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Non-fatal work-related traumatic brain injuries treated in US hospital emergency departments, 1998–2007

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Abstract

Purpose—Little is known about work-related traumatic brain injuries (WRTBI). This study describes non-fatal WRTBIs treated in US emergency departments (ED) from 1998 through 2007.

Methods—Non-fatal WRTBIs were identified from the National Electronic Injury Surveillance System occupational supplement (NEISS-Work) using the diagnoses of concussion, internal organ injury to the head and skull fracture. WRTBI rates and rate ratios were calculated, and the trend in rates was assessed.

Results—An estimated 586 600 (95% CI=±150 000) WRTBIs were reported during the 10-year period at a rate of 4.3 (CI=±1.1) per 10 000 full-time equivalent (FTE) workers (1 FTE=2000 h per year). From 1998 through 2007, the rate of WRTBIs increased at an average of 0.21 per 10 000 FTE per year ($p<0.0001$) and the rate of fall-related WRTBIs increased at an average of 0.10 per 10 000 FTE ($p<0.0001$). During the same period, the annual rate of WRTBIs resulting in hospitalisation increased 0.04 per 10 000 FTE ($p<0.0001$). Ten percent of WRTBIs were hospitalised, compared with hospitalisation of 2% all NEISS-Work injuries. Also, workers with highest fall-related TBI rates per 10 000 FTE were the youngest (2.4; CI=±1.4) and oldest (55 and older) workers (1.9; CI=±0.8).

Conclusions—Non-fatal WRTBIs are one of the most serious workplace injuries among ED-treated work-related injuries. Non-fatal WRTBIs are much more likely to result in hospitalisation compared with other types of injuries. The upward trend of WRTBI rates from 1998 through 2007 underscore the need for more directed effective prevention methods to reduce WRTBI injuries.

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INTRODUCTION

Traumatic brain injury (TBI) is a major public health concern in the USA. Annually, 52000 people die because of a TBI, while 275000 are hospitalised, and an additional 1.4 million people are treated and released from emergency departments (ED).[1] In 2005, an estimated 3.3 million people were living with a TBI-related disability in the USA.[2] TBI can cause temporary changes or permanent disabilities that may impact physical, cognitive and/or emotional skills.[13] Although national estimates for non-fatal work-related TBIs (WRTBI) are not available, a recent study of a Washington state trauma registry and workers' compensation claims found that TBIs accounted for 20% of all work-related injuries from 1998 to 2008.[4] In another state-based analysis in Minnesota, about 5% of all TBIs from 1999 to 2008 were WRTBIs.[5] TBIs impact the lives and functioning of the injured workers, and they can also result in substantial claim costs to the employer and insurer.[267] Furthermore, return to work after a TBI can be difficult due to physical, cognitive and emotional symptoms.[2]

In the USA, studies on non-fatal TBIs have focused on the general population, professional football players and military personnel, but only a few studies have focused on TBIs that occur at work. Existing research on non-fatal WRTBIs in the USA is largely limited to single states, genders, specific age groups or particular industries.[4–689] The dearth of research in this area may be attributed to methodological issues, such as difficulties in ascertaining TBI cases and identifying WRTBIs from hospital records.[1210–12] Work-related fatal TBIs were reported at the national level, but nonfatal TBIs were never described.[12] Given the potentially devastating impact of TBI on workers, research is needed to better understand the epidemiological characteristics of non-fatal WRTBIs at a national level to help inform prevention strategies. Thus, the objectives of this study were to (1) examine non-fatal WRTBIs treated in US EDs, (2) describe the leading events associated with WRTBI and (3) assess injury trends from 1998 through 2007. This report presents the first detailed analysis of non-fatal WRTBIs in the USA.

