Bicycle Injuries Seen in Hospital Emergency Departments, 2013

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Executive Summary

This report presents estimates of injuries associated with bicycles, accessories, and bicycle riding, seen in hospital emergency departments in 2013. Findings include:

- There were 531,340 injuries associated with bicycles and accessories seen in hospital emergency departments in 2013. More than 9 in 10 (91.6%) or 486,703 appeared to result from bicycle riding.

- More than 7 in 10 (72.6%) or 353,534 of the injuries seen in hospital emergency departments in 2013 that appeared to result from bicycle riding involved males.

- Children between the ages of 5 and 17 were most likely to experience injuries seen in hospital emergency departments while bicycle riding in 2013 when the population by age is taken into account (with an estimated 360 bicycle riding injuries per 100,000 children 5 to 17 in the U.S. population, more than twice the overall rate).

- More than half of the injuries seen in hospital emergency departments associated with bicycle riding in 2013 were limb injuries, with nearly a third occurring to the hand, arm or shoulder (32.1%) and more than a fifth (21.4%) involving the leg or foot. About 1 in 6 injuries (16.2%) involved the head, a majority of which involved internal organ injuries or concussions (10.5% and 2.8%, respectively).

- The most frequent diagnoses overall associated with bicycle riding seen in hospital emergency departments in 2013 were contusions/abrasions (24.4%), fractures (21.6%), and lacerations (15.6%).

- Nine in 10 (90.1%) of the patients seen in hospital emergency departments in 2013 for injuries that appeared to result from bicycle riding were treated and released, with 40,788 (8.4%) hospitalized or held for observation.

- More than half of the injuries seen in hospital emergency departments associated with bicycle riding in 2013 were described as falls from the bike (51.9%). The next most frequent hazard pattern was bicycle riders struck by a motor vehicle (14.2%).

- Helmet use was unknown for 74.4% of estimated head injuries and for 88.6% of all injuries seen in hospital emergency departments associated with bicycle riding in 2013. For head injuries, where helmet use was known, a smaller number of people involved in incidents wore helmets than did not (7,167 worn versus 12,959 not worn). Known helmet use overall was more even (26,086 worn versus 29,240 not worn).

- Alcohol use was noted in 18,373 cases or 3.8% of the total injuries seen in hospital emergency departments associated with bicycle riding in 2013.

Overview

Bicycles and bicycle accessories are among the classes of consumer products most frequently associated with injuries seen in hospital emergency departments in the United States (see *e.g.*, NEISS Data Highlights 2012[1]). Although there are a number of potential safety concerns associated with these products, particular focus is often paid to bicycle riding injuries and how often head injuries might be prevented with the use of helmets. Likewise, there are concerns that bicycle riding injuries may occur if the rider has taken drugs or been drinking alcohol. A variety of hazard patterns exist involving bicycles. For example, bicycles can collide with another vehicle or object, a rider can simply fall off of the bicycle, or body parts can become entrapped or entangled with the bicycle chains or tire spokes.

Hospital Emergency Department-Treated Injuries

In 2013, an estimated 531,340 injuries were associated with product codes, 5033 *Mountain or all-terrain bicycles or accessories,* or 5040 *Bicycles or accessories (excluding mountain or all-terrain bicycles)*. The estimate was based on 14,688 National Electronic Injury Surveillance System (NEISS) cases. When considering these products, however, people may be interested in injuries that involve riding bicycles, rather than injuries that may simply involve a bicycle accessory (*e.g.*, a bicycle pump or bike rack); or that do not necessarily involve the product's intended use (*e.g.*, tripping over a bicycle when not intending to ride it).

Table 1: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycles or Accessories, 2013

Year	Cases	Estimate	C.V.[2]
2013	14,688	531,340	0.10

Source: NEISS Database, June 2014

Each of the bicycle-related cases obtained by NEISS in 2013 was reviewed to determine whether the product in question was indeed a bicycle and whether the injured person was riding the bicycle or not. In addition, cases were coded according to whether the victim was wearing a helmet, whether alcohol or drugs was consumed, as well as additional coding for the kind of accident that occurred (*e.g.*, a collision versus simply falling while riding the bicycle).

Table 1 presents the estimated hospital emergency department-treated injuries associated with bicycles by injury type for 2013. Cases were excluded from further analysis if it appeared they either did not involve a bicycle or if there was some doubt whether a bicycle was involved (*e.g.*,

[1] CPSC's NEISS Data Highlights summarizes data from the National Electronic Injury Surveillance System and can be found at: http://www.cpsc.gov//Global/Neiss_prod/2012NeissDataHighlights.pdf.

