

STATISTICAL BRIEF #130

May 2012

Emergency Department Visits and Inpatient Hospital Stays for All-Terrain-Vehicle-Related Injuries, 2009

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Introduction

All-terrain vehicles (ATVs) are small open motorized vehicles designed with large low-pressure tires for off-road use. ATVs are commonly used for both agricultural and recreational purposes. Because of the relatively small size of ATV motors, their use is not restricted by age or licensure. However, they can attain high speeds with rapid acceleration raising concerns for their safety, particularly for children. The Consumer Product Safety Commission estimates that there were 10.2 million 4-wheel ATVs in use in the United States in 2008.¹ Three-wheel ATVs were removed from the market due to safety concerns in 1988,² but a small number of 3-wheel ATVs may remain in use.

ATV-injury related emergency department (ED) visits and hospitalizations increased along with the increasing popularity of ATVs. Between 2000 and 2004 the number of hospitalizations for ATV-related injury rose from 8,232 to 15,630.³ Hospitalizations for ATV injury among children ages 0–17 rose from 1,618 in 1997 to 4,039 in 2006.⁴ In addition to the removal of 3-wheel ATVs from the market, numerous state and local policies have attempted to reduce ATV-related injury by requiring helmet use and promoting safer use through educational programs,⁵ but the effectiveness of these measures remains in doubt.^{6,7}

This report provides an update on recent emergency room visits and hospitalizations for ATV-related injury in the United States, drawing on data from the Healthcare Cost and Utilization Project

Highlights

- In 2009 there were about 115,200 emergency department (ED) visits in the U.S. for ATV-related injuries. Compared with people who visited an ED for other types of injury, people who visited an ED for an ATV-related injury were younger, more likely to be male and much more likely to live in a more rural area.
- Risk for ATV injury related ED visits peaks in early adolescence, reaching a rate of 10.2 per 100,000 population among people ages 13 to 15.
- There is over a 30-fold difference in risk for ATV injury related ED visits between the most urban and most rural regions of the country.
- Patients who visit EDs for ATV-related injuries are less likely to be insured than other injured ED patients, but among those with insurance, patients with ATV-related injury are more likely to have private insurance and less likely to be covered by Medicaid or Medicare.
- In 2009 there were about 12,800 inpatient hospitalizations for ATV-related injuries in the US. These hospitalizations were on average shorter than hospitalizations for other injuries, but cost about 30 percent more per day than hospitalization for other injuries. The aggregate cost of hospitalizations for ATV-related injuries in 2009 was \$166.6 million.
- Between 1997 and 2004 the number of hospitalizations for ATV-related injuries quadrupled, and aggregate costs increased ten-fold. Then between 2004 and 2009 the number of hospitalizations declined by 18 percent, and costs declined by 3 percent.

¹ Garland, S. (2010). Annual Report of ATV-Related Deaths and Injuries. Bethesda, MD, Consumer Product Safety Commission.

² Sawyer, J. R., D. M. Kelly, et al. (2011). "Orthopaedic Aspects of All-terrain Vehicle-related Injury." *Journal of the American Academy of Orthopaedic Surgeons* 19(4): 219–225.

³ Helmkamp, J. C., P. M. Furbee, et al. (2008). "All-terrain vehicle-related hospitalizations in the United States, 2000–2004." *American Journal of Preventive Medicine* 34(1): 39–45.

⁴ Bowman, S. M. and M. E. Aitken (2010). "Still Unsafe, Still in Use: Ongoing Epidemic of All-Terrain Vehicle Injury Hospitalizations Among Children." *Journal of Trauma-Injury Infection and Critical Care* 69(6): 1344–1349.

⁵ Aitken, M. E., C. J. Graham, et al. (2004). "All-terrain vehicle injury in children: strategies for prevention." *Injury Prevention* 10(5): 303–307.

⁶ Winfield, R. D., D. W. Mazingo, et al. (2010). "All-Terrain Vehicle Safety in Florida: Is Legislation Really the Answer?" *American Surgeon* 76(2): 149–153.

⁷ McBride, A. S., D. M. Cline, et al. (2011). "Pediatric All-Terrain Vehicle Injuries Does Legislation Make a Dent?" *Pediatric Emergency Care* 27(2): 97–101.

