Residential Injuries in U.S. Children and Adolescents

Kieran J. Phelan, MD, MS[a,b]
Jane Khoury, MS[b,c]
Heidi Kalkwarf, PHD[b,c]
Bruce Lanphear, MD, MPH[b,c]

SYNOPSIS

Objectives. Injuries are the leading cause of death and disability for U.S. children, but little research exists on injury in the home environment. The purpose of this study was to estimate the rate and severity of and trends in unintentional residential injury for U.S. children <20 years for 1993–1999.

Methods. Data on emergency department (ED) visits were obtained from the National Hospital Ambulatory Medical Care Survey (NHAMCS). Rates and 95% confidence intervals (CIs) were calculated using SUDAAN. Chi-square analysis was used to test for differences among proportions. Time trends were analyzed using linear regression.

Results. Residential injuries accounted for an average of 4.01 million (95% CI 3.50 million, 4.56 million) ED visits each year for U.S. children, representing 39% of unintentional injury ED visits. There were an average of 531,000 (95% CI 456,000, 606,000) visits with moderate-to-severe injuries, resulting in 73,680 (95% CI 59,715, 87,645) hospital admissions annually. The rate of residential injury visits (excluding unknown locations) was 5.6 per 100 (95% CI 4.9 per 100, 6.4 per 100). The visit rates for children <5 years of age were higher than those for children >9 years ($p<0.0001$). Males had a higher rate of visits than females ($p=0.01$). Falls were the leading mechanisms, resulting in 1.5 million ED visits per year (95% CI 1.3 million, 1.8 million). Residential injury rates decreased by 28% over time ($p<0.02$), from 6.3 per 100 (95% CI 3.4, 9.2) in 1993 to 4.5 per 100 (95% CI 2.3, 6.7) in 1999.

Conclusions. The predominant location of injury for U.S. children is the home, accounting for 4.01 million ED visits and more than 70,000 hospitalizations each year. Efforts targeted to the home environment are needed to reduce morbidity and mortality from unintentional injury in U.S. children.

[a]Division of Health Policy and Clinical Effectiveness, Cincinnati Children's Hospital Medical Center and Cincinnati Children's Environmental Health Center, Cincinnati, OH

[b]Division of General and Community Pediatrics, Cincinnati Children's Hospital Medical Center and Cincinnati Children's Environmental Health Center, Cincinnati, OH

[c]Division of Epidemiology and Biostatistics, Department of Environmental Health, University of Cincinnati College of Medicine, Cincinnati, OH

Address correspondence to: Kieran J. Phelan, MD, MSc, Cincinnati Children's Hospital Medical Center, Winslow Bldg., Rm. 5117, MLC 7014, 3333 Burnet Ave., Cincinnati, OH 45229; tel. 513-636-3231; fax 513-636-0171; e-mail <kj.phelan@cchmc.org>.

In the United States, injury-related morbidity and mortality continues to contribute substantially to the health services burden for children.[1,2] In 1998, injuries accounted for 5,189 deaths in U.S. children ages 1 to 15 years (40% of all mortality in this age group).[3] Deaths are the gravest outcome of injury, but they represent only a fraction of the childhood injury burden. Nonfatal injuries and subsequent disability account for a major proportion of health service utilization in children.[1] A study of injury incidence over a one-year period in Massachusetts found that 96% of injuries in children did not result in death; the child was treated and released from an emergency department (ED).[4] More than half of emergency visits for children ages 5–14 years are for injury, and injuries account for more than 11 million emergency visits each year by U.S. children.[5–7]

The home has been implicated as a leading location of injury for U.S. children.[5,8–10] In 1978–1984, residential injuries accounted for 60% to 70% of fatal injuries among children younger than 15 years of age.[11] There is evidence that the rates of deaths from specific unintentional injury mechanisms in the residential environment (e.g., falls, fire/burns, and poisonings) have decreased,[12,13] but national trends in residential injury rates for U.S. children have not been evaluated since 1985.[11] Thus, it is unclear whether nonfatal injuries occurring in the home have increased, decreased, or remained constant during the last decade.