METHODS

Data source

Non-fatal WRTBIs from 1998 through 2007 were identified from the occupational supplement to the National Electronic Injury Surveillance System (NEISS-Work). The year 2007 was the most current year of data that was declared final at the time analyses were conducted. The National Institute for Occupational Safety and Health (NIOSH) collects surveillance data on work-related non-fatal injuries and illnesses treated in a national stratified probability sample of 67 US hospitals with 24 h EDs.[i] These 67 hospitals were divided into strata by hospital size, based on the number of ED visits annually. Work-related injuries[ii] are abstracted from ED medical records by trained coders who review each record

[i]NIOSH collects NEISS-Work data in collaboration with the Consumer Product Safety Commission (CPSC), which operates the base NEISS hospital system for the collection of data on consumer product–related injuries. The CPSC product-related injury estimates exclude work-related injuries, whereas NEISS-Work estimates include all work-related injuries regardless of product involvement (ie, NEISS and NEISS-Work cases are mutually exclusive). There are no implied or expressed endorsements of the results presented herein by the CPSC.

for any documentation indicating work-relatedness. A work-related injury is defined as an injury incurred by a US civilian, non-institutionalised person who was working for pay or other compensation, doing farm-related activities, travelling between locations as a part of the job requirement or volunteering for an organised group.[iii] To calculate national estimates, each case is assigned a statistical weight based on the probability of selection of the hospital. NIOSH classifies the source and event of injury using the Occupational Injury and Illness Classification System[iv]. NEISS-Work does not follow a standard coding system to code the industry of injured workers. However, for 2007 data, NIOSH assigned the Census Bureau industry codes using information in the employment text fields.[13] Therefore, industry-specific analyses were restricted to 2007 data.

NEISS TBI definition

Because guidelines currently do not exist for TBI case identification using the NEISS, the authors identified TBIs using combinations of diagnosis and body part, based on previous TBI research using NEISS data.[101114] First, cases were selected if the diagnosis was 'concussion' (code 52). Second, cases were captured if the diagnosis was 'internal organ injury' (code 62) or 'fracture' (code 57) and the injury occurred to the 'head' (body part code 75). Using these cases, a total of 9400 unweighted WRTBIs were identified, and these do not include facial fractures. A systematic methodology was then used to ensure that these cases accurately represented TBIs as defined by sudden damage to the brain by an external trauma and exclude instances of intracranial haemorrhage with internal cause (eg, cerebrovascular accident (CVA)) where external trauma was not involved.[15] The narrative field of each case was manually reviewed for CVA incidents by using key words such as stroke, CVA, ischaemic, intracranial haemorrhage, syncope and seizures. Descriptive analyses were then performed using a combination of event, injured body part, and diagnosis to exclude non-TBIs if the cases resulted from bodily reaction and exertion and exposure to harmful substances or environments. Of these 9400 unweighted cases, 200 cases were determined not to be TBIs as these resulted from internal causes and, therefore, were excluded from the analysis, resulting in 9200 final unweighted WRTBIs.

Statistical analysis

Non-fatal WRTBIs were estimated by summing the adjusted statistical weights assigned to the cases. To calculate non-fatal WRTBI rates per 10 000 full-time equivalent (FTE) workers (1 FTE=2000 h/year), labour force data for all jobs were obtained from the Current Population Survey (CPS) of US civilian non-institutionalised workers aged 15 years and older.[16] Consequently, this study was restricted to TBIs occurring among workers aged 15 years and older. The 95% CIs for WRTBI rates were calculated by pooling the variances for the injury and the FTE estimates. Rate ratios were calculated and compared among sociodemographic groups by fitting a Poisson model employing generalised estimating equations (GEE). The GEE model allowed adjustments to the SEs and CIs of the rate ratio

[ii] As this study focuses exclusively on TBIs, NEISS-Work cases in this article will simply be referred to as injuries, omitting additional reference to illnesses.
[iii] Additional information can be found at: http://www2a.cdc.gov/risqs/wrtechinfo.htm
[iv] Additional information can be found at: http://wwwn.cdc.gov/wisards/oiics/

estimates by assuming a first-order autoregressive error structure in the year-to-year estimates.

To assess trends over the 10-year period, TBI rates per 10 000 FTE were calculated for each quarter during the 10 years under study by using quarterly injury and employment data within each year. The trends were then analysed using the AUTOREG procedure in SAS (V. 9.3), fitting a linear trend over the 10-year period. The structure of the serial correlation of these time-dependent data was assessed by inspecting the autocorrelation and partial autocorrelation plots of the time series. We concluded that the serial correlation for time series being analysed was best described as a first-order autoregressive structure. After the AUTOREG model was fit in SAS, tests for white noise on the residuals from the model were assessed to ensure the serial correlation was properly accounted for in the model. The slope in the regression model represents the average annual change in the TBI rates per 10 000 FTE.

