Patient- and Community-Level Sociodemographic Characteristics Associated with Emergency Department Visits for Childhood Injury

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Objective To examine pediatric emergency department (ED) visits over 5 years, trends in injury severity, and associations between injury-related ED visit outcome and patient and community-level sociodemographic characteristics.

Study design Retrospective analysis of administrative data provided to the Pediatric Emergency Care Applied Research Network Core Data Project, 2004-2008. Home addresses were geocoded to determine census block group and associated sociodemographic characteristics. Maximum Abbreviated Injury Scale severity and Severity Classification System scores were calculated. Generalized estimating equations were used to test for associations between sociodemographic characteristics and admission or transfer among injury-related ED visits.

Results Overall ED visits and injury-related visits increased from 2004 to 2008 at study sites. Of 2 833 676 successfully geocoded visits, 700 821 (24.7%) were injury-related. The proportion of higher severity injury-related visits remained consistent. Nearly 10% of injury-related visits resulted in admission or transfer each year. After adjusting for age, sex, payer, and injury severity, odds of admission or transfer were lower among minority children and children from areas with moderate and high prevalence of poverty.

Conclusions Pediatric injury-related ED visits to included sites increased over the study period while injury severity, anticipated resource utilization, and visit outcomes remained stable, with low rates of admission or transfer. Sociodemographic differences in injury-related visits and ED disposition were apparent. ED-based injury surveillance is essential to understand disparities, inform targets for prevention programs, and reduce the overall burden of childhood injuries. *(J Pediatr 2015;167:711-8)*.

Injuries remain a leading cause of childhood mortality in the US.[1] For every injured child who dies, the US Centers for Disease Control and Prevention (CDC) estimates that 25 children are hospitalized and 925 are treated in an emergency department (ED).[2] Although the CDC has documented declining rates of fatal childhood injuries,[3] national injury surveillance systems show increased pediatric ED visits for specific injuries.[4-8]

Studies have found childhood injuries to be unevenly distributed throughout the population; disparities appear to be persistent and may be widening.[9-11] In national datasets and trauma registries, children from minority racial/ethnic groups, and families of lower socioeconomic status

AIS	Abbreviated Injury Scale
CDC	Centers for Disease Control and Prevention
ED	Emergency department
ICD-9-CM	*International Statistical Classification of Diseases 9th Revision Clinical Modification*
MAIS	Maximum AIS
PCDP	PECARN Core Data Project
PECARN	Pediatric Emergency Care Applied Research Network
SCS	Severity Classification System
SES	Socioeconomic status

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(SES) experienced higher rates of injury and injury-related mortality.[12-16] In population-based studies in Canada, community-level measures of socioeconomic disadvantage (eg, poverty level) were associated with childhood injuries.[17,18]

Prior studies evaluating temporal trends in the full spectrum of pediatric injury-related ED visits in the US are more than 10 years old[19-21] and administrative datasets contain limited sociodemographic information. In this study, we sought to examine the burden, severity, and outcomes of pediatric injury-related ED visits in a large multicenter database compiled by the Pediatric Emergency Care Applied Research Network (PECARN). This database is unique in that visit-level address information was linked to census block group sociodemographic data. This linkage allowed us to examine the relationship between injury-related ED visits and sociodemographic characteristics at the patient and community level, analyses that would not be possible using publically available national ED datasets.[22,23] We hypothesized that pediatric ED visits for injury would be more common among children from disadvantaged socioeconomic backgrounds and that these visits would be more likely to require admission or transfer.

Methods

Investigators obtained data for this retrospective multicenter, multiyear study from the PECARN Core Data Project (PCDP), a database established from participating hospitals' administrative data.[24] We conducted analyses in 2013 using data from 2004 through 2008, the last year that full patient addresses were available. The institutional review boards of all participating sites and the data-coordinating center approved this study.

We considered sites eligible for the study based on 3 criteria: (1) contribution of data for all study years; (2) provision of patient's home address to the dataset; and (3) assignment of *International Statistical Classification of Diseases 9th Revision Clinical Modification* (ICD-9-CM) E-codes for ≥80% of visits with associated ICD-9-CM codes for injury. Of the 24 EDs contributing data to the PCDP continuously from 2004 to 2008, 16 were included in analyses (**Figures 1** and **2**; available at www.jpeds.com). Eight sites were freestanding children's hospital EDs, 6 sites were separate pediatric EDs within a general ED, and 2 sites were general EDs. Annual pediatric ED visit numbers ranged from 10 437 to 84 301, with overall admission rates ranging from 3% to 22%. Twelve of 16 sites were recognized as level 1 pediatric trauma centers either by the American College of Surgeons (n = 10) and/or state or regional designation (n = 11).

Visit Identification

ED visits by children <19 years of age were eligible for analysis. We categorized visits as injury-related based on the presence of: (1) an ICD-9-CM code for injury or poisoning (800-995); or (2) any non-location E code (E849.x). For example, a visit with an ICD-9-CM code for limb pain (729.5) and an E-Code for motor vehicle collision (E813x) was considered injury-related. Visits were considered noninjury-related if: the diagnosis codes were outside of 800-995 and there was no E-code or the only E-codes were considered "adverse effects" (E870-E879.99, E930-E949.99). ED deaths were rare in this cohort of injured children (n = 400) and excluded from analyses.

Intent and mechanism of injury were determined using the CDC Matrix of E-Code Groupings.[25] We categorized unintentional injuries based on Mechanism/Cause of Injury. A separate category for "Bites and Stings" (E-codes E905 and E906) was created because we observed a large number of "Bites and Stings" visits within the "Natural/Environmental" group. For the same reason, visits with the E-code (E918) "Caught between Objects" or (E915) "Foreign Body" were included as separate categories from the "Other Specified and Classifiable" group. We grouped intentional injuries without distinguishing the mechanism of injury given small sample sizes in subgroups. Among children age less than 10 years, we grouped assault and self-inflicted injuries together because of the smaller sample size of intentional injury visits in these age groups.

We used Abbreviated Injury Scale (AIS) severity scores as a measure of injury severity. AIS severity scores are on an ordinal scale and range from 1 (minor) to 6 (untreatable). Maximum AIS (MAIS) ≥2 indicates injuries of moderate and greater severity.[26] MAIS severity scores were calculated using a 2-step process. First, an investigator (M.Z.) certified in AIS scoring used the ICDMAP-90 software to map each ICD-9-CM code associated with the visit to the 1998 version of the AIS. Second, M.Z. manually remapped codes to the most recent AIS versions (2005 and 2008) using the AIS manual and the ICD-9-CM injury code descriptions.[26-28] Remapping was necessary to ensure the severity categories from the most recent AIS manual were applied to the data. This 2-step process yielded the MAIS severity score value for each visit. ICD-9-CM codes with insufficient detail to be mapped were initially assigned a MAIS severity score of 9 (unknown or indeterminable severity), and that multiple imputation was used to assign severity scores. As AIS scoring does not apply to injury-related visits without trauma (eg, poisoning) or visits with E-codes but no injury-related ICD-9-CM codes, these visits were assigned a MAIS severity score of 0.

We used Severity Classification System (SCS) scores as a measure of the anticipated resource utilization for the visit. The SCS is a 5-level system in which ICD-9-CM diagnosis codes have been assigned a score related to the anticipated ED resource utilization for the care of a child with that diagnosis.[29] In our analyses, each case was assigned the maximal SCS score among all ICD-9-CM codes associated with the visit. Within the SCS, a score of 1 indicates minor illness (eg, diaper dermatitis), and a score of 5 indicates major illness (eg, septic shock).