (each accounting for <0.5%), and other (5%).

safety standards have reduced nursery product-related injuries.<sup>10</sup> There is a voluntary safety standard in the US for strollers; this includes the requirement for a restraint system. However, restraint systems require the parent or caretaker to use the restraint each time the product is used. Although there is much design variation among strollers, all have restraints. Most have a waist wrap with a crotch T-strap and childproof buckles; some also have a shoulder harness. Very few NEISS comments described the use or nonuse of restraints at the time of the injury, however, it seems that the lack of effective restraints or the failure to use them contributed to many injuries related to stroller use, as was also noted in Australia.<sup>3,4</sup> In addition to education about proper restraint use, product design modifications that allow restraints to be readily available each time a stroller is unfolded, as well as the development of passive restraints, will likely reduce stroller-related falls.

Although far less frequent than falls, stroller tips accounted for an estimated 1400 injuries annually. Although the primary education message must focus on restraint use, parents should be reminded that heavy objects hung on stroller handles may contribute to stroller tips. Handle design modification to a single horizontal handle bar would likely also limit the hanging of heavy objects. Collapse of the stroller occurred in 1% of cases. The CPSC plays an important role in the identification and recall of malfunctioning products. Although it is important that malfunctioning products be identified and repaired or removed from homes and day care centers, these data suggest that product malfunction accounts for very few of the injuries related to stroller use.

The rate of stroller-related injuries in the first year of life, 184/100 000 is comparable to other juvenile equipment-related injury rates: 150/100 000 for infant carriers and 100/100 000 for high chairs.<sup>11,12</sup>

This study has several limitations. The data we analyzed are based on case reports by emergency departments participating in NEISS. The injury frequencies are calculated national estimates based on visits to statistically representative emergency departments, resulting in a degree of uncertainty concerning true injury incidence. Because not all injuries are treated in emergency departments, it is likely that the actual number of injuries associated with strollers is higher than estimated. Using NEISS injury diagnosis information to estimate injury severity is also imprecise.

Detailed information about the actual injury

events was limited. Although we do not believe this systematically biased the data we present, more detailed information about the circumstances of the injury would have been helpful. NEISS contains no information about supervision at the time of the injury. The appropriate use of restraints may have prevented many of the injuries, but specific information about restraint use is lacking. Furthermore, more effective restraint systems including the use of a shoulder restraint in addition to a lap belt would likely be helpful. Nevertheless, these data provide information about the circumstances and types of injuries associated with strollers, provide an estimate of incidence, and suggest a specific preventive strategy.

This description of injuries associated with the use of strollers shows that although some injuries result from stroller tips, many more young children fall from them. Although most injuries are minor and involve the head or face, an estimated 2% resulted in hospital admission. Using effective restraints at all times would likely prevent many of these injuries.

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