RESULTS

From 1998 through 2007, 586 600 (CI=±150 000) weighted number of non-fatal WRTBIs were treated in EDs at a rate of 4.3 (CI=±1.1) per 10 000 FTE (table 1).

The overall rate of non-fatal WRTBIs increased by an average of 0.21 per 10 000 FTE per year from 1998 through 2007 ($p<0.0001$). The rate of WRTBIs treated and released increased annually by 0.16 per 10 000 FTE ($p<0.0001$). Also, the rate of WRTBIs resulting in hospitalisation increased by an average of 0.04 per 10 000 FTE per year ($p<0.0001$). While 90% of workers with WRTBIs were treated and released, 10% were hospitalised. By comparison, only 2% of all ED-treated injuries in NEISS-Work (ie, all non-fatal work-related injuries) were admitted for hospitalisation. Of all WRTBIs in this study, the majority (68%) of WRTBIs were internal organ injuries to the head (n=401 300; CI=±131 900), 30% were concussions (n=175 100; CI=±47 100) and 2% were fractures to the head (n=10 200; CI=±3800; data not shown).

Men had a significantly higher non-fatal WRTBI rate compared with women (table 2). The youngest workers (15–24 years) experienced the highest TBI rates among all workers, followed by the 25 year to 34-year age group. The youngest workers had a significantly higher risk for WRTBI than the oldest workers (55 years and older).

Non-fatal WRTBIs were most commonly associated with contact with objects and equipment and falls (table 3; data not shown by minor event categories). Contact with objects and equipment was the leading WRTBI event for workers aged 15–44 years and the majority was due to being struck by building materials (35 000; CI=±8700). Falls were the leading event for workers aged 45 years and older. For workers 55 years and older, falls accounted for more than half of WRTBIs and the majority resulted from falls on the same level (22 100; CI= ±5800). The youngest workers had the highest TBI rate among all workers from contact with objects and equipment. The youngest workers also had the highest fall-related TBI rate among all workers, followed by workers 55 years and older. From 1998 through 2007, the fall-related TBI rate per 10 000 FTE among young workers

increased 54% from 2.0 (CI=±0.9) in 1998 to 3.1 (CI=±1.6) in 2007. During the same period, the fall-related TBI rate per 10 000 FTE among oldest workers increased 136% from 1.3 (CI=±0.7) in 1998 to 3.1 (CI=±1.5) in 2007 (data not shown).

Corresponding to the annual increase in overall WRTBIs, certain event-specific WRTBI rates also increased significantly. From 1998 through 2007, there was a significant average annual increase in WRTBI rates per 10 000 FTE from falls (0.10, $p<0.0001$), assaults and violent acts (0.04, $p<0.0001$) and transportation events (0.03, $p=0.0002$) (figure 1). The average annual WRTBI rate per 10 000 FTE related to contact with objects and equipment also increased, but this increase did not reach statistical significance (0.04, $p=0.07$).

In the single-year industry analysis from 2007 NEISS-Work data, the highest WRTBI rates were in agriculture, forestry, fishing and hunting; transportation and warehousing; and arts, entertainment and recreation (table 4). However, the greatest number of WRTBIs occurred in the construction industry. In the transportation and warehousing industry, the majority of WRTBIs were associated with contact with objects and equipment (2220; CI=±1100; 35%), followed by transportation-related events (1700; CI=±700; 28%) and falls (1700; CI=±1000; 28%). In the construction industry, falls accounted for more than half the WRTBIs (5100; CI=±2000; 54%) and contact with objects and equipment accounted for 40% (3700; CI=±1700). Since industry codes were only available for 2007, some industries could not be partitioned any further due to data not meeting reporting requirements.