[2] A coefficient of variation is the ratio of the standard error of the estimate (*i.e.*, variability) to the estimate itself. This is generally expressed as a percent. A C.V. of 10% means the standard error of the estimate equals 0.1 times the estimate. Large C.V.s alert the reader that the estimate has considerable variability. This is often due to a small sample size.[2] Estimates and confidence intervals are usually not reported unless the number of cases is 20 or more, the estimate is greater than 1,200, and the C.V. is less than 34%.

victim found near a bicycle). There were 230 such cases that comprised an estimated 8,383 injuries (or 1.6% of all injuries associated with bicycles). Among the remaining 14,458 cases, 1,050 (comprising an estimated 36,255 or 6.8% of the injuries) were classified as non-riding injuries. These injuries occurred, for example, when a person was climbing onto or off of the bike; if a person fell against the bicycle; or if the victim was hit by someone else who was riding a bicycle. The remaining 13,408 cases (an estimated 486,703 injuries) could be classified into two categories. There were 8,565 cases (an estimated 313,025 or 58.9% of the injuries) where the victim was clearly riding a bicycle. The remaining 4,843 cases (an estimated 173,677 injuries) were cases where it was not explicitly stated but the victim was presumably riding. For example, cases in this group included descriptions where the victim "fell off the bike," was involved in a "collision," or "flew over the handlebars." The 486,703 injuries form the initial basis for further analysis.

Table 2: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycles or Accessories by Injury Type, 2013

Type of Injury	Cases	Estimate	Percent	C.V.
Bicycle Not Involved or Involvement Unknown	230	8,383	1.6%	0.18
Bicycle, Non-Riding Injury	1,050	36,255	6.8%	0.10
Bicycle, Riding Injury	8,565	313,025	58.9%	0.14
Bicycle, Presumed Riding Injury	4,843	173,677	32.7%	0.13
Total	***14,688***	***531,340***	***100.0%***	***0.10***

Source: NEISS Database, June 2014

Riding injuries (or presumed to be riding injuries) are most likely to involve males as shown in Table 3. This may not be an indication of a greater risk to males, but rather, simply a function of exposure or other behavioral differences. That is, males may simply ride bicycles more frequently, or ride in a different manner than females.[3]

Table 3: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Gender, 2013

Age	Cases	Estimate	Percent	C.V.
Male	9,812	353,534	72.6%	0.11
Female	3,596	133,168	27.4%	0.13
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014

Among the riding injuries (or presumed to be riding injuries), a majority involved adults. However, Table 4 shows when the size of the population for these ages is taken into account, children between the ages of 5 and 17 are more frequently injured on a per capita basis.

[3]See for example, "Walking and Cycling in the United States, 2001-2009: Evidence from the National Household Travel Surveys", Pucher et al, American Journal of Public Health, December 2011, 101 (Suppl 1): S310-S317 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3222478/.

Table 4: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Age, 2013

Age	Cases	Estimate	Percent	Pop. #'s[4]	Est. Injuries per 100K Pop.	C.V.
<5	625	17,497	3.6%	19,770,079	89	0.13
5-17	5,581	193,485	39.8%	53,816,533	360	0.09
18-64	6,723	253,937	52.2%	197,878,237	128	0.14
65+	479	21,784	4.5%	44,663,990	49	0.28
Total	***13,408***	***486,703***	***100.0%***	***316,128,839***	***154***	***0.11***

Source: NEISS Database, June 2014

Table 5 presents the estimated hospital emergency department-treated injuries associated with riding bicycles categorized by body part. A plurality of the estimated injuries occurred to the arm, hand, or shoulder, accounting for 156,096 out of 486,703 estimated injuries (32.1%). Additionally, there were 103,989 injuries to the leg or foot (21.4%), and head injuries accounted for 78,740 (16.2%). A further examination of the head injuries shows that the majority of them were internal organ injuries or concussions (50,944 [10.5%] and 13597 [2.8%], respectively).

Table 5: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Body Part Injured, 2013

Body Part	Cases	Estimate	Percent	C.V.
Head	2,266	78,740	16.2%	0.15
Face/Ear	1,920	66,788	13.7%	0.11
Arm/Hand/Shoulder	4,177	156,096	32.1%	0.10
Leg/Foot	2,820	103,989	21.4%	0.11
Other/Unknown	558	19,573	4.0%	0.14
Torso	1,667	61,516	12.6%	0.12
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014
Columns may not sum to totals due to rounding

Table 6 presents the estimated hospital emergency department-treated injuries associated with riding bicycles categorized by diagnosis. A plurality of the estimated injuries were contusions or abrasions (118,986), followed by fractures (105,332). Lacerations were the next most common (75,972). The internal organ injuries (mostly to the head) were the next most common (53,703), along with strains and sprains (51,660).

