# Emergency Department Care in the United States: A Profile of National Data Sources

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**Study objective:** Emergency departments (EDs) are an integral part of the US health care system, and yet national data sources on the care received in the ED are poorly understood, thereby limiting their usefulness for analyses. We provide a comparison of data sources that can be used to examine utilization and quality of care in the ED nationally.

**Data sources and comparisons:** This article compares 7 data sources available in 2005 for conducting analyses of ED encounters: the American Hospital Association Annual Survey Database™, Hospital Market Profiling Solution©, National Emergency Department Inventory, Nationwide Emergency Department Sample, National Hospital Ambulatory Medical Care Survey, National Electronic Injury Surveillance System–All-Injury Program, and the National Health Interview Survey. In addition to describing the type and scope of data collection, available characteristics, and sponsor of the ED data sources, we compare (where possible) estimates of the total number of EDs, national and regional volume of ED visits, national and regional admission rates (percentage of ED visits resulting in hospital admission), patient characteristics, hospital characteristics, and reasons for visit generated by the various data sources.

**Major findings:** The different data sources yielded estimates of the number of EDs that ranged from 4,609 to 4,884 and the number of ED encounters from more than 109 million to more than 116 million. Admission rates across data sources varied from 12.0% to 15.3%. Although comparisons of the 7 data sources were somewhat limited by differences in available information and operational definitions, variation in estimates of utilization and patterns of care existed by region, expected payer, and patient and hospital characteristics. The rankings and estimates of the top 5 first-listed conditions seen in the ED are relatively consistent between the 2 data sources with diagnoses, although the Nationwide Emergency Department Sample estimates 1.3 to 5.8 times more ED visits for each chronic and acute all-listed condition examined relative to the National Hospital Ambulatory Medical Care Survey.

**Conclusion:** Each of the data sources described in this article has unique advantages and disadvantages when used to examine patterns of ED care, making the different data sources appropriate for different applications. Analysts should select a data source according to its construction and should bear in mind its strengths and weaknesses in drawing conclusions based on the estimates it yields. [Ann Emerg Med. 2010;56:150-165.]

Please see page 151 for the the Editor's Capsule Summary of this article.

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## INTRODUCTION

Emergency departments (EDs) serve a dual role in the US health infrastructure: they are a point of entry for approximately 50% of inpatient admissions and a setting for acute care outpatient visits.[1] About 20% of the US population visits an ED each year,[2] making it a relatively common site of care, and it has been suggested that care delivered in the ED provides a window into the state of health care in the United States.[3]

Numerous challenges, however, confront US hospital EDs, as highlighted in a recent Institute of Medicine report, *Hospital-Based Emergency Care: At the Breaking Point*.[3] ED crowding, boarding (ie, holding patients until an inpatient bed is available), and ambulance diversion have become more

**Editor's Capsule Summary**

*What is already known on this topic*

Multiple national data sources are available for the study of utilization and quality of care in US emergency departments (EDs).

*What question this study addressed*

This study describes 7 common publicly available data sources, comparing and contrasting their methods of sampling, types of data collected, definitions, and assumptions.

*What this study adds to our knowledge*

There were systematic differences among the data sources. Some were more suitable for understanding hospital-level characteristics; others, for detailed clinical- and visit-level data. Data sources differed somewhat on global estimates for fundamental variables, such as the number of emergency departments and the number of visits.

*How this might change clinical practice*

This will not change practice but will enable researchers and policymakers to choose appropriate sources for their purpose. In some circumstances, more than one source will be needed.

prevalent. At the same time, the ED is increasingly used for primary care, particularly among patients with limited access to alternative care sites, in part because of lack of or inadequate insurance, time or travel constraints, or lack of knowledge about how to navigate the health care system.

Many of the challenges faced by EDs are issues of increasing concern to policymakers. ED utilization patterns among individuals with different types of insurance coverage and without insurance coverage is a subject that is particularly relevant to health care reform, as noted in the Health Care Community Discussions led by the Presidential Transition Team during the end of 2008 and beginning of 2009.[4] More than 16% of the 3,276 groups criticized a health care system that was accessible only through the ED, with some group participants describing bankruptcy from medical bills, inability to pay for primary care visits, and care-seeking in the ED. Others highlight urban/rural and regional differences in ED utilization as high-priority topics for policymakers.[5] Additionally, recent reports note that EDs are insufficiently prepared for disasters, in part because of inadequate surge capacity.[3,6]

Understanding and addressing these systemic issues frequently requires accurate, unbiased data. In particular, understanding patterns of ED utilization across all hospitals, by institution type, region, and other characteristics, can help policymakers, researchers, and administrators analyze and plan to improve operations of EDs. There are a number of national data resources that can be used to examine ED encounters; however, differences in the construction of the data sets may lead to differences in the estimated number of annual visits and their characteristics.[7,8] It is important for researchers investigating ED utilization to understand the reasons behind these differences, as well as the strengths and weaknesses of the various data sources, to determine which source would be most suitable to address the clinical and policy issues of interest. Recognizing the unique features of the different data sources will allow analysts to maximize the usefulness of the available data resources.

This article provides descriptive comparisons of multiple data sources available for conducting analyses of ED visits. In addition to describing the type and scope of data collection, available characteristics, and sponsor of the ED data sources, we compare (where possible) estimates of the total number of EDs, national and regional volume of ED visits, national and regional admission rates, patient characteristics, hospital characteristics, and reasons for visits generated by the various data sources. We use 2005 data, a year in which all of these data sources were available. We examine whether some ED data sources are more appropriate than others for addressing issues related to insurance status, region, trauma center utilization, or setting of care for various conditions, including injuries.