(HCUP) Nationwide Inpatient Sample (NIS) and the Nationwide Emergency Department Sample (NEDS) for years between 1993 and 2009.⁸ The report focuses on the age and geographic distribution of ATV injuries and on the time trends in the number of ED visits and hospitalizations for ATV injuries and their associated costs.

Findings

ATV-related emergency department visits, 2009

In 2009 there were about 115,200 emergency room visits for ATV injuries in the United States, around 315 visits per day. Table 1 shows characteristics of these visits in comparison with all other injury-related emergency room visits. ATV injury related ED visits were slightly more likely than the average injury-

Table 1. Characteristics of ATV-related injuries treated in emergency departments, 2009

	ATV-related ED visits	All other injury-related ED visits
Total number of visits	115,200	29,858,700
Rate per 100,000 population	37.9	9,819.80
Utilization characteristics		
Percentage treated and released	86.1%	89.1%
Percentage admitted to the hospital	13.5%	10.4%
Percentage died in ED	0.1%	0.1%
Other	0.3%	0.4%
Patient characteristics		
Mean age, years	27.1	36.3
Gender (percentage distribution)		
Males	71.7%	51.9%
Females	28.3%	48.1%
Patient residence (percentage distribution)		
Large central metro (urban)	10.5%	24.8%
Large fringe metro (suburban)	16.6%	22.4%
Medium and small metro	34.4%*	32.3%
Micropolitan and noncore (rural)	38.5%	20.6%
Community-level income (percentage distribution)		
1st Quartile (lowest, under \$39,999)	30.9%	29.6%
2nd Quartile	33.5%	28.7%
3rd Quartile	22.4%	23.0%
4th Quartile (highest)	13.2%	18.8%
Admission day (percentage distribution)		
Weekday (Monday–Friday)	53.0%	69.5%
Weekend (Saturday–Sunday)	47.0%	30.5%

*Difference from all other injury-related ED visits not statistically significant at $p < 0.05$.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

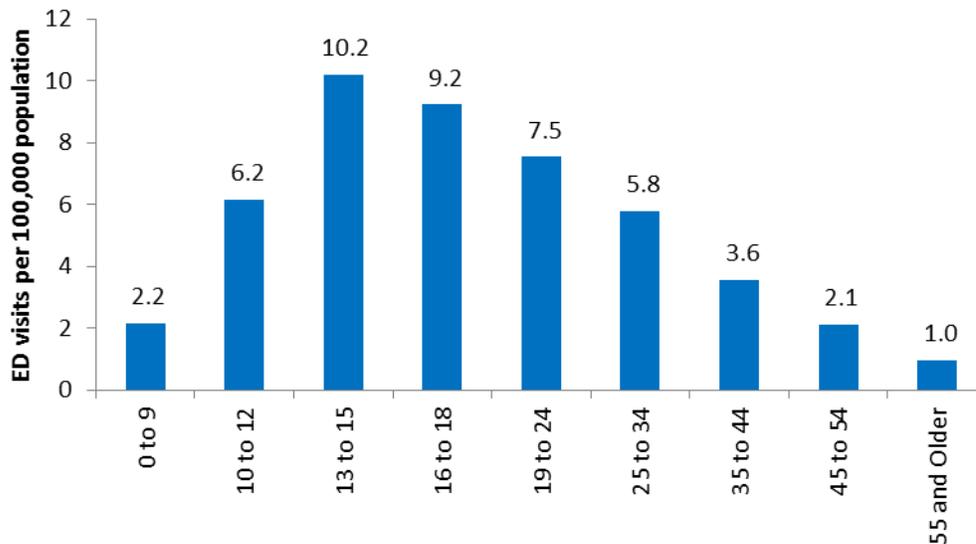
⁸ Garland, S. (2010). Annual Report of ATV-Related Deaths and Injuries. Bethesda, MD, Consumer Product Safety Commission.

related visit to result in a hospitalization (13.5 percent versus 10.4 percent). About one in every 1,000 ED visits for an ATV-related injury ended in death. ATV injury victims seen in the ED were about a decade younger than other injury victims seen in the ED (27.1 years versus 36.3 years), and they were much more likely to be male (71.7 percent versus 51.9 percent). The large majority of ATV injury victims lived in relatively rural areas: 38.5 percent lived in micropolitan and non-core areas and an additional 34.4 percent lived in medium and small metropolitan areas. ED visits for ATV injuries were more likely to occur on a weekend than the total of other injury-related ED visits (47.0 percent versus 30.5 percent).