We undertook the present study to examine rates and severity of and trends in childhood injuries occurring in the home environment. The first objective of this study was to compare the prevalence of residential and non-residential injury visits to U.S. EDs by children younger than 20 years of age. The second objective was to describe unintentional residential injury in terms of child characteristics, mechanism of injury, and severity. The final objective was to examine trends in rates and severity of nonfatal residential injuries in U.S. children from 1993 through 1999.

METHODS

We obtained data on patient visits to EDs for 1993 through 1999 from the National Hospital Ambulatory Medical Care Survey (NHAMCS). The NHAMCS, conducted by the National Center for Health Statistics (NCHS), is a nationally representative probability sample of patient visits to EDs and hospital-based outpatient clinics of non-institutional, nonfederal, general, and short-stay hospitals (thus excluding Veterans Administration and military hospitals) in the United States. The survey uses a four-stage complex probability sampling design. The sampling stratification for the NHAMCS ED data includes geographic primary sampling units, hospitals within the primary sampling units, EDs within hospitals, and patient visits within EDs. Each selected hospital participates for a randomly selected four-week period during a given survey year. The staff of the participating hospitals abstract data from the medical record at or near the time of a patient visit during the selected four-week period. The data collected include demographics, the reason for the visit, whether the visit was for an injury, the E-coded mechanism of injury, three diagnoses according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) system (N-codes), and the place of occurrence of the injury. The abstracted data do not include individual patient identifiers. Therefore, repeat visits for the same injury event (e.g., multiple visits for neck or back pain resulting from the same fall) could inflate estimates for a given injury mechanism. The 1992 dataset, which included information on repeat ED visits for the same injury event, did not include data on location of injury and was therefore not used in these analyses. Prior analyses using the 1992 dataset suggest that repeat ED visits for children represent no more than 5% or 6% of all injury visits for children in the NHAMCS.[14,15]

Data from the NHAMCS for the years 1993 through 1999 were obtained from the NCHS website and converted into an SAS dataset. Injury visits were identified by an ICD-9-CM E-coded mechanism in the primary, secondary, or tertiary E-code fields in the NHAMCS records. We limited the analysis to injury visits for children younger than 20 years of age. There were 49,884 unweighted ED visits for all causes in 1993–1999, and 19,372 unweighted visits for which a valid E-code (indicating an injury) was present. Unintentional injury visits were defined as visits with primary E-codes in the range of 800–929.9, and intentional injury visits as those with E-codes in the range of 950–978. Categories of E-codes relating mechanisms, body regions, and tissue injuries were developed based on matrices recommended by the Centers for Disease Control and Prevention (CDC)[16] and Barrel et al.[17]

NCHS coding rules for the place of occurrence of an injury were revised every two years during our study period; therefore, for consistency, we recoded all place of occurrence codes to "home," "school/daycare," "public," "other," and "unknown" (not missing). The location of injury was "unknown" for 23% of records. To assess for possible systematic bias introduced by missing data for location of injury, we compared the proportions of residential injuries among hospitals with more complete data (n=47 hospitals with location of injury recorded for >90% of ED visits with known location of injury) vs. hospitals with less complete data (n=654 hospitals with location of injury recorded for <90% of ED visits with known location of injury).