## DATA SOURCES

In this article, we examine the characteristics of 7 data sets and compare their 2005 estimates of the number of visits in EDs affiliated with community, short-term, nonfederal, nonrehabilitation, US hospitals within the 50 states and the District of Columbia.* The data sources were selected according to 2 criteria: (1) ability to derive national estimates of ED visits (or injury-related ED visits) regardless of payer, and (2) availability of the data to the public. As shown in Table 1, 3 are national inventories or censuses of EDs: American Hospital Association Annual Survey Database (AHA Annual Survey™), Hospital Market Profiling Solution©, and National Emergency Department Inventory (NEDI-USA). Three of the data sources consist of samples of EDs in the United States: Healthcare Cost and Utilization Project (HCUP) Nationwide Emergency Department Sample (NEDS), National Hospital Ambulatory Medical Care Survey (NHAMCS), and National Electronic Injury Surveillance System–All Injury Program (NEISS-AIP). One is based on interviews from a sample of households: National Health Interview Survey (NHIS).

* Community hospitals, defined as short-term, non-Federal, general and other hospitals, include obstetrics and gynecology; ear, nose and throat; orthopedic; cancer; pediatric; acute care county and other public hospitals; and academic tertiary care medical hospitals. They exclude hospitals whose main focus is long-term care, psychiatric, or alcoholism and chemical dependency treatment.

**Table 1.** Description of 2005 data sources.

| Type of ED Data | ED Data Source | Sponsor | Sampling Frame | Number of Hospitals and Visits in 2005 | Characteristics Available | Availability |
|---|---|---|---|---|---|---|
| National inventories of EDs | AHA Annual Survey™ | AHA | Universe | Data from 6,349 community hospitals, including 4,884 EDs | Region, hospital | Available annually beginning with 1946 data year |
| | Hospital Market Profiling Solution© | Verispan LLC; now called SDI Health LLC | Universe | Data from 6,921 community hospitals, including 4,609 EDs | Region, hospital | Available annually beginning with 1977 data year |
| | NEDI-USA | EMNet | Universe<br>AHA Annual Survey™, Hospital Market Profiling Solution©, and EMNet research/ analysis | Data from 4,828 EDs | Region, hospital* | Available in 2001, 2003, 2005, and 2007 |
| ED visit information from a sample of EDs | NEDS | AHRQ of the DHHS | AHA Annual Survey™ | Data from nearly all hospitals in 23 states (sample is 972 EDs and 27,011,634 ED visits) | Region, hospital, disposition, patient, expected payer, diagnosis, injury* | 2005 NEDS is a pilot database. Publicly available through the HCUP Central Distributor annually, beginning with the 2006 NEDS. |
| | NHAMCS | NCHS of the DHHS CDC | Hospital Market Profiling Solution© and Verispan's Healthcare Market Index | Data from 352 EDs and 33,605 ED visits | Region, hospital, disposition, patient, expected payer, diagnosis, injury* | Available annually, beginning with 1992 data year |
| | NEISS-AIP | NCIPC of the DHHS CDC and US CPSC | Hospital Market Profiling Solution© | Data from 66 hospitals with EDs and 780,000 injury records | Injury | Available annually, beginning with the 2000 data year |
| ED visit information from a sample of households | NHIS | NCHS of the DHHS CDC | US Census Bureau | Data from 38,509 households (98,649 persons in 39,284 families) | Region, patient | Available annually, beginning with the 1997 data year |

*AHA,* American Hospital Association; *EMNet,* Emergency Medicine Network; *AHRQ,* Agency for Healthcare Research and Quality; *DHHS,* US Department of Health and Human Services; *NCHS*, National Center for Health Statistics; *CDC,* Centers for Disease Control and Prevention; *NCIPC,* National Center for Injury Prevention and Control; *CPSC,* Consumer Product Safety Commission.
*Additional detail is available on research or state-specific files accessible through the sponsor.

**National Inventories of EDs**

Since 1946, the AHA Annual Survey™ has been sent out to more than 6,300 hospitals in the United States and its territories, 98% of which are registered with the American Hospital Association (AHA). These hospitals are asked about their organizational structure, personnel, financial performance, services offered, and utilization, including the number of ED visits. The reported average response rate for the 2001 to 2006 surveys is 85%. The AHA imputes some missing data in the survey, based on previous responses from the hospitals, responses from hospitals with similar size, ownership, services, length of stay and geography, or estimates from regression models.[9] In 2005, 4,884 of the 6,349 hospitals surveyed were community, nonfederal, nonrehabilitation, US hospitals with an ED; therefore, they met the criteria to be included in the study.

The Hospital Market Profiling Solution© is a commercially available database on hospital organizational structure, beds, accreditation, staffing, financials, services, and utilization, including the number of ED visits. Since 1977, Verispan LLC (formerly SMG and now SDI Health LLC) has collected information on more than 6,900 hospitals in the United States and Puerto Rico from federal and state licensing agencies, the Centers for Medicare & Medicaid Services, and directly from hospitals. The average reported response rate for the Hospital Market Profiling Solution© is 88%. No information was available about the treatment of missing data (SDI Health LLC, May 2009). In 2005, 4,608 of the 6,921 hospitals in the Hospital Market Profiling Solution© met our study criteria.