Rates of ATV-related ED visits, 2009

As shown in figure 1, there is a strong relationship between age and the rate of ATV-injury-related ED visits. The rate of visits peaks in the 13 to 15 year age range at 10.2 per 100,000 population. Relative to older age groups, the rate of visits is also high for individuals ages 16 to 18 years (9.2 visits per 100,000 population), individuals ages 19 to 24 years (7.5 visits per 100,000 population), and individuals ages 10 to 12 years (6.2 visits per 100,000 population).

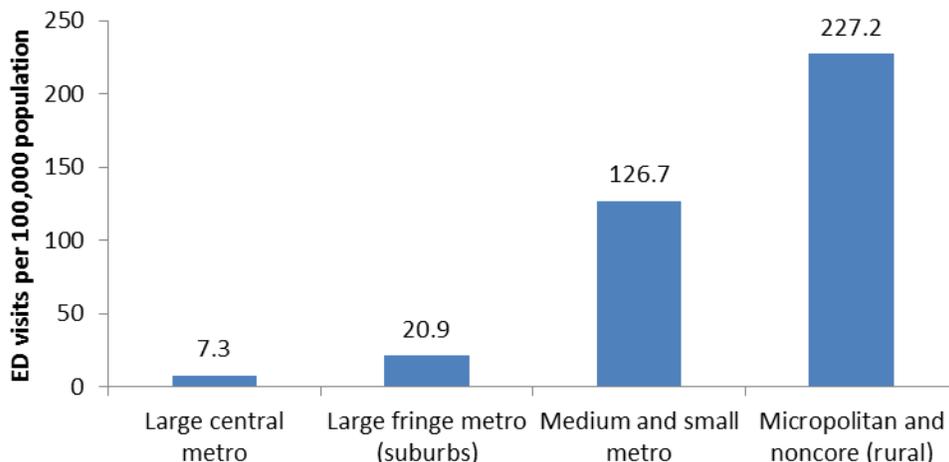
Figure 1. Rate of ED visits for ATV-related injuries by age, 2009



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

There is an enormous disparity in the population rates of ATV-injury related ED visits between urban and rural residents with the rate at only 7.3 per 100,000 among residents of urban areas and 227.2 among residents of rural areas, over a 30-fold difference (figure 2).

Figure 2. Rate of ED visits for ATV-related injuries by location of patient residence, 2009

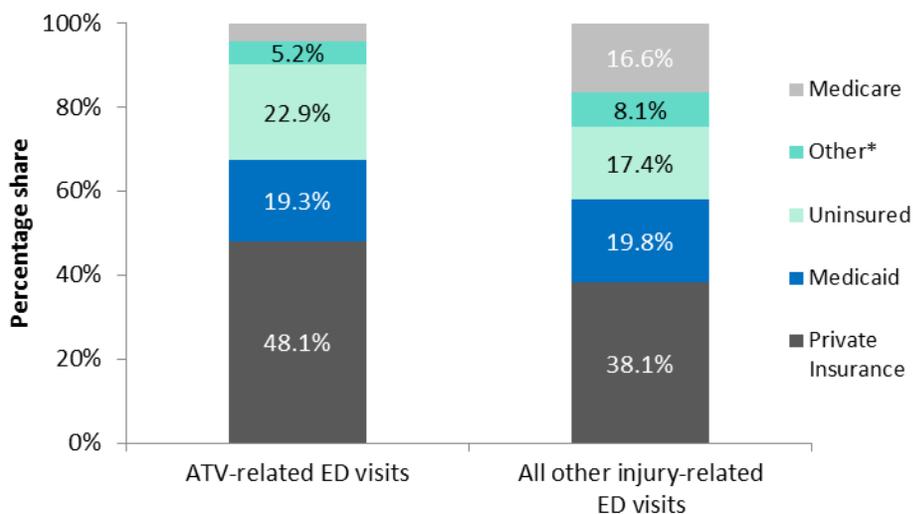


Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

Distribution of ATV-related ED by payer, 2009

Figure 3 shows the primary expected payers for ATV injury related ED visits and all other injury related ED visits in 2009. Compared with all injury related visits, those for ATV injuries were more likely to be covered by private insurance (48.1 percent versus 38.1 percent) and more likely to be uninsured (22.9 percent versus 17.4 percent). ATV injury related ED visits were less likely than other injury related visits to be covered by Medicare, probably as a result of the low average age of ATV injury victims.