DISCUSSION

The findings presented in this study demonstrate a significant increase in the overall rate of non-fatal WRTBIs from 1998 through 2007, as well as in the rates of treated and released WRTBIs and hospitalised WRTBIs. The increase in non-fatal WRTBI rates during this period could be indicative of an increased public awareness of the importance for early diagnosis and medical care for TBI.[1] Also, the increase in hospitalisation rates likely demonstrates a true increase in WRTBIs. These increases can lead to an increase in lost wages and medical costs, especially from hospitalisation. The cost of hospitalisation due to TBIs may account for 90% of the total TBI medical costs.[17] Additionally, short-term and long-term consequences of TBI can pose difficult, if not insurmountable, challenges to resuming work and other daily activities. Thus, it is important to prevent WRTBIs and reduce occupational injury costs and preserve the existing workforce.

Similar to previous studies, men were at an increased risk for non-fatal WRTBI compared with women.[5,18] While data in this study could not be stratified by gender and occupation, this increase may be due to more men working in occupations that may be at greater risk of WRTBIs due to dangerous and physically demanding work.[19]

Consistent with previous studies, our study found that the youngest workers had an increased risk for non-fatal WRTBI compared with other age groups.[8,18] Factors associated with this increased risk include an inability to assess risks associated with hazards in workplaces.[20] A general lack of job experience and safety training may also increase injury risks.[20] Although no prevention strategies are specifically aimed at reducing WRTBIs

among young workers,[12] strategies targeted at preventing injuries to young workers might also reduce TBIs. For example, NIOSH developed a curriculum to help students understand the importance of basic knowledge of occupational safety and health before they enter the workforce.[20] This curriculum helps students identify hazards, prepares young workers for emergencies, provides knowledge of safety measures for reducing injury risk, and assists young workers in understanding their legal rights.

From 1998 through 2007, fall-related WRTBI rates significantly increased, and the youngest and oldest workers were found to be most vulnerable. Prior research also found that the youngest[9] and oldest workers were at an increased risk for fall-related WRTBIs in the workplace.[51221] We found that among the oldest workers, fall-related TBI rates have more than doubled over the 10-year period. The increase in fall-related WRTBIs reflected the increase in overall fall-related TBIs among the oldest populations.[122] Thomas *et al*[23] reported that as age increases, so does the rate of hospitalisations and fatalities due to fall-related TBIs. Prevention of fall-related WRTBIs is extremely important in the workplace, especially for older persons who may have slower and more costly recoveries.[24] Pre-existing health conditions, physical deficiencies, impaired mobility and gait, medication use and sensory deficits have been associated with increased risk for fall-related TBI among older persons.[2526] Prevention of these injuries is important, as the number of older workers in the US workforce is increasing.[22] Fall-related events may be prevented through behavioural measures, such as regular exercise, regular vision checkups and education;[27] elimination of fall hazards, such as poor lighting, slippery floors, uneven surfaces; and by following workplace protection standards including installing guardrails and personal fall arrest systems.[2829]

TBIs can be serious injuries that may require prolonged medical care. In our study, we found that the proportion of ED-treated WRTBIs requiring hospitalisation was higher than the proportion of all ED-treated occupational injuries requiring hospitalisation. To avert long-term consequences, TBIs require prompt attention and early diagnosis.[14] While TBI awareness among professional athletes and military personnel has improved,[30] promotion of TBI awareness among the general workforce is limited. Thus, a strong educational message aimed at workers is needed to promote awareness of causes, signs and symptoms, and consequences of WRTBIs, as well as the importance of early diagnosis and medical care. Raising awareness of the benefits of WRTBI medical care may increase the number of workers with head injuries seeking medical care and reduce long-term negative effects of TBIs. The Centers for Disease Control and Prevention has developed a series of Heads-Up toolkits to educate parents, athletes, coaches, physicians and school employees, about the importance of identifying and preventing a TBI.[14] A similar resource focusing on TBIs in the workplace could be developed to educate employers and workers about the identification, treatment and prevention of WRTBIs.