The NEDI-USA is created by the Emergency Medicine Network at the Massachusetts General Hospital, beginning with the 2001 data year. This inventory of ED locations and annual ED visit volume integrates information from the AHA Annual Survey™, the Hospital Market Profiling Solution©, Internet searches, and direct communication with hospital staff. Other characteristics come from independent sources (eg, US Census, the Council of Teaching Hospitals, and the Society for Academic Emergency Medicine) and are merged into the NEDI-USA database.[5,10] In 2005, all 4,828 hospitals in the NEDI-USA met our study criteria.

**National Samples of EDs**

The 2005 NEDS database was created as part of a HCUP feasibility study. The HCUP, which is sponsored by the Agency for Healthcare Research and Quality of the US Department of Health and Human Services, brings together statewide encounter-level data collection efforts of state government data organizations, hospital associations, private data organizations, and the federal government. Using the AHA Annual Survey™ as the universe of hospitals, the NEDS is built with a 20% stratified sample of hospital EDs from the sampling frame of community hospitals with an affiliated ED in the HCUP State Emergency Department Databases and the State Inpatient Databases. The State Emergency Department Databases capture information on ED visits that do not result in admission to the same hospital (ie, "treated and released," which includes patients who were discharged home, transferred to another health care facility, left against medical advice, left without being seen, transferred to another hospital, or died) and the State Inpatient Databases capture ED and hospital stay information on ED visits that result in admission to the same hospital. Five hospital characteristics are used in sample stratification: US Census region, designation as a trauma center, urban/rural location of the hospital, ownership, and teaching status. All ED encounters obtained from UB-04 billing records (both the "treated and released" from the State Emergency Department Databases and ED visits resulting in inpatient admission to the same hospital from the State Inpatient Databases) from the selected sample of EDs are included in the NEDS. More than 98% of hospitals in the sample frame provide data to the HCUP. Poststratification was used to calculate hospital and discharge weights that provide unbiased national estimates of the universe of the number of hospital EDs and the number of encounters, respectively. The strata that were collapsed for sampling were also collapsed for sample weight calculations. The 2005 NEDS, which contains more than 25 million unweighted or 116 million weighted records for ED visits at about 1,000 hospitals in 23 states in the United States, includes data on hospital characteristics, patient characteristics, expected payer, and the nature of visits (eg, common reasons for ED visits, including causes of injuries and acute and chronic conditions).[11]

The NHAMCS, conducted annually since 1992 by the National Center for Health Statistics of the US Department of Health and Human Services Centers for Disease Control and Prevention (CDC), is a national survey of nonfederal, general, short-stay (average stay of fewer than 30 days) hospitals. Using the Healthcare Market Index and the Hospital Market Profiling Solution© as the universe of hospitals, the multistage probability sample is based on geographic primary sampling units, as defined by the 1984 to 1994 NHIS: hospitals with EDs within the primary sampling units, emergency service areas within EDs, and patient visits within emergency service areas.[12] Data on patient demographics, expected source of payment, patient complaints and diagnoses (chronic and acute conditions, injuries, cause of injuries), diagnostic and screening services, procedures, medications, disposition, and types of health care professionals consulted during the visit are collected directly from patient records at the hospitals. Census field representatives visit individual EDs, obtain responses to an institutional questionnaire, and instruct hospital staff to complete a patient record form for a random sample of 100 patient visits during a randomly assigned 4-week period. More than 91.2% of in-scope hospitals participated in the study. Missing data resulting from nonresponse from hospitals or incomplete responses on patient forms are imputed based on information from hospitals or patient forms from hospitals within the same region, similar organizational structures, same Metropolitan Statistical Area, and same seasonality of reporting period.[13] The unweighted emergency service area response rate was 94.3%, and the overall unweighted 2-stage sampling

response rate was 86.0%. Weights were computed for each visit to inflate the data to produce unbiased nationally representative annual estimates, taking into account all sampling stages, as well as including selection probabilities, adjustment for nonresponse, population ratio adjustments, and weight smoothing. The 2005 NHAMCS contains approximately 34,000 unweighted or 115 million weighted records from 352 EDs.[14,15]

The NEISS-AIP, operated jointly by the National Center for Injury Prevention and Control of the US Department of Health and Human Services CDC and the US Consumer Product Safety Commission beginning in 2000, is an expansion of the NEISS, which monitors consumer product-related injuries. The NEISS-AIP is designed to provide national incidence estimates of all types and external causes of nonfatal injuries. With the Hospital Market Profiling Solution© as the universe of hospitals, data are collected from a representative stratified probability sample of 66 hospitals in the United States and its territories with 6 or more beds and 24-hour emergency services. The sampling frame is updated every 10 years and has 4 strata determined by the size of the hospital according to annual ED visits, as well as 1 children's hospital stratum. On a daily or near-daily basis, hospital coders review the emergency care records to determine whether an injury-related ED visit occurred.[16-18] The NEISS reports that approximately 90% of all reportable incidents are identified.[19] Weights are computed for each case according to the inverse probability of selection.[17] The 2005 NEISS-AIP contains approximately 780,000 unweighted or 29 million weighted first-time injury-related ED records.