Severity of injury was assessed in three ways: *(1)* body region and type of tissue damage, *(2)* the Abbreviated Injury Scale (AIS), an injury severity score,[18] and *(3)* the estimated number of hospital admissions for injury-related ED visits. The AIS score describes the severity of each injury sustained by a patient on a scale of 1 (least severe) to 6 (most severe) in nine defined body regions.[18] The AIS was originally developed by the Association for the Advancement of Automotive Medicine to compare trauma outcomes and is applicable to various injury mechanisms.[19,20] AIS scores correlate well with mortality, with increasing scores correlating with a greater probability of death.[19,21] The AIS score was determined from the ICD-9-CM nature of injury codes (N-codes) in the records using ICDMAP-90 software.[22,23] The scores developed by this software result in conservative estimates of injury severity.[24] This mapping software could not assign a severity score to 24% of all injury visits and 22% of residential injury visits due to a lack of specific injury information. To minimize the potential bias associated with missing data, we used a conservative strategy and assigned severity scores of "0" to N-codes outside the range of 800–999, or "1" to non-specific N-codes, such as "head injury, of unspecified," to those records that

did not have assignable severity scores. Analysis of severity scores with and without missing values (after addition of above assigned values) did not alter the conclusions of this study.

Statistical analyses

The complex sampling design of the NHAMCS requires the use of specialized statistical procedures to develop valid variance estimates and confidence intervals (CIs) for hypothesis testing.[25] We computed weighted prevalence estimates and population-specific rates with 95% CIs using SUDAAN.[26] The NCHS Research Data Center provided information on the primary sampling unit and stratification variables needed for these computations. The lower limit of reliability for unweighted records to produce population estimates and accurate CIs is 30 records per cell.[5] Rates were developed using population estimates from U.S. Census data.

The chi-square statistic was used to test for differences among proportions of injury visits according to age, race/ethnicity, gender, place of occurrence, season, and region of the country. Linear regression was utilized to examine trends in injury visits over time.[27] Race/ethnicity was defined as Asian/Pacific Islander (non-Hispanic), black (non-Hispanic), Hispanic, Native American (non-Hispanic), or white (non-Hispanic). There were insufficient numbers of records for injury visits to develop estimates other than for non-Hispanic blacks or non-Hispanic whites or for age-by-gender or age-by-race/ethnicity categories.

The distribution of injury severity scores was not normal; therefore, we examined the median and percentiles of the AIS scores. We also classified injury severity according to the number and proportion of AIS scores >1. This cut-off corresponds to the 90th percentile for emergency visits across all mechanisms of injury and defines a "moderate-to-severe" injury category. Other investigators have used a similar cut-off for AIS scores (AIS >1) to define more severe injuries.[14,28–30] The proportions of injuries above the 90th percentile of severity (AIS >1) over time were compared using the chi-square statistic. A p-value of <0.05 was considered statistically significant.

RESULTS

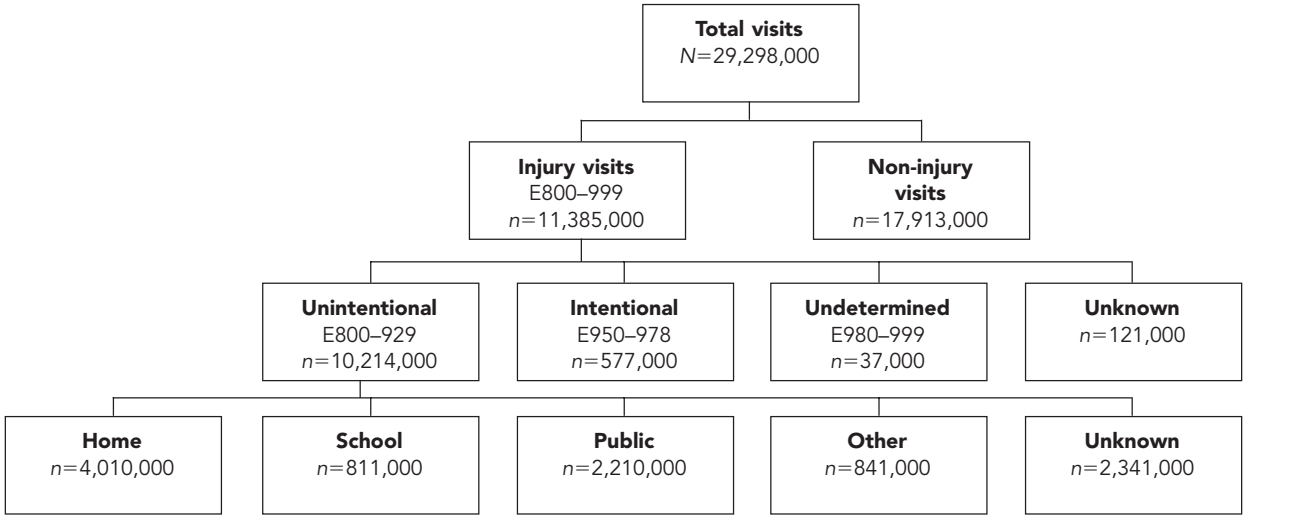
From 1993 through 1999, there was a mean of 29.3 million emergency visits annually for U.S. children <20 years of age (see Figure). Visits for injury accounted for 11.4 million (95% CI 9.63 million, 13.14 million), or 39% of all such ED visits. Unintentional injuries accounted for 10.2 million (95% CI 8.5 million, 12.0 million), or 35% of all emergency visits for U.S. children <20 years of age. Unintentional injury visits outnumbered intentional injuries by almost 20 to 1.