Although not all WRTBI patients seek treatment in EDs, NEISS-Work is a good source for capturing WRTBIs because anyone sustaining a head injury is often encouraged to seek immediate medical attention in EDs.[1531] However, using NEISS-Work data has a number of limitations. First, the small number of hospitals in the NEISS-Work sample contributes to large SEs. Second, International Classification of Diseases, 9th Revision, Clinical

Modification (ICD-9-CM) codes are not available in NEISS-Work and it has no TBI case identification methodology. To overcome this, we used a TBI case definition based on previous NEISS research on TBI case ascertainment.[1011] Thompson *et al*[11] evaluated the sensitivity of this case ascertainment and confirmed that a large number of true TBI cases can be identified using their definition (91% sensitivity). Also, they found that the NEISS TBI classification codes corresponded well with the ICD-9-CM codes.[1011] Third, following their prescribed case identification methods, 2% of WRTBIs were skull fractures. Brain injury involvement cannot be confirmed for these cases as that information is not available in NEISS-Work. Fourth, NEISS-Work only collects data from EDs and excludes patients who receive medical treatment in other settings (eg, physician offices and outpatient settings). Also, potential TBI cases due to contusions, abrasions, haematomas, or lacerations to the head were missed with this case definition. Therefore, the data presented in this study are likely an underestimate of the overall burden of WRTBIs in the USA. Fifth, NEISS-Work does not collect TBI severity measurements, which are important in assessing the burden of TBI by severity type for developing prevention efforts. Sixth, industry data were only available for 2007, limiting an industry-specific in-depth analysis.

CONCLUSIONS

Non-fatal WRTBIs are one of the most serious workplace injuries among ED-treated work-related injuries as evidenced by the higher proportion of WRTBIs that resulted in hospitalisation compared with overall ED-treated occupational injuries. The number and rate of WRTBIs steadily increased from 1998 through 2007. The magnitude of TBIs and upward trend in TBI rates observed during the 10-year period highlights the need for effective workplace prevention methods. Specific areas of concern include youngest workers, who have the highest risk for WRTBIs of all age groups, especially from contact with objects and equipment and falls, and oldest workers, who most commonly sustain a WRTBI via a fall and may have difficulty recovering from such an injury.[24] For future research, detailed analyses of WRTBIs across industries and occupations, including efforts to characterise the severity of the injury with a focus on age, are needed so that effective and targeted prevention strategies can be developed and implemented to reduce these injuries. Such data can inform prevention efforts and could have a substantial impact on reducing WRTBIs as well as assisting in identifying issues related to recovery and return to work after TBI.

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What is already known on the subject

- Traumatic brain injury (TBI) is a serious public health problem.
- TBI causes disability with long-term negative health effects and leads to prolonged recovery.

What this study adds

- This is the first study to report national estimates of non-fatal work-related TBIs (WRTBIs).
- Non-fatal WRTBI rates significantly increased from 1998 through 2007, especially fall-related TBI rates.
- Youngest workers (15–24 years) are at increased risk for WRTBIs among all workers, especially, from contact with objects and equipment and falls.
- Oldest (55 years and older) workers have an increased risk for WRTBIs due to falls.

New efforts to combat distracted driving

A driver talking on her cell phone killed a 20-year-old. The mother of the victim, a nurse, working with Hartford Hospital, has begun a pledge campaign ‘Thumbs Up, Phones Down’. The goal is to persuade drivers to ‘keep their hands on the wheel and their phones in their pocket’.

Another airbag recall

Toyota, Chrysler and Honda are recalling about 2.1 million vehicles with airbags that might suddenly deploy even when the vehicle is not in a crash. Federal regulators said replacement parts might not be fully available until the end of the year.

Demonstrating 'drunk' goggles

Following an increase in alcohol-related driving deaths, New York….demonstrated Drunk Goggles that simulate many of the effects of being drunk. New York State Police and the injury prevention team at a Medical Center demonstrated. Volunteers wearing the goggles attempted a series of challenges. Everyone wearing the goggles failed.