### National Sample of Households

NHIS, conducted annually since 1957 by the National Center for Health Statistics of the US Department of Health and Human Services CDC, is a household-based survey of the civilian, noninstitutionalized US population and includes information on health status, health care utilization, health insurance coverage, and a variety of sociodemographic characteristics. Data are collected on about 99,000 persons through computer-assisted personal interviewing, with one respondent reporting basic information on all family members. Since 1997, a supplement has included questions on the number of ED visits in the last 12 months for one randomly selected adult (self-reported) and one randomly selected child (reported by a knowledgeable adult) from the household. Approximately 86.5% of participants selected to complete the survey responded. All person-level estimates are weighted, taking into account the multistage probability of selection and probabilities of nonresponse, as well as poststratification adjustment to 2000 Census control totals for age, sex, and race/ethnicity populations.[20] Because the NHIS is a household survey, no data are available at the hospital level. The survey contains information on 98,648 persons (unweighted) and 291.1 million persons (weighted).

## MEASURES FOR COMPARISON

ED visit counts are estimated for each data source (only injury-related ED visits are estimated with the NEISS-AIP). For the NHIS, counts of ED visits are calculated from the number of ED visits per person, which are collected in 9 categories (0, 1, 2 to 3, 4 to 5, 6 to 7, 8 to 9, 10 to 12, 13 to 15, and 16 or more visits). We use the midpoint value of each category in the NHIS question as the number of visits for each person. All of the data sources except the NEISS-AIP and the NHIS provide the universe of ED visit counts or a weighted estimate of counts by hospital.

In addition to ED visit counts, ED admission rates (percentage of ED visits resulting in an inpatient admission to the same hospital) are derived by geographic area, using the NEDS and NHAMCS, the only data sources that provide disposition from the ED. ED visit records in both data sources indicate whether the patient is "treated and released" or admitted to the same hospital.

### Characteristics of ED Visits

We compare ED visit counts across geographic (national and regional) locations, patient demographic characteristics, hospital characteristics, and type of patient clinical condition (common reasons for visits, chronic and acute conditions, and injuries). To the extent possible, we aggregate visit counts into similar categories for each data source. We describe the classification rules used for each data source below.

### Patient Demographics

For the NEDS, NHAMCS, and NHIS, ED visit counts are compared by patient age (0 to 17, 18 to 44, 45 to 64, and ≥65 years) and sex. For the NEDS and NHAMCS, ED visit counts are also compared by expected payer, which is classified into 6 categories (private insurance, Medicare, Medicaid, uninsured, other payers, and missing). For the NEDS, primary expected source of payment is used for the expected payer categories. Uninsured is defined as self-pay or no charge. "Other payers" include other insurance types not listed in the previous categories, such as worker's compensation, TRICARE, Title V, and other government programs. Depending on the state program, the State Children's Health Insurance Program may be classified as private insurance, Medicaid, or other payers. For the NHAMCS, expected payer is based on a hierarchy of all-listed expected sources of payment created by NCHS, with Medicaid/State Children's Health Insurance Program being first, followed by Medicare, worker's compensation, private insurance, self-payment, and no charge. For the purposes of this article, self-pay and no charge are grouped together as uninsured. "Other payers" include other insurance types such as worker's compensation, Civilian Health and Medical Program of the Uniformed Services (CHAMPUS)/TRICARE, state and local government, private charitable organizations, and other liability coverage.

**Hospital Characteristics**

Data on hospital characteristics are available in 4 of the 7 data sources (AHA Annual Survey™, Hospital Market Profiling Solution©, NEDS, and NHAMCS). Hospital characteristics include designation as a trauma center, location (Metropolitan Statistical Area and non-Metropolitan Statistical Area), teaching status, and ownership (public, nonprofit, and proprietary).

Definitions of trauma center vary across the databases. Although the AHA Annual Survey™ queries hospitals about their trauma center status, for consistency across data sources, we link data from the Trauma Information Exchange Program[21,22] to the AHA Annual Survey™ to assign a trauma level (I to V) to a hospital. Trauma level designation is determined by a state or regional authority or verified by the American College of Surgeons' Committee on Trauma (ACS/COT). Designation of trauma center Levels I, II, and III is based on criteria developed by the ACS/COT. For the purposes of this article, hospitals in the AHA Annual Survey™ are classified as trauma (Levels I to III) or nontrauma (Level IV, V, or none). The Hospital Market Profiling Solution© contains information on whether the hospital or a licensing agency considers the hospital to be a trauma center (yes, no, or blank). Hospitals that are classified as Levels I to V trauma centers or which are listed as unspecified trauma centers in the Hospital Market Profiling Solution© are regarded as trauma hospitals. Hospitals in NEDS are classified as trauma (Levels I to III) or nontrauma (Level IV, V or none) according to Trauma Information Exchange Program data. NHAMCS reports of trauma hospitals are based on the trauma designation in the Hospital Induction Interview Survey (question 9c), with additional information from the Trauma Information Exchange Program.[15,23] For this article, the assigned classification provided by NHAMCS is used.

The databases also use different approaches for identifying teaching institutions. The AHA Annual Survey™ does not have a specific variable for teaching status, but it does contain information that could be used to assign teaching status. For the purpose of this article, we regard an AHA hospital as a teaching institution if it has an American Medical Association–approved residency program or is a member of the Council of Teaching Hospitals or has a ratio of full-time equivalent interns and residents to beds of 0.25 or higher. These criteria are used to assign teaching status to hospitals in the NEDS as well. The Hospital Market Profiling Solution© defines teaching as a "teaching hospital or affiliated with a teaching hospital." NHAMCS does not contain information on the teaching status of hospitals.