The home was the single most common location of injury, accounting for 39% of injury-related ED visits and 51% of all unintentional injury visits with known locations. Unintentional injuries sustained in the home environment accounted for an average of 4.01 million (95% CI 3.46 million, 4.56 million) ED visits annually. The rate of residential injury visits excluding those with unknown locations, 5.26 per 100 children <20 years of age (95% CI 4.87 per 100, 6.36 per 100), was not significantly different from the rate of non-residential injury visits, 5.39 per 100 (95% CI 4.54 per 100, 6.23 per 100; p=0.35).

There was no difference in the distribution of residential injuries by completeness of hospital documentation. In hospitals with location documented for ≥90% of injuries, 51% of injuries were reported to occur in the home, compared with 50% for hospitals with location documented for <90% of injuries (p=0.68).

Children younger than 5 years of age had the greatest

Figure. Estimated mean number of injury-related ED visits for U.S. children <20 years of age by E-coded intent and location, NHAMCS, 1993–1999



ED = emergency department

NHAMCS = National Hospital Ambulatory Medical Care Survey

number and highest rate of ED visits for unintentional injuries occurring in the home. The rates of unintentional residential injury for children <1 year and 1–4 years were significantly higher than the rate for children older than 9 years (Table 1; $p<0.0001$ for each of these comparisons). Males had a significantly greater number of visits and higher age-specific rates than females ($p=0.01$ for each comparison). In contrast, there was no significant difference in ED visit rates for unintentional residential injury by race/ethnicity ($p=0.39$).

The rate estimate for residential injury in U.S. children was highest in the Midwest, but this was not significantly different from the rates of other regions (Table 1; $p=0.39$). The number and rate of visits for residential injury in U.S. children were highest in spring (April–June) and lowest in fall (October–December; $p=0.03$ for both number and rate). The rate of residential injury was greater in non-Metropolitan Statistical Areas compared to Metropolitan Statistical Areas ($p=0.01$).

Table 1. ED visits for unintentional residential injuries among children and adolescents <20 years of age, by demographics, location, season, and Metropolitan Statistical Area, NHAMCS, 1993–1999