[4] *U.S. Census Bureau, American Community Survey, http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP05&prodType=table.*

Table 6: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Diagnosis, 2013

Diagnosis	Cases	Estimate	Percent	C.V.
Internal Organ Injury	1,483	53,703	11.0%	0.17
Contusion/Abrasion	3,107	118,986	24.4%	0.11
Laceration	2,133	75,972	15.6%	0.10
Other/Unknown	1,874	67,454	13.9%	0.14
Fracture	3,037	105,332	21.6%	0.14
Concussion	447	13,597	2.8%	0.14
Strain/Sprain	1,327	51,660	10.6%	0.10
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014
Columns may not sum to totals due to rounding

Table 7 presents the estimated hospital emergency department-treated injuries associated with riding bicycles categorized by disposition. The majority of the injuries were treated and released. Eight percent (40,788 estimated injuries) were hospitalized or held for observation. Fractures (19,622) and internal organ injuries (10,609) accounted for most of the injuries that resulted in hospitalizations.

Table 7: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Disposition, 2013

Disposition	Cases	Estimate	Percent	C.V.
Treated and Released	11,868	438,535	90.1%	0.11
Hospitalized/Held for Observation	1,343	40,788	8.4%	0.22
Left Without Being Seen/Unknown	187	7,076	1.5%	0.34**
Fatality/DOA/Died in ED	10	*	*	*
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014
**Too few cases to produce a valid estimate*
***C.V. is 0.336 which rounds to 0.34, the cutoff value for publication*

Table 8 presents the estimated hospital emergency department-treated injuries associated with riding bicycles categorized by hazard pattern. The hazard categories are not necessarily mutually exclusive. Given the abbreviated nature of NEISS narratives, these were the categorizations that best captured the description of the incident.

Table 8: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Hazard Pattern, 2013

Hazard Pattern	Cases	Estimate	Percent	C.V.
Fall	6,844	252,668	51.9%	0.13
Thrown/Knocked Off	20	*	*	*
Jumped Off	19	*	*	*
Collision	177	4,863	1.0%	0.21
Hit by Motor Vehicle	2,087	69,290	14.2%	0.18
Hit Vehicle with Bicycle	286	9,292	1.9%	0.17
Hit Stationary Object w/ Bicycle	751	26,226	5.4%	0.15
Injured Doing Bike Tricks	204	8,965	1.8%	0.19
Dog/Insect Bites While Riding	95	4,194	0.9%	0.21
Contact Injury with Bicycle	578	18,933	3.9%	0.14
Mechanical Failure	164	6,427	1.3%	0.19
Injury, Cause Unknown	637	25,547	5.2%	0.16
Crash/Wreck/Accident	894	35,340	7.3%	0.21
Road Hazard	46	1,396	0.3%	0.21
Flipping/Thrown Over Handlebars	598	22,056	4.5%	0.10
Laid Bike Down	8	*	*	*
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014

**Does not meet criteria for publishing NEISS estimate of C.V. <0.34, estimate >1,200, and n>19*

The following definitions were used for the hazard patterns in Table 8:

- **Fall:** The rider fell from the bike with no other hazard patterns involved. Typically this was just described in the data as "fell from bike" or "fell off of bike."
- **Thrown/Knocked Off:** The rider was thrown or knocked off of the bike.
- **Jumped Off:** The rider jumped off of the bike.
- **Collision:** The rider collided with another bike or scooter, a motor vehicle, or a person (without mention of whether they were on a bike or not) without a clear sense of who hit whom.
- **Hit by Motor Vehicle:** The rider was hit by a car, truck, or other motor vehicle.
- **Hit Motor Vehicle with Bicycle:** The rider hit a motor vehicle or bicycle with their bicycle.
- **Hit Stationary Object with Bicycle:** The rider hit a stationary object with their bicycle.
- **Injured Doing Bike Tricks:** The injury occurred as the rider attempted to do a bike trick.
- **Dog/Insect Bites While Riding:** The rider was bitten by a dog, had a bug fly into their eye/ear, or was stung by a bee.