**Reasons for Visits**

For NEDS and NHAMCS, data on conditions are derived from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) codes recorded on hospital records. The NEDS includes up to 15 *ICD-9-CM* diagnoses and 4 *ICD-9-CM* external cause of injury codes (E codes) for each ED record, whereas the NHAMCS includes up to 3 *ICD-9-CM* diagnoses and 3 *ICD-9-CM* E codes. In addition, diagnoses on the NEDS are grouped into categories with the Clinical Classification Software, a disease categorization scheme that collapses *ICD-9-CM* diagnosis codes into 260 mutually exclusive, clinically meaningful categories.[24] For consistency, we also group the NHAMCS *ICD-9-CM* diagnoses into Clinical Classification Software categories.

In addition, ED visit counts are derived for selected, commonly occurring chronic and acute conditions. Chronic conditions of interest include respiratory disease (Clinical Classification Software 122-134), diabetes (Clinical Classification Software 49-50), heart disease (Clinical Classification Software 96-121), and mood disorders (Clinical Classification Software 657). Acute conditions of interest include gastrointestinal conditions (Clinical Classification Software 135-155) and pneumonia (Clinical Classification Software 122). Visit counts for a condition that requires laboratory testing to accurately diagnose, methicillin-resistant *Staphylococcus aureus* (MRSA) (*ICD-9-CM* diagnosis code V09.0), are also compared.

Three of the data sources (NEDS, NHAMCS, and NEISS-AIP) can be used to investigate ED utilization for injuries, although the definition of injury varies by data source. Injury-related ED visits in the NEDS are identified by *ICD-9-CM* diagnosis codes of 800-909.2, 909.4, 909.9, 910-994.9, 995.5-995.59, and 995.80-995.85 (all-listed diagnoses on records of treat and release ED visits and principal or first-listed diagnosis on records of ED visits that resulted in admission). For consistency with the NEISS-AIP estimates, injury estimates using the NEDS are limited to those that do not result in death. Using NHAMCS publications as a guide to coding of injuries in the data source,[15] injuries in the NHAMCS are identified by a positive response to the question of, Is this visit related to an injury, poisoning, or adverse effect of medical treatment?, presence of an injury-related *ICD-9-CM* diagnosis code, or presence of an injury-related E code. Nonfatal injuries in the NEISS-AIP are defined as bodily harm resulting from severe exposure to an external force or substance (mechanical, thermal, electrical, chemical, or radiant). NEISS-AIP excludes cases if the principal diagnosis is an illness, psychological harm only, contact dermatitis, or unknown, or if the injury is related to an adverse effect of therapeutic drugs or of surgical or medical care.

For the NEDS and NEISS-AIP, we classify injuries by State and Territorial Injury Prevention Directors Association Mechanism of Intent coding[25] using all-listed E codes on the injury record and calculate counts of unintentional injuries (falls, struck by/against, motor vehicle traffic, cut/pierce, other mechanism, and mechanism unspecified) and counts of intentional injuries (assault, self-inflicted, and other causes of violence). For the NHAMCS, unintentional and intentional injuries based on first cause of injury are classified according to a similar but not identical scheme described in Table II in the National Center for Health Statistics Advance Data publication on 2001 ED visits.[14] Counts of the various types of injuries are

**Table 2.** Number of EDs* by ED visit volume, 2005.

| | Data Sources, 2005 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Inventories of EDs | | | | | | Samples of EDs | |
| | AHA Annual Survey™ | | Hospital Market Profiling Solution© | | NEDI-USA | | NEDS | |
| Volume of ED Visits | No. | % | No. | % | No. | % | No. (Weighted) | % |
| **All Hospital EDs** | 4,884 | 100.0 | 4,609 | 100.0 | 4,828 | 100.0 | 4,884 | 100.0 |
| <10,000 visits | 1,797 | 36.8 | 1,508 | 32.7 | 1,540 | 31.9 | 1,366 | 28.0 |
| 10,000–19,999 visits | 936 | 19.2 | 1,006 | 21.8 | 1,051 | 21.8 | 994 | 20.4 |
| 20,000–29,999 visits | 662 | 13.6 | 688 | 14.9 | 762 | 15.8 | 787 | 16.1 |
| 30,000–39,999 visits | 523 | 10.7 | 550 | 11.9 | 578 | 12.0 | 626 | 12.8 |
| 40,000–49,999 visits | 357 | 7.3 | 347 | 7.5 | 377 | 7.8 | 452 | 9.3 |
| ≥50,000 visits | 609 | 12.5 | 510 | 11.1 | 520 | 10.8 | 658 | 13.5 |

*US community hospital EDs reporting ED visits in 2005.

taken from the National Center for Health Statistics Advance Data publication on 2005 ED visits.[15]

## ESTIMATES AND COMPARISONS

ED counts and ED admission rates are summarized for the entire United States. Analyses of the inventories (AHA Annual Survey™, Hospital Market Profiling Solution©, NEDI-USA) produce point estimates of the number of ED visits. For the data sources that are based on samples of EDs or patients (NEDS, NHAMCS, NEISS-AIP, and NHIS), weighted estimates of the total number of visits, the standard error of the visit counts, and the corresponding 95% confidence intervals (CIs) are produced. To better understand the differences among the data sources (except NHAMCS, NEISS-AIP, and NHIS), the estimate of the distribution of hospitals by reported volume of ED visits is compared. Although the NHAMCS has a hospital-level weight to calculate hospital ED counts starting in 2005, confidentiality restrictions prevent researchers outside of National Center for Health Statistics' data center from examining the volume of ED visits by hospital. Therefore, NHAMCS is not included in this comparison.