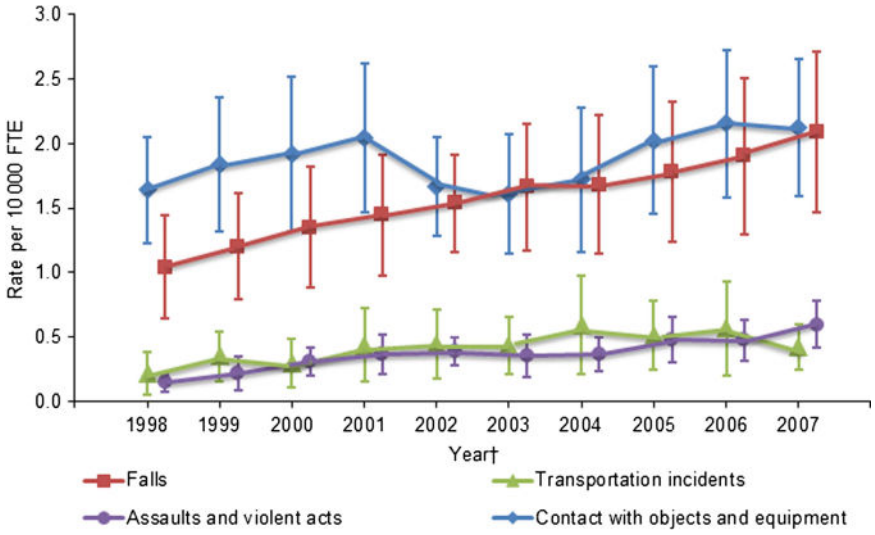

Figure 1.

Rates of non-fatal WRTBIs treated in emergency departments by year and event, USA, 1998–2007†.

†Data points for each year are adjusted slightly to aid visualisation. FTE, full-time equivalent; WRTBIs, work-related traumatic brain injuries.

Table 1

Weighted number (in thousands) and rate per 10 000 FTE of non-fatal WRTBIs treated in emergency departments by year and treatment disposition, USA, 1998–2007

	Treated and released		Hospitalised		Total*	
Year	Number (95% CI)	Rate (95% CI)	Number (95% CI)	Rate (95% CI)	Number (95% CI)	Rate (95% CI)
1998	37.1 (±10.4)	2.9 (±0.8)	3.6 (±2.5)	0.3 (±0.2)	40.9 (±12.2)	3.2 (±0.9)
1999	44.8 (±14.0)	3.4 (±1.1)	4.5 (±2.2)	0.3 (±0.2)	49.3 (±15.4)	3.7 (±1.2)
2000	48.7 (±14.7)	3.6 (±1.1)	4.5 (±2.1)	0.3 (±0.2)	53.3 (±16.1)	4.0 (±1.2)
2001	52.7 (±16.5)	4.0 (±1.2)	4.6 (±1.7)	0.3 (±0.1)	57.3 (±17.1)	4.3 (±1.3)
2002	49.0 (±11.9)	3.7 (±0.9)	4.8 (±1.7)	0.4 (±0.1)	54.1 (±12.6)	4.1 (±1.0)
2003	50.4 (±15.2)	3.7 (±1.1)	5.1 (±2.1)	0.4 (±0.2)	55.8 (±16.5)	4.2 (±1.2)
2004	54.2 (±17.4)	4.0 (±1.3)	5.7 (±2.7)	0.4 (±0.2)	59.9 (±19.1)	4.4 (±1.4)
2005	59.9 (±17.2)	4.3 (±1.2)	8.0 (±3.3)	0.6 (±0.2)	68.0 (±18.8)	4.9 (±1.4)
2006	63.4 (±18.2)	4.5 (±1.3)	9.5 (±4.1)	0.7 (±0.3)	72.8 (±20.6)	5.1 (±1.5)
2007	66.4 (±16.8)	4.6 (±1.2)	8.7 (±4.1)	0.6 (±0.3)	75.2 (±19.2)	5.3 (±1.3)
Total	526.6 (±134.9)	3.9 (±1.0)	58.9 (±22.6)	0.4 (±0.2)	586.6 (±150.0)	4.3 (±1.1)

*Row values may not add to total because other disposition cases were not included.

FTE, full-time equivalent; WRTBIs, work-related traumatic brain injuries.

Table 2

Weighted number (in thousands), rate per 10 000 FTE, and rate ratios of non-fatal WRTBIs treated in emergency departments by demographic characteristics, USA, 1998–2007

Characteristics	Number (95% CI)	Per cent	Rate (95% CI)	Rate ratio
Sex				
Male	397.5 (±111.2)	68	5.1 (±1.6)	**1.5**
Female	189.1 (±44.1)	32	3.3 (±1.0)	1.0
Age group (in years)				
15–24	124.5 (±37.5)	21	7.7 (±3.3)	**2.1**
25–34	151.9 (±38.9)	26	4.9 (±2.2)	1.3
35–44	137.7 (±35.8)	23	3.8 (±1.7)	1.0
45–54	102.3 (±26.6)	18	3.2 (±1.4)	0.9
55 and older	70.2 (±16.5)	12	3.7 (±1.6)	1.0
Total	586.6 (±150.0)	100	4.3 (±1.1)	–

Bold font denotes statistical significance at the α=0.05 level.

