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Age Patterns in the Causes and Nature of Non-Fatal Injury and Subsequent Care-Seeking Behavior

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Key Findings

Data from the Integrated Health Interview Series, 2004-2014

- Falls were the leading cause of non-fatal injury for all age groups.
- Non-fatal injury incidence rates were highest among youth aged 10-24 and adults aged 65 and older.
- Non-fatal injury rates increased over the 2004-2014 period for adults aged 65 and older; rates were stable for all other age groups.
- The incidence of non-fatal head injuries and hip fractures differed significantly by age.
- Children under age 10 visited the ER for non-fatal injury at the highest rates; adults aged 65 and older were most likely to be hospitalized following non-fatal injury.

Injury presents a pressing public health problem in the U.S. Among those under the age of 45, injuries account for 59% of all deaths – more deaths than non-communicable and infectious diseases combined (1). Among adults aged 65 and older, injury is the 8th leading cause of death, with a mortality impact comparable to that of influenza (2). The impact of injury is not limited to mortality. Annually, more than 30 million people are treated and released from hospitals and emergency departments for non-fatal injuries (1).

This brief describes age patterns in the nature and causes of non-fatal injury, and care-seeking behavior following injury. The National Health Interview Survey (NHIS) offers many variables suitable for describing and monitoring the epidemiology of non-fatal injury in the U.S. Harmonized versions of these variables are available through the Integrated Health Interview Series (IHIS) at the Minnesota Population Center.

Falls were the leading cause of non-fatal injury for all age groups.

Table 1: Non-fatal injury causes by age group, 2004-2014 IHIS

Age < 5	Age 5-9	Age 10-24	Age 25-64	Age >= 65
(Population estimate of injury numbers)				
Fall (2,195,115)	Fall (2,255,271)	Fall (6,164,732)	Fall (13,890,010)	Fall (8,015,929)
Being struck (488,881)	Being struck (737,537)	Other (4,083,784)	Overexertion (7,621,404)	Other (1,100,993)
Other (441,167)	Transportation (438,646)	Being struck (3,453,142)	Other (6,097,787)	Overexertion (1,003,731)
Poisoning (209,321)	Other (436,287)	Transportation (2,734,953)	Transportation (5,590,273)	Being struck (882,496)
Transportation (199,899)	Cut or piercing (303,840)	Overexertion (2,569,895)	Being struck (4,468,438)	Transportation (819,570)
Animal or insect (174,354)	Animal or insect (170,282)	Cut or piercing (1,468,478)	Cut or piercing (3,827,844)	Cut or piercing (591,141)
Cut or piercing (172,754)	Overexertion (148,411)	Animal or insect (474,562)	Animal or insect (1,446,690)	Animal or insect (299,632)
Burn or scald (155,197)	Burn or scald (58,779)	Poisoning (288,113)	Poisoning (746,118)	Poisoning (129,029)
Overexertion (50,316)	Poisoning (24,889)	Burn or scald (288,113)	Machinery (592,282)	Machinery (92,893)
Machinery (3,997)	Machinery (9,929)	Machinery (126,448)	Burn or scald (522,174)	Burn or scald (92,299)