- **Contact Injury with Bicycle:** The rider was hurt from contact with the bicycle. This could include the foot getting caught in the gears, the handlebar striking the rider, or a straddling injury.
- **Mechanical Failure:** These included chain breaks, break failure, a blown or dislodged tire, or a pedal that broke off.
- **Injury, Cause Unknown:** This includes cases where the cause of the injury was unknown or too little detail was provided in the narrative to determine the hazard. This includes syncopal episodes, which are difficult to differentiate from cases of cardiac arrest or exertion injuries. It also includes shortness of breath, seizure, nausea, dizziness, heat exhaustion, dehydration, and dermatitis.
- **Crash/Wreck/Accident:** This includes cases in which the rider of the bike has been described as having been in a crash, wreck, or accident with little or no additional detail.
- **Road Hazard:** Those cases in which the bike encountered a change in terrain or a wet or slippery surface that seemed to cause or contribute to the incident. This can include going over a bump, loose gravel, a pothole, or the bike sliding from under the victim.
- **Flipped/Thrown Over Handlebars:** The rider was thrown over the handlebars. The incident may include overlapping details for other categories (like road hazard or wreck) though often being thrown or flipping was the only incident detail captured.
- **Laid Bike Down:** A small set of cases said simply that the rider laid the bike down, presumably in an attempt to avoid more serious injury.

Table 9 presents the estimated hospital emergency department-treated injuries associated with bicycles categorized by helmet use. In the majority of cases, it was not described, or unknown. In part, that may due to a number of cases where helmet use may seem irrelevant (e.g. injuries to the arm, leg, or torso).

Table 9: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Helmet Use, 2013

Disposition	Cases	Estimate	Percent	C.V.
Helmet Worn	829	26,086	5.4%	0.25
Helmet Not Worn	1,047	29,240	6.0%	0.20
Helmet Not Mentioned or Unknown	11,532	431,377	88.6%	0.11
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014

Table 10 presents the estimated hospital emergency department head injuries associated with bicycles categorized by helmet use. In cases of head injury where helmet use was known, more victims did not wear helmets than did. An estimated, 12,959 head injuries occurred when the victim was not wearing a helmet in 2013. An estimated 7,167 head injuries occurred when the victim was wearing a helmet. There were an estimated 58,615 head injuries seen in hospital emergency departments where helmet use was unknown.

Table 10: Estimated Hospital Emergency Department-Treated Head Injuries Associated with Bicycle Riding by Helmet Use, 2013

Disposition	Cases	Estimate	Percent	C.V.
Helmet Worn	220	7,167	9.1%	0.27
Helmet Not Worn	445	12,959	16.5%	0.21
Helmet Not Mentioned or Unknown	1,601	58,615	74.4%	0.15
Total	***2,266***	***78,740***	***100.0%***	***0.14***

Source: NEISS Database, June 2014
Columns may not sum to totals due to rounding

Table 11 presents the estimated hospital emergency department-treated injuries associated with bicycles categorized by alcohol or drug use. In the majority of cases, alcohol or drug use was not described, or was unknown.

Table 11: Estimated Hospital Emergency Department-Treated Injuries Associated with Bicycle Riding by Alcohol/Drug Use, 2013

Disposition	Cases	Estimate	Percent	C.V.
Alcohol Use	489	18,373	3.8%	0.19
Alcohol and Drug Use	23	*	*	*
Drug Use	42	*	*	*
Alcohol/Drug Use Not Mentioned	12,854	465,985	95.7%	0.11
Total	***13,408***	***486,703***	***100.0%***	***0.11***

Source: NEISS Database, June 2014
**Does not meet criteria for publishing NEISS estimate of C.V. <0.34, estimate >1,200, and n>19*

Appendix: Methodology

The product codes searched for this memo were 5033 (Mountain or All-Terrain Bicycles or Accessories) and 5040 (Bicycles or Accessories Excluding Mountain or All-Terrain Bicycles). The database searched for reports was the National Electronic Injury Surveillance System (NEISS).

National Electronic Injury Surveillance System (NEISS)

The estimate of hospital emergency department-treated injuries was derived from NEISS, which is a probability sample of approximately 100 U.S. hospitals having 24-hour emergency departments (EDs) and more than six beds. NEISS collects injury data from these hospitals. Coders in each hospital code the data from the ED record and the data is then transmitted electronically to CPSC. Because NEISS is a probability sample, each case collected represents a number of cases (the case's *weight*) of the total estimate of injuries in the U.S. Different hospitals carry different weights, based on stratification by their annual number of emergency department visits (Schroeder and Ault, 2001).

A coefficient of variation is the ratio of the standard error of the estimate (i.e., variability) to the estimate itself. This is generally expressed as a percent. A C.V. of 10% means the standard error of the estimate equals 0.1 times the estimate. Large C.V.'s alert the reader that the estimate has considerable variability. This is often due to a small sample size.[2] Estimates and confidence intervals are usually not reported unless the number of cases is 20 or more, the estimate is greater than 1,200, and the C.V. is less than 34%.

[2]Schroeder T, Ault K. *The NEISS Sample (Design and Implementation)*. U.S. Consumer Product Safety Commission. 2001.