Variable	*Number[a] (95% CI)*	*Rate[b] (95% CI)*
All unintentional	4.01 (3.50, 4.56)	5.26 (4.53, 5.98)
Age (years)[c]		
<1	0.24 (0.19, 0.28)	6.22 (5.00, 7.44)
1–4	1.48 (1.30, 1.72)	9.58 (8.09, 10.12)
5–9	0.94 (0.79, 1.20)	4.84 (4.09, 5.60)
10–14	0.71 (0.63, 0.80)	3.75 (3.29, 4.21)
15–19	0.64 (0.55, 0.73)	3.43 (2.93, 3.93)
Gender[d]		
Female	1.68 (1.44, 1.93)	4.53 (3.87, 5.19)
Male	2.32 (2.00, 2.65)	5.95 (5.12, 6.77)
Race/ethnicity category		
Non-Hispanic black	0.64 (0.53, .75)	5.40 (4.48, 6.33)
Non-Hispanic white	3.37 (2.90, 3.84)	5.57 (4.80, 6.34)
Region		
Northeast	0.78 (0.48, 1.08)	5.64 (3.48, 7.80)
South	1.30 (1.10, 1.50)	4.86 (4.10, 5.61)
Midwest	1.19 (0.96, 1.42)	6.62 (5.33, 7.91)
West	0.74 (0.42, 1.06)	4.18 (2.38, 5.97)
Season[e]		
January–March	0.95 (0.79, 1.11)	1.25 (1.04, 1.46)
April–June	1.13 (0.95, 1.30)	1.48 (1.25, 1.71)
July–September	1.01 (0.85, 1.17)	1.32 (1.11, 1.54)
October–December	0.92 (0.81, 1.03)	1.20 (1.06, 1.35)
Metro area		
MSA	3.13 (2.59, 3.68)	5.16 (4.26, 6.05)
Non-MSA	0.88 (0.78, 0.97)	6.59 (5.90, 7.29)

[a]Mean annual number (in millions) of ED visits for unintentional residential injuries.

[b]Mean annual rate of ED visits for unintentional residential injuries per 100 population.

[c]$p<0.0001$, for <1 year and 1–4 year age groups compared to 10–14 and 15–19 years.

[d]$p=0.01$ by gender.

[e]$p=0.03$ for both number and rate for April-June compared to October–December.

CI = confidence interval

ED = emergency department

NHAMCS = National Hospital Ambulatory Medical Care Survey

Falls were the leading mechanism of residential injury for U.S. children (Table 2). Falls resulted in a mean of 1.52 million visits per year (95% CI 1.29 million, 1.75 million), and accounted for 38% of all residential injury visits. The next most common mechanisms were "struck/strike," with a mean of 0.98 million emergency visits per year, and "cutting/piercing" injuries, with a mean of 0.51 million emergency visits per year.

The number of ED visits for unintentional residential injuries in U.S. children decreased by 24%, from 4.66 million (95% CI 2.51 million, 6.81 million) in 1993 to 3.53 million (95% CI 1.83 million, 5.23 million) in 1999 ($p<0.0001$). Similarly, the overall rate of ED visits decreased by 28% ($p<0.02$), from 6.30 per 100 (95% CI 3.39 per 100, 9.20 per 100) to 4.52 per 100 (95% CI 2.34 per 100, 6.69 per 100). Regression analyses did not reveal a statistically significant decline from 1993 to 1999 in the annual number or rate of falls ($p=0.09$). Only injury visits due to "cut/pierce" ($p=0.01$) and "struck/strike" ($p=0.05$) mechanisms showed significant decreases over the seven-year study period; however, a number of mechanisms showed significant year-to-year variability.

Severity of injury is a function of the energy transferred to human tissue, the resulting type of tissue injury, and its anatomic location.[18,31–33] The most frequently injured regions of the body due to residential mechanisms were the extremities, followed by head and neck and thorax, abdomen, or pelvis (Table 3). The most frequent type of injury was an open wound or superficial injury, followed by contusions/crush injuries and fractures/dislocations (Table 4).

"Moderate-to-severe" injuries, defined by AIS scores >1, accounted for 13% of all unintentional residential injuries (Table 5). There were an average of 531,000 (95% CI 465,000, 606,000) ED visits annually for moderate-to-severe injuries. The proportion of injuries that were moderate-to-severe was significantly lower in the home (13.3%) than in non-residential locations (18.6%; $p<0.01$). The rates of visits for moderate-to-severe (AIS >1) residential injuries decreased significantly over the seven-year study period ($p=0.03$), although the absolute numbers and proportions did not.