Figure 3. Distribution of ATV-related ED visits and all other injury-related visits by expected payer, 2009



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

ATV-related hospital stays, 2009

ATV injury related hospitalizations differ from other injury related hospitalizations in several ways. First, the patients tend to be much younger, averaging 34.1 years of age, compared with the average of 58.1 years of age for all other injury related hospitalizations (table 2). ATV injury related hospitalizations are shorter on average (4.3 days) than other injury hospitalizations (5.6 days), but there is no statistically significant difference among most age groups.

On average, the costs associated with each day of hospitalization for an ATV injury is about 30 percent higher than the average for all other injury related hospitalizations (\$3,000 versus \$2,300). As a result, ATV injury related hospitalizations cost nearly the same amount as the average injury related hospitalization, despite the shorter mean length of stay. The estimated annual cost for all ATV injury related hospitalizations is \$166.6 million.

Table 2. Characteristics of ATV-related inpatient hospital stays, 2009

	ATV-related hospital stays	Hospital stays for all other injuries
Total number of discharges	12,800	3,413,900
Rate per 100,000 population	4.2	1,122.7
Patient characteristics		
Mean age, years	34.1	58.1
Utilization characteristics		
Mean length of stay, days	4.3	5.6
Mean length of stay by age, days		
0 to 9	2.6	5.3
10 to 12	4.3*	4.3
13 to 15	3.5*	4.2
16 to 18	3.4	4.3
19 to 24	4.2*	4.4
25 to 34	4.3*	4.6
35 to 44	4.6*	5.0
45 to 54	4.5	5.6
55 and Older	5.4*	6.1
Average cost per stay	\$13,000*	\$13,100
Average cost per day	\$3,000	\$2,300
Aggregate costs (million \$)	\$167	\$44,730
Discharge status (percentage distribution)		
Routine	82.0%	52.9%
Transfer to short-term hospital or other facility	10.5%	31.9%
Home health	5.6%	11.4%
Against medical advice	0.7%	1.2%
Died	1.2%	2.6%

*Difference from all other injury-related inpatient stays not statistically significant at $p < 0.05$.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2009

Trends in hospitalizations for ATV-related injuries, 1993–2009

Between 1993 and 2004, the number of hospitalizations for ATV-related injuries more than quadrupled, and aggregate costs increased ten-fold. Since 2004 the number of hospitalizations for ATV injuries has declined. In the most recent year for which data are available, 2009, the number of these hospitalizations had declined 18 percent from the peak in 2004. From 2004 to 2009, aggregate costs of ATV-related hospital stays declined by 3 percent.

Figure 4. Number and aggregate costs of ATV-related hospital stays, 1993–2009



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1993–2009

Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2009 NIS and 2009 NEDS. Historical data were drawn from the 1993–2009 NIS. Supplemental sources included data from the U.S. Census Bureau, Population Division, Annual Estimates of the Population for the United States, Regions, and Divisions and U.S. Census Bureau, Current Population Reports, P60–226, Coverage by Type of Health Insurance.

Definitions

Diagnoses, ICD-9-CM, and Clinical Classifications Software (CCS)

The *principal diagnosis* is that condition established after study to be chiefly responsible for the patient's admission to the hospital. *Secondary diagnoses* are concomitant conditions that coexist at the time of admission or that develop during the stay.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses. There are about 13,600 ICD-9-CM diagnosis codes. CCS categorizes ICD-9-CM diagnoses into a manageable number of clinically meaningful categories.⁹ This "clinical grouper" makes it easier to quickly understand patterns of diagnoses. CCS categories identified as "Other" are typically not reported; these categories include miscellaneous, otherwise unclassifiable diagnoses that may be difficult to interpret as a group.