Various methodological strategies are used to compare the information produced by each data source and for each type of comparison. First, the absolute differences in total and regional visit counts are compared because these are based on either point estimates for inventories or "control totals" in the case of samples. For example, by design, NEDS-weighted estimates of total and regional ED visits are the same as those of the AHA Annual Survey™, whereas the NHAMCS estimates are similar but not an exact match to those of the Hospital Market Profiling Solution©. As described above, the NHIS does not weight to an ED visit control total; rather, weights are based on US Census population data. Variation in estimates as shown in the CIs is provided only for national and regional estimates of ED visits for the weighted estimates derived from the NEDS, NHAMCS, and NHIS. Second, the top 10 reasons for ED visits are ranked in descending order and the relative rankings between data sources are compared. Last, estimates of the number of ED visits for selected acute and chronic conditions, and injuries are calculated. In addition, for these measures the 95% CI of each estimate is calculated. The upper and lower boundaries of the CIs are compared across data sources.

This project, which uses existing data that are publicly available or data in which the subjects cannot be identified directly or through identifiers,[26] was assessed to be exempt by the Agency for Healthcare Research and Quality's institutional review board officer.

## MAJOR FINDINGS

### Estimates of ED Visits and ED Admission Rates

Although the AHA Annual Survey™ includes approximately 250 more hospitals in the universe than the Hospital Market Profiling Solution©, the distribution of hospitals by ED visit volume category is fairly comparable across the data sources, with a few exceptions (Table 2). About one third of the hospitals have fewer than 10,000 ED visits annually, and only one tenth of the hospitals have 50,000 or more ED visits annually. Compared with the Hospital Market Profiling Solution©, the AHA Annual Survey™ includes 290 more hospitals with an ED visit volume of less than 10,000 per year, 100 more hospitals with an ED visit volume of 50,000 or more per year, and about 150 fewer hospitals with an ED visit volume of 10,000 to 49,999 per year.

Across the 6 data sources with counts for all ED visits, the total number of ED visits nationally ranges from 109.2 million to 116.3 million in 2005, a difference of 7.1 million (Table 3). The Hospital Market Profiling Solution© and the NHIS have the lowest estimate, with approximately 109 million ED visits, whereas the AHA Annual Survey™ and the NEDS have the highest estimates of visits, at approximately 116 million. NEDI-USA and NHAMCS have slightly lower estimates of 115 million.

Although the absolute number of ED visits varies by 6.5% across the data sources, the percentage distribution of ED visits across regions is relatively consistent. The difference in regional

**Table 3.** National and regional estimates of ED visits (in thousands), 2005.

| | Data Sources, 2005 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inventories of EDs* | | | | | | Samples of EDs | | | | | | Sample of Households | | | |
| | AHA Annual Survey™ | | Hospital Market Profiling Solution© | | NEDI-USA | | NEDS | | | NHAMCS | | | NHIS† | | | |
| | Number of | | Number of | | Number of | | Number of Visits‡ | | | Number of Visits‡ | | | Number of Visits‡ | | | |
| Nation and Regions | Visits‡ | %§ | Visits‡ | %§ | Visits‡ | %§ | No. | 95% CI | %§ | No. | 95% CI | %§ | No. | 95% CI | %§ |
| National | 116,291 | | 109,217 | | 115,231 | | 116,291 | 111,409–121,173 | | 115,323 | 103,339–127,307 | | 109,654 | 105,433–113,875 | |
| Northeast | 22,590 | 19.4 | 20,881 | 19.1 | 21,987 | 19.1 | 22,590 | 20,641–24,538 | 19.4 | 22,245 | 18,569–25,921 | 19.3 | 20,023 | 18,292–21,753 | 18.3 |
| Midwest | 27,085 | 23.3 | 24,211 | 22.2 | 25,399 | 22.0 | 27,085 | 24,398–29,772 | 23.3 | 28,771 | 21,769–35,772 | 24.9 | 27,819 | 25,713–29,924 | 25.4 |
| South | 46,032 | 39.6 | 44,820 | 41.0 | 47,292 | 41.0 | 46,032 | 42,806–49,258 | 39.6 | 43,871 | 35,863–51,879 | 38.0 | 42,583 | 39,803–45,364 | 38.8 |
| West | 20,584 | 17.7 | 19,305 | 17.7 | 20,553 | 17.9 | 20,584 | 19,031–22,137 | 17.7 | 20,436 | 16,041–24,832 | 17.7 | 19,230 | 17,665–20,794 | 17.5 |

*CIs cannot be calculated. Inventories contain the universe of visits.
†Estimates were calculated using the midpoint of the ranges provided in the survey.
‡In thousands.
§Percent represents percentage of national estimate.

percentages across the data sources ranges from 0.2% in the West to 3.2% in the Midwest. Consistently, the South has the highest proportion of visits (38.0% to 41.0%) and the West has the lowest proportion of visits (17.5% to 17.7%).† Most of the difference in regional percentages occurs in comparisons between hospital surveys and the household survey data from the NHIS.

National ED admission rates, a common measure of acuity, vary between the NEDS and the NHAMCS, with the NEDS reporting a higher ED admission rate (15.3% or 17.8 million ED visits from the NEDS versus 12.0% or 13.8 million visits from NHAMCS) (Table 4). The ED admission rate in the NEDS is relatively consistent across the 4 regions (14.1% in the Midwest to 16.3% in the Northeast). More variation is evident in ED admission rates with the NHAMCS, with 9.5% of ED visits in the South resulting in admission and 15.5% of ED visits in the Northeast resulting in admission. Moreover, the NEDS reports significantly higher ED admission rates in the West and the South compared with those reported by the NHAMCS (15.5% versus 11.4%). The ED admission rates in the Northeast and Midwest are similar in the NEDS and NHAMCS.