There were an average of 74,000 (95% CI 60,000, 88,000) hospital admissions for residential injuries each year in U.S. children and adolescents <20 years of age, accounting for 27% of all admissions for unintentional injury in this age group. However, the majority of residential injuries that presented to emergency departments in this study were minor (AIS <1) and did not result in hospitalization.

DISCUSSION

More than 39% of all emergency department visits for U.S. children and adolescents <20 years of age in 1993–1999 were injury-related. The home was the single most common location of unintentional injury, accounting for 4 million

Table 2. ED visits for unintentional residential injuries among children and adolescents <20 years of age: leading mechanisms of injury by age group, NHAMCS, 1993–1999

	Age (years)					
Mechanism	*0–1*	*1–4*	*5–9*	*10–14*	*15–19*	*All ages <20 years*
Falls						
Number[a]	0.12	0.68	0.33	0.22	0.17	1.52
Rate[b]	3.12	4.43	1.72	1.16	0.90	2.00
Fall from one level to another						
Number[a]	0.06	0.17	0.10	0.04	0.01	0.39
Rate[b]	1.48	1.12	0.53	0.24	0.07	0.51
Fall from furniture						
Number[a]	0.06	0.11	0.04	0.02	0.01	0.21
Rate[b]	1.00	0.73	0.20	0.08	0.03	0.28
Stairway fall						
Number[a]	0.02	0.05	0.01	0.02	0.03	0.14
Rate[b]	0.59	0.32	0.05	0.11	0.18	0.18
Other falls						
Number[a]	0.04	0.46	0.22	0.15	0.12	1.00
Rate[b]	1.05	3.00	1.13	0.79	0.65	1.31
Struck/strike						
Number[a]	0.05	0.40	0.24	0.15	0.15	0.98
Rate[b]	1.30	2.58	1.24	0.77	0.80	1.29
Cut/pierce/knives						
Number[a]	0.01	0.11	0.13	0.13	0.12	0.51
Rate[b]	0.37	0.73	0.70	0.68	0.66	0.67
Dog/other animal bite						
Number[a]	—[c]	0.04	0.04	0.03	0.02	0.13
Rate[b]	—[c]	0.29	0.21	0.15	0.09	0.17
Submersion/suffocation						
Number[a]	0.01	0.08	0.03	0.02	0.02	0.16
Rate[b]	0.37	0.52	0.13	0.11	0.10	0.21
Poisoning						
Number[a]	0.01	0.07	0.08	0.07	0.01	0.11
Rate[b]	0.26	0.44	0.04	0.04	0.07	0.14
Burn/hot liquid/caustic						
Number[a]	0.02	0.06	0.02	0.07	0.02	0.11
Rate[b]	0.43	0.36	0.09	0.04	0.09	0.15
All other						
Number[a]	0.03	0.17	0.18	0.17	0.15	0.69
Rate[b]	0.70	1.10	0.91	0.88	0.80	0.90

[a]Mean annual number (in millions) of ED visits for unintentional residential injuries.

[b]Mean annual rate of ED visits for unintentional residential injuries per 100 population.

[c]Insufficient number of records to develop a reliable weighted estimate.

CI = confidence interval

ED = emergency department

NHAMCS = National Hospital Ambulatory Medical Care Survey

ED visits annually. Children younger than 5 years of age accounted for 1.7 million (43%) visits for residential injury each year. More than 10% of the annual visits to U.S. EDs in this study were for "moderate-to-severe" injuries.

