Trends in Incidence of Pediatric Injury Hospitalizations in Pennsylvania

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A B S T R A C T

Objectives. This study analyzed short-term trends in pediatric injury hospitalizations.

Methods. We used a population-based retrospective cohort design to study all children 15 years or younger who were admitted to all acute care hospitals in Pennsylvania with traumatic injuries between 1991 and 1995.

Results. Injuries accounted for 9% of all acute hospitalizations for children. Between 1991 and 1995, admissions of children with minor injuries decreased by 29% ($P<.001$). However, admissions for children with moderate ($P=.69$) or serious ($P=.41$) injuries did not change.

Conclusions. Significant declines in pediatric admissions for minor injuries were noted and may reflect both real reductions in injury incidence and changes in admission practices over the period of the study. (*Am J Public Health.* 2000;90: 1782–1784)

The number of children killed each year as a result of injury has steadily declined in recent years.[1] The incidence of nonfatal injuries, a more accurate indicator of the total burden of injuries on children, is less well known.[2–8] Therefore, the objective of this study was to evaluate trends in demographic and injury severity characteristics of children hospitalized for traumatic injuries in Pennsylvania. We sought to provide more recent population-based surveillance data both to support efforts to control childhood injuries and to assist in the further planning of regional trauma care for children.

Methods

The subjects of the study were all children 15 years or younger admitted to all acute care hospitals in Pennsylvania with a principal diagnosis of traumatic injury (*ICD-9-CM* codes 800–959) between 1991 and 1995 were studied. Data were obtained from the Pennsylvania Health Care Cost Containment Council, an independent state agency that collects demographic, billing, and clinical outcome data on every patient admitted to every hospital in the state.

The Abbreviated Injury Scale score and its derivative, the Injury Severity Score, were used to characterize injury severity.[9,10] These scores were ascertained with ICDMAP (Tri-Analytics, Inc, Bel Air, Md), a computerized program that converts *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis codes into Abbreviated Injury Scale and Injury Severity Score scores.[11,12] We analyzed the data with Poisson regression; the rate of admission was the outcome of interest, and the year was the primary predictor in the model.[13] We measured tests of statistical significance with likelihood ratio statistics.[14] All models were fit with the Poisson regression routines of Stata, Version 5.0 (Stata Corp, College Station, Tex). Results are expressed as the number of admissions per population per year. Population counts were obtained from US Census Bureau estimates for each year.[15]

Results

During the period of study, 46 348 children were admitted for injuries, representing approximately 9% of all pediatric acute care admissions each year. Basic descriptive characteristics of the study population are provided in Table 1. In 1994 through 1995, the years for which nearly complete (>95%) *ICD-9-CM* - external-cause-of-injury codes (E-codes) were available, falls accounted for approximately 40% of the injury admissions, and motor vehicle occupant, pedestrian, and pedal cyclist injuries each accounted for approximately 9% of the admissions.

As noted in Figure 1, the annual overall pediatric injury admission rate decreased by an average of 5.5% per year, from 447 admissions per 100 000 population in 1991 to 323 per 100 000 population in 1995 ($P<.001$). The rate of admission for children with minor injuries decreased by 28.8% ($P<.001$). However, the rate of admission for children with moderate ($P=.69$) or serious ($P=.41$) injuries did not change.

We also evaluated trends in severity-specific admission rates, stratified by body region of injury. Admission rates for minor (Abbreviated Injury Scale score ≤ 2) injuries decreased significantly ($P<.001$) over time for every body region except the abdomen; admission rates for injuries to that region showed no change ($P=.49$). In contrast, among serious injuries (Abbreviated Injury Scale score ≥ 3), only those to the head showed a statistically significant 2% per year decrease in admissions. Rates of serious chest injuries *increased* significantly ($P<.001$)—approximately 6% per year—over the time of the study. Head injuries accounted for the greatest proportion (59.5%) of serious injuries, followed by injuries to the

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Note. The views expressed are those of the authors and do not necessarily reflect the official views of the National Center for Injury Prevention and Control, Centers for Disease Control and Prevention.