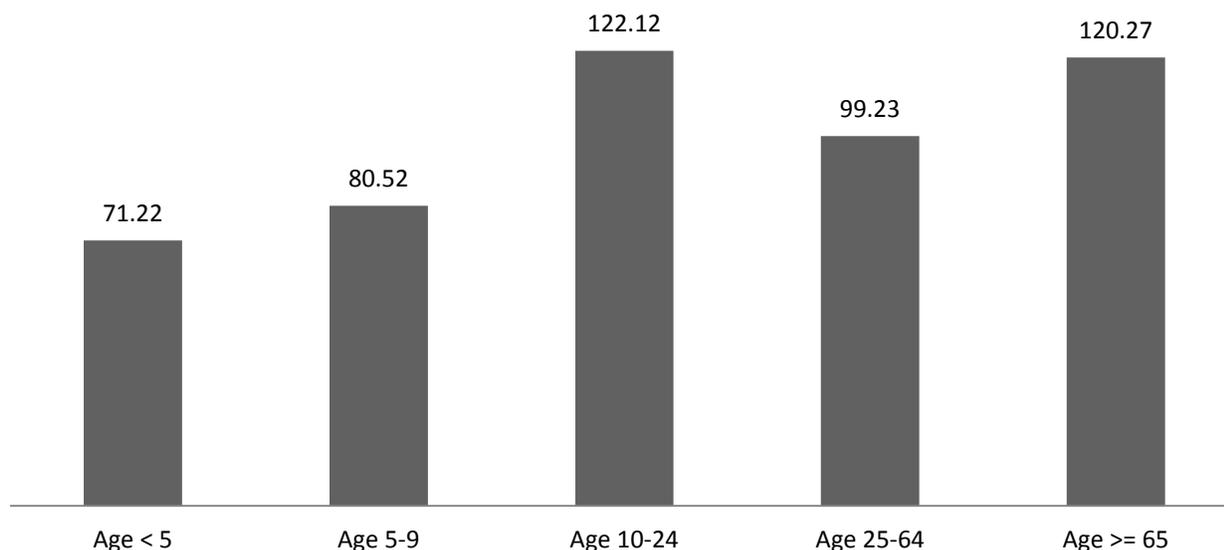
SOURCE: Integrated Health Interview Series, 2004-2014

Note: 644 people (2.7%) had at least two causes.

- Falls (highlighted in green) were the leading cause of non-fatal injury in all age groups.
- Transportation-related accidents (in blue) and being struck by an object or person (in orange) were also top causes of non-fatal injury for all age groups.
- Poisonings (in pink) ranked much higher (fourth) for persons under age 5.
- Overexertion (in purple) as a cause of non-fatal injury increased with age, becoming a leading cause of non-fatal injury in the 25-64 and 65 and older age groups.

Non-fatal injury incidence rates were highest among youth aged 10-24 and adults aged 65 and older.

Figure 1: Non-fatal injury incidence per 1,000 persons by age group, 2004-2014 IHIS



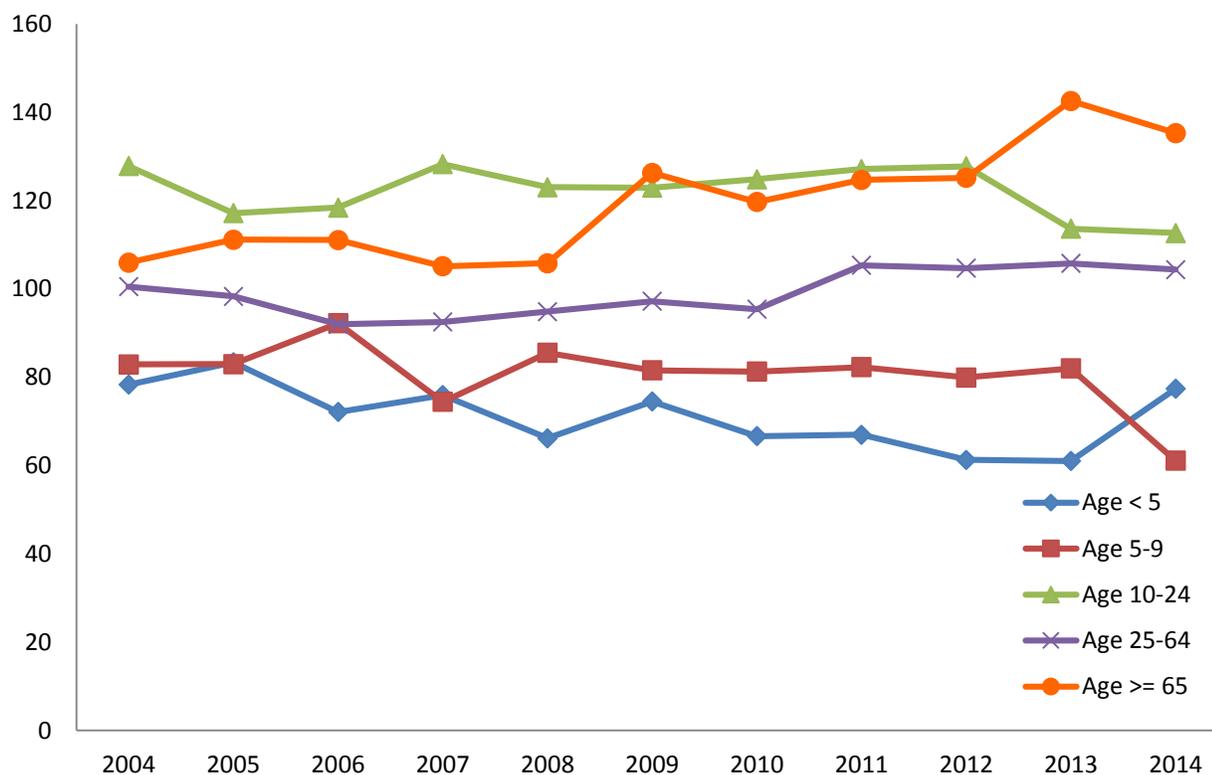
SOURCE: Integrated Health Interview Series, 2004-2014