Childhood injury control efforts directed at road traffic environments and intentional mechanisms such as firearms and interpersonal violence receive a great deal of attention due to the associated high mortality of such injuries. However, examination of medically attended injuries by location may provide new direction for future control efforts. Many residential injuries can be prevented by the use of safety devices (e.g., stairway gates), improved home design (e.g., compliance with housing codes), and appropriate parental supervision.[34] Controlled trials of consumer products installed in residential environments are sorely needed to determine whether such products are safe and effective.[35]

Table 3. ED visits for unintentional residential injuries among children and adolescents <20 years of age, by body region injured, NHAMCS, 1993–1999

Region of body	*Number[a] (95% CI)*	*Rate[b] (95% CI)*
Extremities	1.77 (1.51, 2.03)	2.32 (1.97, 2.66)
Head/neck	1.33 (1.13, 1.53)	1.75 (1.48, 2.01)
Thorax/abdomen/pelvis	0.31 (0.25, 0.37)	0.41 (0.33, 0.49)

[a]Mean annual number (in millions) of ED visits for unintentional residential injuries.

[b]Mean annual rate of ED visits for unintentional residential injuries per 100 population.

CI = confidence interval

ED = emergency department

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The home as a location for childhood injury has not been systematically examined in the U.S. since the mid-1980s. In 1970–1985, residential mechanisms caused one in four fatal injuries to children younger than 15 years of age.[11] Other researchers have found the home environment to be a common location of injury for children, but they did not focus their investigations on that environment.[1,9,10,36] In comparison to the findings of the present study, higher estimates of nonfatal injury rates (approximately 12 per 100) and lower proportions in the home environment (approximately 25%) in young children have been reported using the National Health Interview Survey (NHIS) and the NHAMCS.[1,10,37,38] Scheidt et al. also found slightly higher rates of medically-attended home injury (16 events per 100 children) using the Child Health Supplement to the 1988 NHIS over a 12-month recall period.[9] The inclusion of office and non-ED visits in the NHIS contributed to the higher rate estimate for nonfatal injuries.

Table 4. ED visits for unintentional residential injuries among children and adolescents <20 years of age, by type of injury, NHAMCS, 1993–1999

Type of injury	*Number[a] (95% CI)*	*Rate[b] (95% CI)*
Open wound/superficial	1.80 (1.52, 2.08)	2.36 (1.99, 2.73)
Contusion/crush	0.63 (0.53, 0.74)	0.83 (0.70, 0.96)
Fracture/dislocation	0.52 (0.43, 0.60)	0.68 (0.56, 0.79)
Sprain/strain	0.34 (0.29, 0.39)	0.45 (0.38, 0.51)
Internal	0.16 (0.14, 0.19)	0.21 (0.18, 0.25)
Burn	0.14 (0.11, 0.17)	0.18 (0.14, 0.22)

[a]Mean annual number (in millions) of ED visits for unintentional residential injuries.

[b]Mean annual rate of ED visits for unintentional residential injuries per 100 population.

CI = confidence interval

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The rate of unintentional injury in home environments was not significantly different from that for non-residential environments. Over the seven-year study, these home injuries accounted for more than 28 million visits. Although the rate of unintentional injuries in residential locations decreased over the period of study, these injuries remain the single most common cause of an ED visit and the most common location of injury for an injury-related ED visit.

The proportion of moderate-to-severe injuries sustained by U.S. children in home environments was significantly less than the proportion sustained in other locations (school, public, other). Still, injuries to children in the home environment resulted in 74,000 hospital admissions, or 27% of all admissions for children injured unintentionally. This is the first nationally representative survey to our knowledge to report estimates for hospital admissions for U.S. children injured in the home.

From 1993 to 1999, emergency visits for residential injury due to falls and other leading mechanisms decreased, but only "struck/strike" and "cut/pierce" injury rates declined significantly. Despite the overall decrease in residential injuries and in injuries due to certain mechanisms, there was not a decline in the proportion of moderate-to-severe injuries presenting to U.S. EDs. Clearly, more focused attention and research relating injury mechanisms and childhood risk factors to the environments in which U.S. children reside is urgently needed.