FTE, full-time equivalent; WRTBIs, work-related traumatic brain injuries.

Table 3

Weighted number (in thousands) and rates per 10 000 FTE of non-fatal WRTBIs treated in emergency departments by age and event, USA, 1998–2007

	Contact with objects and equipment			Falls			All other*		
Age (in years)	**Number (95% CI)**	**Per cent**	**Rate**	**Number (95% CI)**	**Per cent**	**Rate**	**Number (95% CI)**	**Per cent**	**Rate**
15–24	58.5 (±17.2)	47	3.6 (±1.5)	41.9 (±13.7)	34	2.6 (±1.2)	24.1 (±8.5)	19	1.5 (±0.7)
25–34	73.3 (±16.7)	48	2.4 (±1.0)	46.0 (±12.4)	30	1.5 (±0.7)	32.7 (±13.7)	21	1.1 (±0.6)
35–44	63.1 (±14.2)	46	1.7 (±0.7)	45.5 (±13.3)	33	1.2 (±0.6)	29.1 (±10.4)	21	0.8 (±0.4)
45–54†	38.9 (±9.4)	38	1.2 (±0.5)	43.5 (±11.8)	42	1.3 (±0.6)	_‡	–	–
55 and older†	20.2 (±4.6)	29	1.1 (±0.5)	36.4 (±9.6)	52	1.9 (±0.8)	–	–	–
Total	254.0 (±57.9)	43	1.9 (±0.4)	213.3 (±57.6)	36	1.6 (±0.4)	119.4 (±41.0)	21	0.9 (±0.3)

*Includes assaults and violent acts, transportation incidents and non-classifiable events.

†Row numbers do not sum to 100% due to omission of non-reportable results.

‡Estimates did not meet NEISS-Work minimum reporting requirements.

FTE, full-time equivalent; NEISS-Work, National Electronic Injury Surveillance System occupational supplement; WRTBIs, work-related traumatic brain injuries.

Table 4

Weighted number (in thousands) and rate per 10 000 FTE of non-fatal WRTBIs treated in emergency departments by industry, USA, 2007*

Industry	Number (95% CI)	Per cent	Rate (95% CI)
Agriculture, forestry, fishing and hunting	3.8 (±2.0)	5	16.8 (±8.7)
Transportation and warehousing	6.1 (±2.4)	8	8.9 (±3.6)
Arts, entertainment and recreation	2.1 (±1.1)	3	8.6 (±4.3)
Construction	9.4 (±3.1)	12	7.8 (±2.6)
Accommodation and food services	6.0 (±2.8)	8	7.2 (±3.4)
Public administration	3.9 (±1.9)	5	5.7 (±2.9)
Retail trade	8.6 (±3.5)	11	5.6 (±2.3)
Healthcare and social assistance	8.2 (±2.2)	11	4.9 (±1.3)
Wholesale trade	2.0 (±1.8)	3	4.3 (±2.5)
Manufacturing	6.3 (±2.2)	8	3.6 (±1.3)
Educational services	3.9 (±1.3)	5	3.5 (±1.2)
Other services (except public admin)	1.6 (±0.8)	2	2.4 (±1.3)
Professional and business services	3.6 (±1.5)	5	2.3 (±1.0)
Financial activities	1.4 (±0.7)	2	1.4 (±0.7)
Other†	2.0 (±1.3)	3	3.5 (±2.2)
Unknown	6.4 (±2.0)	9	–
Total	75.4 (±17.2)	100	5.3 (±1.3)

*Rates were calculated using full-time equivalent (FTE) from 2007 Current Population Survey.

†Other includes mining, utilities and information industries.

FTE, full-time equivalent; WRTBIs, work-related traumatic brain injuries.