Notes: Significance of differences between age-groups was tested using a chi-square test.

- Non-fatal injury incidence was highest among youth aged 10-24 and adults aged 65 and older, at approximately 120 per 1,000 persons.
- The injury incidence was lowest in the under 5 and 5-9 age groups at 71.2 and 80.5 per 1,000, respectively.
- While injury incidence rates were higher among adults between 25 and 64 years of age compared to children under 10, they were still significantly lower than the injury incidence rates observed in the 10-24 and 65 and older age groups.

Non-fatal injury rates increased over the 2004-2014 period for adults aged 65 and older; rates were stable for all other age groups.

Figure 2: Time trends in non-fatal injury incidence per 1,000 persons by age group, 2004-2014 IHIS



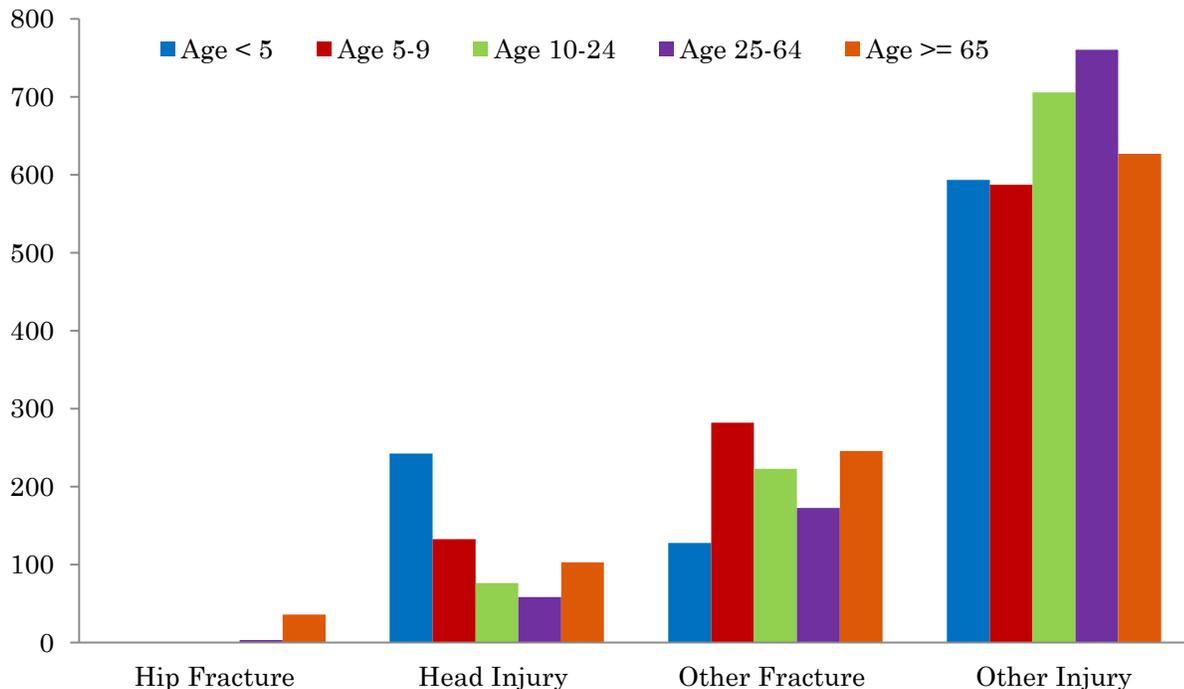
SOURCE: Integrated Health Interview Series, 2004-2014