TABLE 1—Pediatric Injury Admissions to Pennsylvania Acute Care Hospitals, 1991–1995

	1991	1992	1993	1994	1995
Injury admissions	10485	10332	8948	8940	7643
Sex, no. (%)					
Male	7102 (67.7)	6906 (66.8)	5980 (66.8)	5952 (66.6)	5161 (67.5)
Female	3383 (32.3)	3426 (33.2)	2967 (33.2)	2986 (33.4)	2481 (32.5)
Age, y, no. (%)					
<1	489 (4.7)	471 (4.6)	361 (4.0)	413 (4.6)	329 (4.3)
1–4	2045 (19.5)	1980 (19.2)	1767 (19.7)	1746 (19.5)	1388 (18.2)
5–9	3106 (29.6)	3031 (29.3)	2510 (28.1)	2479 (27.7)	2164 (28.3)
10–15	4844 (46.2)	4850 (46.9)	4310 (48.2)	4302 (48.1)	3762 (49.2)
Injury severity, no. (%)					
Minor (*ICD*/ISS≤12)[a]	9518 (90.8)	9437 (91.3)	8055 (90.0)	8072 (90.3)	6789 (88.8)
Moderate (*ICD*/ISS=13–19)	551 (5.3)	548 (5.3)	569 (6.4)	565 (6.3)	567 (7.4)
Serious (*ICD*/ISS≥20)	276 (2.6)	265 (2.6)	256 (2.9)	275 (3.1)	254 (3.3)
Length of stay, d, mean±SD	3.4±5.3	3.3±5.3	3.3±4.9	3.3±5.1	3.2±5.0
Discharge status, no. (%)					
Home	10153 (96.8)	10011 (96.9)	8635 (96.5)	8592 (96.1)	7341 (96.0)
Interhospital transfer	225 (2.1)	244 (2.4)	247 (2.8)	234 (2.6)	231 (3.0)
In-hospital death	62 (0.6)	61 (0.6)	52 (0.6)	103 (1.2)	55 (0.7)
Cause of injury, no. (%)					
Fall	. . .[b]	. . .[b]	. . .[b]	3441 (38.5)	3049 (39.9)
Motor vehicle occupant				710 (7.9)	690 (9.0)
Pedal cyclist				852 (9.5)	700 (9.2)
Pedestrian				724 (8.1)	694 (9.1)
Other motor vehicle				480 (5.4)	435 (5.7)
Firearm				148 (1.7)	110 (1.4)
Other				2104 (23.5)	1776 (23.2)

Note. E-coding = *ICD-9* external-cause-of-injury coding.
[a]*International Classification of Diseases (ICD)*/Injury Severity Score (ISS) determined via the ICDMAP. See text for details.
[b]Incomplete E-coding.

lower extremities (17.2%), the chest (8.2%), the upper extremities (6.8%), and the abdomen (5.3%).

Discussion

Our surveillance data showed a significant reduction in the rate of pediatric hospitalization for injury between 1991 and 1995, occurring almost exclusively among children with minor injuries. Decreases in hospitalization for injuries may be the result of either actual decreases in the incidence of injuries severe enough to require medical attention or changes in the practice of admitting injured children to the hospital. In Pennsylvania, the injury mortality rate for children 15 years or younger declined by 17% between 1991 and 1995,[16] indicating a reduction in the incidence of the most serious injuries. Unfortunately, no source of Pennsylvania-specific data on emergency department visits for injury during this time is available, so our ability to directly evaluate changes in hospital admission practices was limited.

On a national level, between 1991 and 1995, injury mortality rates for children younger than 15 years decreased by nearly 10%,[17] whereas hospitalizations for injury declined by 19.6%.[18–22] However, the rate of injury-related emergency department visits for children younger than 15 years did not change between 1992 (14.5 visits per 100 population) and 1995 (14.6 per 100).[23–26] This pattern suggests that, on a national level, there was a real reduction in the incidence of the most serious (i.e., fatal) injuries to children, with a concomitant change in the pattern of admission of less serious injuries to the hospital.

Hospital admission practices are influenced both by improvements in diagnostic modalities and by economic pressures to restrict costs. Changes in hospital admission practice for injured children have become the focus of recent investigations. Several studies have questioned the need for routine hospitalization for observation of children with minor head trauma, including those with skull fractures.[27,28] In addition, other investigators have suggested that more restrictive hospital admission practices, brought about by increasing penetration of managed care organizations into regional health care markets, explain the significant decreases in use of hospital inpatient services for injuries over the past 2 decades.[2,29,30] Further investigation is required to identify the relative contribution that these and other factors affecting hospital admission practices may have had on the declining admission rates noted in this study.