⁹HCUP Clinical Classifications Software (CCS). Healthcare Cost and Utilization Project (HCUP). U.S. Agency for Healthcare Research and Quality, Rockville, MD. Available at <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>. Updated March 2012. (Accessed March 22, 2012).

Case definition

The External Cause of Injury codes (E-codes) used to define ATV-related injuries were the following: E821.0, E821.1, E821.8, and E821.9.

Types of hospitals included in HCUP

HCUP is based on data from community hospitals, defined as short-term, non-Federal, general and other hospitals, excluding hospital units of other institutions (e.g., prisons). HCUP data include obstetrics and gynecology, otolaryngology, orthopedic, cancer, pediatric, public, and academic medical hospitals. Excluded are long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. However, if a patient received long-term care, rehabilitation, or treatment for psychiatric or chemical dependency conditions in a community hospital, the discharge record for that stay will be included in the NIS.

Unit of analysis

The unit of analysis is the hospital discharge (i.e., the hospital stay), not a person or patient. This means that a person who is admitted to the hospital multiple times in one year will be counted each time as a separate "discharge" from the hospital.

Costs and charges

Total hospital charges were converted to costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare & Medicaid Services (CMS).¹⁰ *Costs* will reflect the actual expenses incurred in the production of hospital services, such as wages, supplies, and utility costs; *charges* represent the amount a hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used. Hospital charges reflect the amount the hospital billed for the entire hospital stay and do not include professional (physician) fees. For the purposes of this Statistical Brief, costs are reported to the nearest hundred.

Mean cost per day is calculated as the mean cost per stay divided by the mean length of stay.

Location of patients' residence

Place of residence is based on the urban-rural classification scheme for U.S. counties developed by the National Center for Health Statistics (NCHS). For this Statistical Brief, we collapsed the NCHS categories into either urban or rural according to the following:

Urban:

- Large Central Metropolitan: includes metropolitan areas with 1 million or more residents
- Large Fringe Metropolitan: includes counties of metropolitan areas with 1 million or more residents
- Medium and Small Metropolitan: includes areas with 50,000 to 999,999 residents.

Rural:

- Micropolitan and Noncore: includes nonmetropolitan counties (i.e., counties with no town greater than 50,000 residents).

¹⁰HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2009. U.S. Agency for Healthcare Research and Quality, Rockville, MD. Available at <http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp>. Updated August 2011. (Accessed March 22, 2012).

Median community-level income

Median community-level income is the median household income of the patient's ZIP Code of residence. The cut-offs for the quartile designation are determined using ZIP Code demographic data obtained from Claritas. The income quartile is missing for homeless and foreign patients.

Payer

Payer is the expected primary payer for the hospital stay. To make coding uniform across all HCUP data sources, payer combines detailed categories into more general groups:

- Medicare: includes fee-for-service and managed care Medicare patients.
- Medicaid: includes fee-for-service and managed care Medicaid patients. Patients covered by the State Children's Health Insurance Program (SCHIP) may be included here. Because most State data do not identify SCHIP patients specifically, it is not possible to present this information separately.
- Private Insurance: includes Blue Cross, commercial carriers, and private HMOs and PPOs.
- Other includes Worker's Compensation, TRICARE/CHAMPUS, CHAMPVA, Title V, and other government programs.
- Uninsured: includes an insurance status of "self-pay" and "no charge."

When more than one payer is listed for a hospital discharge, the first-listed payer is used.

About HCUP

HCUP is a family of powerful health care databases, software tools, and products for advancing research. Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP includes the largest all-payer encounter-level collection of longitudinal health care data (inpatient, ambulatory surgery, and emergency department) in the United States, beginning in 1988. HCUP is a Federal-State-Industry Partnership that brings together the data collection efforts of many organizations—such as State data organizations, hospital associations, private data organizations, and the Federal government—to create a national information resource.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

Alaska State Hospital and Nursing Home Association (ASHNA)
Arizona Department of Health Services
Arkansas Department of Health
California Office of Statewide Health Planning and Development
Colorado Hospital Association
Connecticut Hospital Association
Florida Agency for Health Care Administration
Georgia Hospital Association
Hawaii Health Information Corporation
Illinois Department of Public Health
Indiana Hospital Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Louisiana Department of Health and Hospitals
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts Division of Health Care Finance and Policy
Michigan Health & Hospital Association
Minnesota Hospital Association
Mississippi Department of Health
Missouri Hospital Industry Data Institute