Notes: Significance of time trends was assessed by regressing year (continuous) on injury for each age group and year (categorical) on injury for each age group.

- Trends in non-fatal injury incidence were largely stable between 2004 and 2014 for all age groups except adults aged 65 and older.
- For adults aged 65 and older, non-fatal injury incidence displayed an increasing trend beginning in 2009. In 2008, their injury incidence rate was 105.8 per 1,000; by 2014, it was 135.3.

The incidence of non-fatal head injuries and hip fractures differed significantly by age.

Figure 3: Non-fatal injury incidence per 1,000 persons by nature of injury and age group, 2004-2014 IHIS



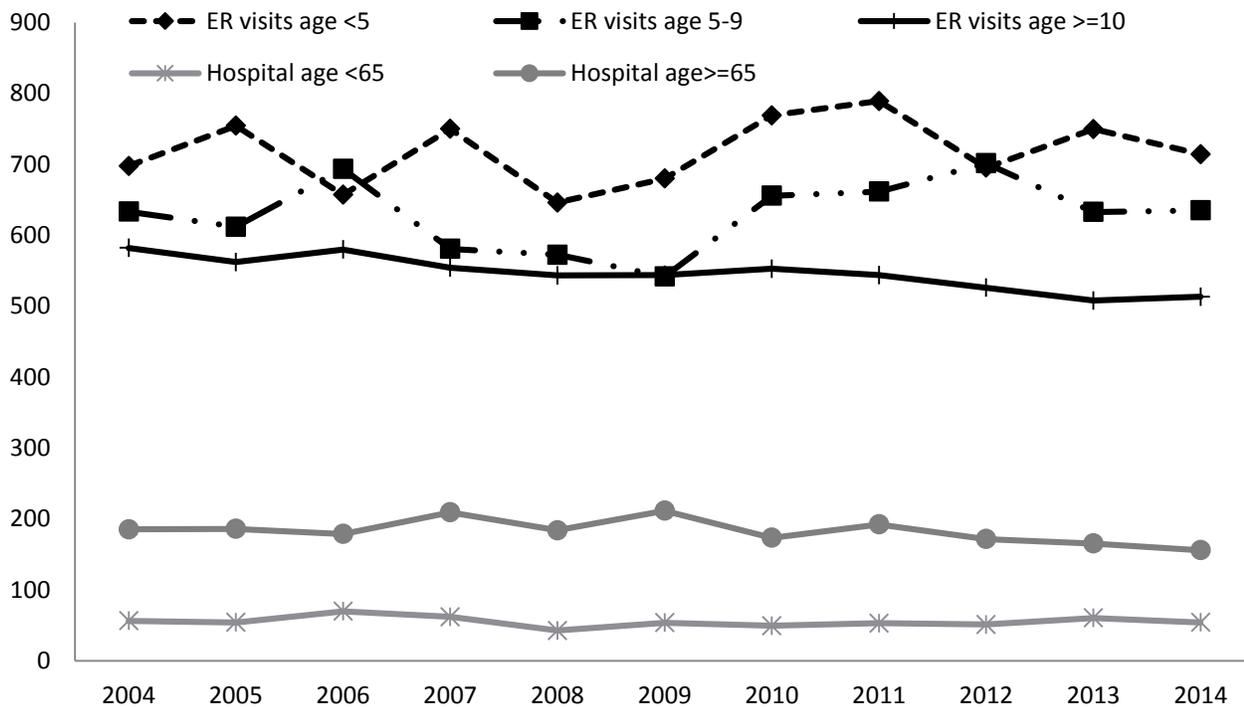
SOURCE: Integrated Health Interview Series, 2004-2014