Hospital discharge data may play several important roles in injury surveillance. With recent improvements in E-codes and the ability to identify the body region and severity of injury, these data may be used to identify specific injuries in need of intervention as well as the effects of specific intervention strategies. For example, the significant increase in admissions for serious chest injuries suggests an area in need of further research to develop potential intervention strategies. Given the continued evolution of hospital admission practice, hospital discharge data will remain an important source of information on changing trends in the use of acute care resources that can be applied to the planning of regional trauma system care for children. □

Contributors

D. R. Durbin planned the study, oversaw the data analyses, and wrote the first and subsequent drafts of the paper. D. F. Schwarz and E. J. MacKenzie contributed to the planning of the study, the interpretation of results, and the writing of the paper. A. R. Localio contributed to the planning of the study, conducted all the analyses, and contributed to the writing of the paper.

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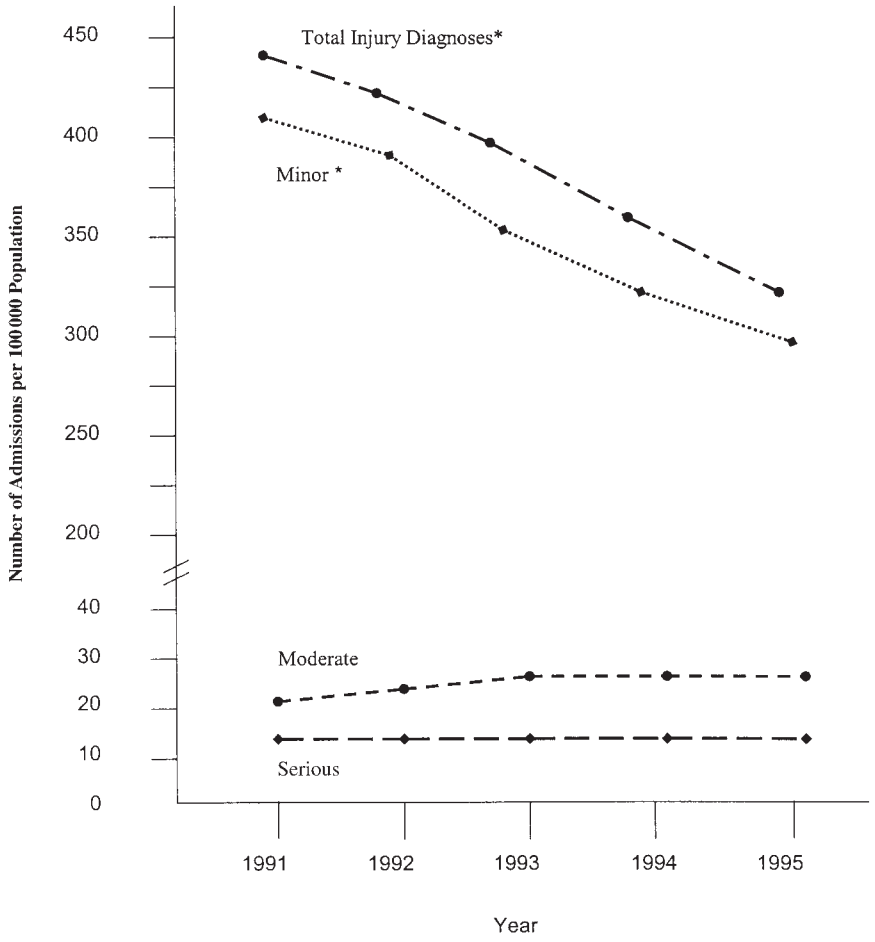

Note. Minor = *International Classification of Diseases (ICD)*/Injury Severity Score ≤ 12; Moderate = *ICD*/Injury Severity Score = 13–19; Serious = *ICD*/Injury Severity Score ≥ 20.

FIGURE 1—Rates of pediatric injury admissions to all acute care hospitals in Pennsylvania (1991–1995) by injury severity group (P* < .001 for trend).**

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