There are several possible reasons for the higher rates of residential injury in children <5 years of age. Between 1 and 5 years, children progressively become more mobile and able to interact with their environment. It is not until 2 to 4 years of age, however, that children begin to learn home safety rules.[39] To prevent home injuries, injury risks in the home must be reduced or eliminated, younger children must be adequately supervised, and they must be taught to negotiate hazards.[40,41]

The higher rate of residential injuries in the younger age groups in this study to some extent reflects greater exposure and their greater vulnerability due to developmental immaturity.[42] Similarly, the lower rates of injury in older age groups may reflect greater exposure to environments other than the home, such as school or athletics. Unfortunately, we were unable to measure exposure to the home environment with this survey. The NHAMCS does not collect data on exposure to locations, events associated with an injury, or specific consumer products.[43] It is possible that we have underestimated the burden of unintentional residential injury, as some proportion of ED visits without external cause of injury codes (7% to 10% of all records in this study) may have been due to unintentional injury.[44,45] On the other hand, ICD-9-CM coding guidelines indicate that if the patient record form does not indicate the intent of the injury, the intent defaults to unintentional, possibly inflating these estimates.[5] There are no data on housing characteristics or residential injury hazards in the NHAMCS. Residential hazards have been shown to cluster in the homes of low-income families, and injury hazards are present in up to a third of federally subsidized housing units.[46–48] Therefore, validated instruments to assess the quality of housing and residential injury hazards together with assessment of interventions to reduce unintentional injury in high-risk populations such as

Table 5. ED visits for "moderate-to-severe" (AIS >1) unintentional residential injuries among children and adolescents <20 years of age, by year, NHAMCS, 1993–1999

Year	*Number[a] (95% CI)*	*Rate[b,c] (95% CI)*	*Percent of visits with AIS >1*
1993	0.564 (0.292, 0.836)	0.763 (0.395, 1.130)	12.1
1994	0.758 (0.355, 1.16)	1.012 (0.474, 1.550)	14.7
1995	0.560 (0.278, 0.841)	0.740 (0.368, 1.112)	14.9
1996	0.620 (0.318, 0.922)	0.811 (0.416, 1.206)	16.3
1997	0.455 (0.209, 0.701)	0.591 (0.271, 0.910)	12.8
1998	0.354 (0.201, 0.508)	0.456 (0.258, 0.654)	9.9
1999	0.412 (0.202, 0.614)	0.521 (0.258, 0.784	11.5
Mean	0.531 (0.456, 0.606)	0.697 (0.598, 0.795)	13.3

[a]Number (in millions) of ED visits for unintentional residential injuries.

[b]Rate of ED visits for unintentional residential injuries per 100 population.

[c]p=0.03 for decreasing trend from 1993 to 1999.

AIS = Abbreviated Injury Scale

CI = confidence interval

ED = emergency department

NHAMCS = National Hospital Ambulatory Medical Care Survey

young children from low-income families should be a high priority for child health research.

The missing data associated with location of injury (23% of records in this study) is another limitation of the NHAMCS. However, the distributions of location of injury for hospitals with more complete documentation (location of injury present for >90% of visits) did not differ from those with less complete documentation (location of injury present for <90% of visits). Thus, the number and rates of residential injury reported in this study are underestimates, as up to half of injuries occurring in unknown locations are likely to have occurred in homes. Assuming that half of these injury visits with unknown locations actually occurred in the home, we have underestimated the actual number of residential injury visits in U.S. children by 1.26 million a year.

Injuries are the single most common cause of ED visits for U.S. children. The predominant location of injury resulting in ED visits is the home. Although the number and rate of unintentional injuries sustained in the home for U.S. children decreased from 1993 to 1999, the burden of residential injuries remains high. Efforts to reduce the burden of injury for U.S. children should focus on the home environment. Controlled trials of home safety interventions are needed to evaluate the effectiveness of residential safety products.

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