Notes: Hip fracture, head injury, other fracture, and other injury were not mutually exclusive. One person may both have hip fracture and head injury. Estimates for hip fracture incidence were available only for the 25-64 and 65 and older age groups; in all other age groups there were too few hip fractures to produce reliable estimates. The significance of differences between age groups was assessed using a chi-square test.

- The incidence rate of non-fatal head injury for children under 5 was 242.5 per 1,000 injured persons. This incidence rate was roughly two times higher than for the 5-9 and 65 and older age groups, three times higher than for the 10-24 group, and four times higher than for the 25-64 age group.
- Incidence of non-fatal hip fracture was 36 per 1,000 injured persons among adults aged 65 and older, almost 11 times higher than it was among 25-64-year-olds.
- Non-fatal injuries resulting in fractures other than hip fractures were most common among the 5-9 and 65 and older age groups, at 282.0 and 245.7 per 1,000 injured persons, respectively.
- At 760.5 per 1,000 injured persons, incidence of other types of non-fatal injury was highest among the age 25-64 group compared with other age groups.

Children under age 10 visited the ER for non-fatal injury at the highest rates; adults aged 65 and older were most likely to be hospitalized following non-fatal injury.

Figure 4: Incidence of care-seeking behavior per 1,000 injured persons by age, 2004-2014 IHIS



SOURCE: Integrated Health Interview Series, 2004-2014

Notes: Rates of hospital-treated non-fatal injuries were comparable for the under 5, 5-9, 10-24, and 25-64 age groups, so we combined them into a single line for comparison purposes. Similarly, ER rates were combined for the 10-24, 25-64, and 65 and older age groups.

- The rates of non-fatal injuries treated in an ER or hospital visit over the 2004-2014 period were fairly stable for all age groups.
- Relative to other age groups, the rates of non-fatal injuries treated in the ER were significantly higher for children under age 10 for the majority of time points.
- Rates of hospitalization following injury were significantly higher at all time-points for adults aged 65 and older.

Summary

Non-fatal injury is a pressing public health problem in the U.S. In this data brief, we found that patterns in the causes and nature of non-fatal injury – as well as care-seeking behaviors for injury – varied substantially by age.

Using the pooled 2004-2014 sample, we found that falls were the leading cause of non-fatal injury for all age groups. Transportation-related injury, being struck by object or person, and "other injures" were among the fifth leading causes of non-fatal injury in all age groups. Being poisoned was the fourth leading cause of non-fatal injury for children under age 5, compared to the eighth or ninth leading cause for other age groups. Overexertion or strenuous movement-related injury increased with age, becoming a leading cause of non-fatal injury in the 25-64 and 65 and older age groups.

We found that non-fatal injury incidence rates were highest among those aged 10-24 and those aged 65 and older. The rates among older adults demonstrate a clear, increasing trend. Due to the observed stability in injuries treated in an ER or hospital setting, the overall increase appears to have been entirely driven by an increase in less serious injuries.

Adults aged 65 and older were more likely experience fractures than other

age groups. Incidence of non-fatal hip fractures was 11 times higher for this age group than other age groups and non-fatal non-hip fractures were highest among adults aged 65 and older and children ages 5-9. Older adults were also most likely to be hospitalized.