**Patient Characteristics**

Regardless of data source, the majority of ED visits are for patients aged 18 to 44 years (40.1% to 41.2%) (Table 5).‡ Less than one quarter of visits are for patients aged 0 to 17 years (22.8% to 25.1%) and 45 to 64 years (19.2% to 22.5%). Relative to the NHAMCS and NHIS, the NEDS captures an older population nationally (16.8% of ED visits are for patients aged 65 years and older in the NEDS versus 14.5% in NHAMCS and 14.1% in NHIS).

Regardless of data source, more ED visits are for women (53.9% to 55.8%) than for men (44.2% to 46.1%). Similarly, in all data sources, more than one third of ED visits are billed to private insurance (34.3% to 35.4%), nearly one quarter are billed to Medicaid (22.7% to 24.9%), and 1 in 6 is billed as uninsured. Consistent with the age distribution, NEDS reports a larger proportion of ED visits being billed to Medicare compared with that being reported by NHAMCS (20.0% versus 13.9%, respectively). Some of the variation in payer distribution is a result of missing expected payer data, with NEDS reporting only 0.5% of ED records as missing payer data and NHAMCS reporting 6.5% of ED records as missing payer data.

†Of note, the South also has the highest proportion of the U.S. population (36.4%), although the West does not have the lowest proportion of the population (West 23.1%, Midwest 22.3% and Northeast 18.3%).[27]

‡Of note, 18-to-44-year olds comprise 37.8% of the U.S. population (compared with 24.6% 0-to-17-year olds, 24.4% 45-to-64 year olds, and 12.3% 65 and over).[28]

**Table 4.** Percentage of ED visits resulting in inpatient admissions (admission rate), national and regional estimates, 2005.

| | Data Sources, 2005: Samples of EDs | | | |
|---|---|---|---|---|
| | NEDS | | NHAMCS | |
| **Nation and Regions** | **Estimate** | **95% CI** | **Estimate** | **95% CI** |
| **Number of ED visits, in thousands, national** | 116,291 | 111,409–121,173 | 115,323 | 103,339–127,307 |
| National, % | 15.3 | 14.8–15.7 | 12.0 | 10.8–13.2 |
| Northeast, % | 16.3 | 15.3–17.3 | 15.5 | 12.9–18.1 |
| Midwest, % | 14.1 | 13.1–15.0 | 13.6 | 11.0–16.2 |
| South, % | 15.3 | 14.6–16.1 | 9.5 | 7.7–11.4 |
| West, % | 15.5 | 14.8–16.2 | 11.4 | 8.8–14.0 |

**Table 5.** Percentage distribution of ED visits by patient characteristics, 2005.

| | Data Sources, 2005 | | | | | |
|---|---|---|---|---|---|---|
| | Samples of EDs | | | | Sample of Households | |
| | NEDS | | NHAMCS | | NHIS* | |
| **Patient Characteristics** | **Estimate** | **95% CI** | **Estimate** | **95% CI** | **Estimate** | **95% CI** |
| Number of ED visits, in thousands | 116,291 | 111,409–121,173 | 115,323 | 103,339–127,307 | 109,654 | 105,433–114,875 |
| **Age, y, %** | | | | | | |
| 0–17 | 22.8 | 21.6–24.0 | 25.1 | 22.8–27.3 | 23.3 | 22.0–24.5 |
| 18–44 | 40.2 | 39.5–40.9 | 41.2 | 39.8–42.6 | 40.1 | 38.3–41.8 |
| 45–64 | 20.2 | 19.9–20.6 | 19.2 | 18.2–20.2 | 22.5 | 21.0–24.1 |
| ≥65 | 16.8 | 16.2–17.3 | 14.5 | 13.6–15.4 | 14.1 | 12.9–15.4 |
| **Sex, %** | | | | | | |
| Female | 53.9 | 53.7–54.2 | 53.9 | 53.1–54.6 | 55.8 | 54.2–57.5 |
| Male | 46.1 | 45.8–46.3 | 46.1 | 45.4–46.9 | 44.2 | 42.5–45.8 |
| **Expected payer, %** | | | | | | |
| Private | 35.4 | 34.4–36.4 | 34.3 | 32.3–36.4 | — | — |
| Medicare | 20.0 | 19.4–20.5 | 13.9 | 12.8–15.1 | — | — |
| Medicaid | 22.7 | 21.8–23.6 | 24.9 | 22.7–27.0 | — | — |
| Self-pay/no charge/uninsured | 16.5 | 15.8–17.2 | 16.9 | 15.3–18.5 | — | — |
| Other | 4.9 | 4.6–5.2 | 3.6 | 3.0–4.2 | — | — |
| Missing | 0.5 | 0.3–0.7 | 6.5 | 4.4–8.6 | — | — |

Dashes indicate information either not collected or not applicable to data.
*Estimate was calculated using the midpoint of the ranges provided in the survey.

### Hospital Characteristics

Focusing on the inventories of EDs, the AHA Annual Survey™ reports a greater proportion of ED visits in Metropolitan Statistical Area hospitals (80.9%), in teaching hospitals (34.2%), and in proprietary hospitals (13.8%) compared with the Hospital Market Profiling Solution© (78.6%, 17.0%, and 11.8%, respectively) (Table 6). The AHA Annual Survey™ reports fewer ED visits in trauma hospitals (29.8%), nonteaching hospitals (65.8%), and in public hospitals (15.9%) compared with the Hospital Market Profiling Solution© (32.6%, 83.0%, and 17.4%, respectively).