Montana MHA – An Association of Montana Health Care Providers
Nebraska Hospital Association
Nevada Department of Health and Human Services
New Hampshire Department of Health & Human Services
New Jersey Department of Health
New Mexico Health Policy Commission
New York State Department of Health
North Carolina Department of Health and Human Services
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Health Policy and Research
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina State Budget & Control Board
South Dakota Association of Healthcare Organizations
Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health Services
Wyoming Hospital Association

About the NIS

The HCUP Nationwide Inpatient Sample (NIS) is a nationwide database of hospital inpatient stays. The NIS is nationally representative of all community hospitals (i.e., short-term, non-Federal, nonrehabilitation hospitals). The NIS is a sample of hospitals and includes all patients from each hospital, regardless of payer. It is drawn from a sampling frame that contains hospitals comprising about 95 percent of all discharges in the United States. The vast size of the NIS allows the study of topics at both the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use.

About the NEDS

The HCUP State Inpatient Databases (SID) are hospital inpatient databases from data organizations participating in HCUP. The SID contains the universe of the inpatient discharge abstracts in the participating HCUP States, translated into a uniform format to facilitate multi-state comparisons and analyses. Together, the SID encompasses 95 percent of all U.S. community hospital discharges in 2009. The SID can be used to investigate questions that are unique to one State; to compare data from two or more states; to conduct market area variation analyses; and to identify State-specific trends in inpatient care utilization, access, charges, and outcomes.

For More Information

For more information about HCUP, visit www.hcup-us.ahrq.gov.

For additional HCUP statistics, visit HCUPnet, our interactive query system, at <http://hcupnet.ahrq.gov/>.

For information on other hospitalizations in the U.S., download *HCUP Facts and Figures: Statistics on Hospital-Based Care in the United States in 2009*, located at <http://www.hcup-us.ahrq.gov/reports.jsp>.

For a detailed description of HCUP, more information on the design of the NIS, and methods to calculate estimates, please refer to the following publications:

Introduction to the HCUP Nationwide Inpatient Sample, 2009. Online. May 2011. U.S. Agency for Healthcare Research and Quality. Available at http://hcup-us.ahrq.gov/db/nation/nis/NIS_2009_INTRODUCTION.pdf. (Accessed March 22, 2012).

Introduction to the HCUP Nationwide Emergency Department Sample, 2009. Online. September 2011. U.S. Agency for Healthcare Research and Quality. Available at <http://hcup-us.ahrq.gov/db/nation/neds/NEDS2009Introductionv3.pdf>. (Accessed March 22, 2012).

Houchens R., Elixhauser A. *Final Report on Calculating Nationwide Inpatient Sample (NIS) Variances, 2001*. HCUP Methods Series Report #2003-2. Online. June 2005 (revised June 6, 2005). U.S. Agency for Healthcare Research and Quality. Available at <http://www.hcup-us.ahrq.gov/reports/CalculatingNISVariances200106092005.pdf>. (Accessed March 22, 2012).

Houchens R.L., Elixhauser A. *Using the HCUP Nationwide Inpatient Sample to Estimate Trends. (Updated for 1988–2004)*. HCUP Methods Series Report #2006–05. Online. August 18, 2006. U.S. Agency for Healthcare Research and Quality. Available at http://www.hcup-us.ahrq.gov/reports/methods/2006_05_NISTrendsReport_1988-2004.pdf. (Accessed March 22, 2012)

Suggested Citation

Breslau J. (RAND), Stranges E. (Thomson Reuters), Gladden M. (CDC), and Wong H. (AHRQ). *Emergency Department Visits and Inpatient Hospital Stays for All-Terrain-Vehicle-Related Injuries, 2009*. HCUP Statistical Brief #130. May 2012. Agency for Healthcare Research and Quality, Rockville, MD. Available at <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb130.pdf>

Acknowledgments

The authors would like to acknowledge Nils Norstrand and Lindsay Terrel for their assistance.

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please e-mail us at hcup@ahrq.gov or send a letter to the address below:

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