Non-fatal injury incidence rates were lowest among children under age 10 and the rates were stable over the recent 11-year period. Children under age 10 had the highest rates of non-fatal head injury and children ages 5-10 had the highest non-fatal non-hip fracture incidence, while children under age 5 had the lowest non-fatal non-hip fracture. Moreover, children under age 10 were more likely to visit the ER after sustaining non-fatal injury; however, their rate of hospitalization was similar to other groups under age 65.

This analysis found important age differences in injury causes and nature, and post-injury care seeking behavior. Although non-fatal injury is an important health issue for all age groups, rates were especially high among those aged 10-24 and those aged 65 and older. Severe injury – that is, injuries requiring care in an ER or hospital – was most pronounced among the very young and the very old. Future research should investigate the apparent rise in non-fatal injury among adults 65 and older.

Definitions

Injury. An injury here refers to the traumatic event in which a person was harmed seriously enough by external cause (e.g., a fall or a motor vehicle accident) to seek medical advice or treatment in the past three months. Nearly all survey participants injured during the three-month recall period (94.9%) sustained only one injury. For those with more than one injury, we dichotomized injury in our estimates of injury incidence rates and for analyses examining the nature of injury and care-seeking behavior after injury, we included information from all injuries.

Cause of injury. Cause of injury was categorized based on ICD-9-CM external cause codes (E-codes). Injuries were grouped into ten categories by NHIS staff: transportation, fire/burn/scald related, fall, poisoning, overexertion/strenuous movements, struck by object or person, animal or insect bite, cut/pierce, machinery, and other. Transportation includes motor vehicle, bicycle, motorcycle, pedestrian, train, boat, or airplane.

Nature of injury. We constructed four variables indicating nature of injury including hip fracture, head injury, other fracture, and other injury. These four variables were not mutually exclusive and were constructed based on four variables about “parts of body hurt” and eight variables about “how body part was hurt.”

Help-seeking behaviors. Places where the injured person could have sought medical care following injury included hospital, emergency room (ER) or emergency vehicle, doctor’s office or clinic, and a call to a medical professional. Injured persons could have received more than one type of care. For this analysis, we constructed a variable for those injuries treated in an ER or emergency vehicle, which were compared with those injuries treated only in a hospital. These categories of care-seeking behavior were not mutually exclusive.

Age groups. Age was grouped into five categories: under 5, 5-9, 10-24, and 25-64, and 65 and older age groups.

Data source and methods

This data brief used data from the Integrated Health Interview Series (IHIS), an integrated database of the National Health Interview Survey (NHIS). Using the IHIS made it dramatically easier to make consistent comparisons across samples and manage the complex NHIS data. The NHIS is an annual, nationally representative survey of the non-institutionalized, civilian United States population. The NHIS collects information about health status, health care access and utilization, health behaviors, and key sociodemographic characteristics. Information for this data brief was drawn from the core family questionnaire, covering all members of NHIS-participating households, and the injury supplement, asked about all persons reporting an injury in the family questionnaire. All of the injury information available from the NHIS was self-reported and thus only available for non-fatal injuries. Beginning in 2000, the NHIS has only released episode-level data for injuries. IHIS has used this episode-level data to generate person-level data comparable to the person-level data offered by NHIS in 1997-1999. Additionally, IHIS offers the episode-level data used to create the person-level injury variables. Users who wish to include more detailed information at the level of injury episodes may wish to use these hierarchical injury variables. More detailed information can be found in the [“Injury and Poisoning Data User Note.”](#)

For Table 1, we first estimated the population proportion of each cause of injury in the past three months for each age group using the pooled 2004-2014 sample. This proportion was then multiplied by the injured population size in the corresponding age group to get the population number for each cause in each age group.

For Figure 1, we estimated the population injury incidence rate per 1,000 persons for persons in each age group using the pooled 2004-2014 sample. Because the question about injuries included on the NHIS questionnaire asks about injuries sustained within a three-month period, we multiplied the rate by four to obtain an annualized incidence rate.

For Figure 2, we used the same estimation method in each year to show the time trends in non-fatal injury incidence per 1,000 persons by age group.

For Figure 3, we estimated incidence of hip fracture, head injury, other fracture and other injury per 1,000 injured persons in each age group using the pooled 2004-2014 sample. Because there was no hip fracture in certain years for persons ages less than 25, the incidence of hip fracture was unavailable for the youngest age groups.

For Figure 4, we estimated the rates of ER visit and hospitalization over time in non-fatal injury incidence per 1,000 injured persons by age group.

Statistical significance of age group differences was evaluated using a set of two-tailed chi-square tests. The statistical significance of time trends was assessed by regressing year – measured continuously and as dummy variables – on the injury-related outcome of interest. If we detected a statistically significant association between continuous year and outcomes, we investigated further by estimating a coefficient for each year and evaluating whether the statistical significance of the linear trend resulted from one outlying year or from a sustained increase or decrease over multiple years. All estimates were population weighted and adjusted for complex survey design. All statistical analyses were performed using Stata 12.1 and statistical significance was accepted at the $p < 0.05$ level.

Table 2: List of Variables Used to Measure Injury – Person-Level

Variable	Description
INJURY3MO	Whether or not the person had an injury or poisoning episode that was serious enough that she/he sought medical advice or treatment in the past 3 months.
INJURY3MONO	The number of injury or poisoning episodes the person experienced in the past 3 months.
INJCAUSANIM	The number of times a person's injury or poisoning episode was caused by an animal or insect bite in the past 3 months.
INJCAUSBURN	The number of times a person's injury or poisoning episode was caused by fire, a burn, or a scald in the past 3 months.
INJCAUSCUT	The number of times a person's injury or poisoning episode was caused by a cut or piercing in the past 3 months.
INJCAUSFALL	The number of times a person's injury or poisoning episode was caused by a fall in the past 3 months.
INJCAUSMACH	The number of times a person's injury or poisoning episode was caused by machinery in the past 3 months.
INJCAUSOVER	The number of times a person's injury/poisoning episode was caused by overexertion or strenuous movements in the past 3 months.
INJCAUSTRAN	The number of times a person's injury/poisoning episode was caused by some sort of transportation in the past 3 months.
INJCAUSTRIK	The number of times a person's injury/poisoning episode was caused by being struck by an object or a person in the past 3 months.
INJCAUSPOIN	The number of times a person's injury was caused by poisoning in the past 3 months.
INJCAUSOTH	The number of times a person's injury/poisoning episode was caused by something other reasons in the past 3 months.
AGE	The individual's age

Table 3. List of Variables Used to Measure Injury – Episode-Level

Variable	Description
IRBODY1	The first part of the body that was affected by the injury. Persons could list up to four affected body parts.
IRBODY2	The second part of the body that was affected by the injury.
IRBODY3	The third part of the body that was affected by the injury.
IRBODY4	The fourth part of the body that was affected by the injury.
IRTYPE1A	The first type of injury on the first affected part of the body.
IRTYPE1B	The second type of injury on the first affected part of the body.
IRTYPE2A	The first type of injury on the second affected part of the body.
IRTYPE2B	The second type of injury on the second affected part of the body.
IRTYPE3A	The first type of injury on the third affected part of the body.
IRTYPE3B	The second type of injury on the third affected part of the body.
IRTYPE4A	The first type of injury on the fourth affected part of the body.
IRTYPE4B	The second type of injury on the fourth affected part of the body.
IRMEDEMER	Whether or not the injured person received medical advice, treatment, or follow up care from a visit to an emergency department or emergency room for this injury or poisoning.
IRMEDEMVE	Whether or not the injured person received medical advice, treatment, or follow up care for this injury or poisoning from an emergency vehicle.
IRMEDHOSP	Whether or not the person was hospitalized for at least one night as a result of this injury/poisoning.

About the authors

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