Although similar patterns are evident between NEDS and NHAMCS, a few important differences in magnitude and direction of the comparisons stand out. The NEDS reports 29.8% of ED visits from trauma hospitals, whereas there are 36.9% of visits from hospitals with a trauma designation in NHAMCS. NEDS reports 80.9% of ED visits from hospitals in Metropolitan Statistical Areas, whereas NHAMCS reports more ED visits (85.5%) from such hospitals.

### Reasons for ED Visits

One important distinction between NEDS and NHAMCS is the number of diagnoses possible on an ED record (a maximum of 15 versus 3 diagnoses, respectively). There is an average of 2.9 diagnoses on records from NEDS and an average of 1.5 diagnoses on records from the NHAMCS. Despite the differences in diagnostic reporting, the top 5 most common all-listed diagnoses for treat and release visits are fairly similar across these 2 data sources (Table 7).

Both the NEDS and NHAMCS report superficial injuries, other upper respiratory infections, sprains and strains, and abdominal pain in the top 5 conditions. The most common reason reported on ED treat and release records in the NEDS, however, is hypertension, but it does not rank among the top 10 conditions listed in NHAMCS treat and release ED visits. In addition to hypertension, other common conditions found among NEDS treat and release ED visits, but not NHAMCS, include screening for mental health and substance abuse conditions, lower respiratory disease, and diabetes mellitus

**Table 6.** Percentage distribution of ED visits by hospital characteristics, 2005.

| | Data Sources, 2005 | | | | | |
|---|---|---|---|---|---|---|
| | Inventories of EDs* | | Samples of EDs | | | |
| | AHA Annual Survey™ | Hospital Market Profiling Solution© | NEDS | | NHAMCS | |
| **Hospital Characteristics** | **Estimate** | **Estimate** | **Estimate** | **95% CI** | **Estimate** | **95% CI** |
| Number of ED visits, in thousands | 116,291 | 109,217 | 116,291 | 111,409–121,173 | 115,323 | 103,339–127,307 |
| **Trauma designation, %** | | | | | | |
| Trauma | 29.8 | 32.6 | 29.8 | 27.8–31.8 | 36.9 | 30.5–43.4 |
| Nontrauma | 70.2 | 67.4 | 70.2 | 68.2–72.2 | 61.8 | 55.1–68.5 |
| **Location of hospital, %** | | | | | | |
| MSA | 80.9 | 78.6 | 80.9 | 79.5–82.2 | 85.5 | 78.0–93.0 |
| Non-MSA | 19.1 | 21.4 | 19.1 | 17.8–20.5 | 14.5 | 7.0–22.0 |
| **Teaching hospital, %** | | | | | | |
| Teaching | 34.2 | 17.0 | 33.6 | 31.4–35.8 | — | — |
| Non-teaching | 65.8 | 83.0 | 66.4 | 64.2–68.6 | — | — |
| **Ownership of hospital, %** | | | | | | |
| Public | 15.9 | 17.4 | 16.0 | 13.4–18.6 | 17.0 | 12.1–21.9 |
| Nonprofit | 70.3 | 70.8 | 71.3 | 68.4–74.2 | 72.2 | 65.7–78.8 |
| Proprietary | 13.8 | 11.8 | 12.7 | 11.2–14.2 | 10.8 | 6.2–15.4 |

*MSA,* Metropolitan Statistical Area.
*CIs cannot be calculated. Inventories contain the universe of visits.

without complication. In contrast, common conditions found among NHAMCS treat and release ED visits, but not NEDS, include injuries caused by external causes, open wounds, and skin and subcutaneous tissue infections.

The most common conditions for ED visits that resulted in admission are relatively similar in the NEDS and NHAMCS, with 5 conditions common to both lists, although with different rankings. The majority of top 10 reasons in both data sources are related to circulatory disorders (hypertension, coronary atherosclerosis [NEDS only], cardiac dysrhythmias, congestive heart failure, and nonspecific chest pain [NHAMCS only]). Hypertension is ranked first in the NEDS and ranked sixth in NHAMCS. Nonspecific chest pain is ranked first in the NHAMCS and does not appear in the top 10 for the NEDS. Injuries are not listed in the top 10 reasons for ED visits resulting in admission in either data source.

Estimates of ED visits for specific first-listed diagnoses (whether chronic or acute conditions) are fairly comparable between the NEDS and NHAMCS, with one exception (Table 8). Estimates of ED visits with a first-listed diagnosis of diabetes mellitus with or without complications are double in the NEDS compared with the NHAMCS (874,000 versus 418,000). Estimates of ED visits using all-listed diagnoses, however, are significantly different between the 2 data sources for all specific diagnoses examined. The NEDS estimates 1.3 to 5.8 times more ED visits for each chronic and acute all-listed condition examined relative to the NHAMCS. For example, using all-listed diagnoses, the NEDS reports 8.7 million ED visits related to diabetes, whereas the NHAMCS reports only 1.5 million ED visits. Similarly, the NEDS reports 291,000 ED visits related to MRSA, whereas the NHAMCS reports 50,000 ED visits.

Table 9 shows estimates of ED visits for injuries, using 3 data sources: NEDS, NHAMCS, and NEISS-AIP. Estimates of nonfatal-injury-related ED visits are comparable between the NEDS and NEISS-AIP, at 27.7 million to 29.3 million ED visits. The NHAMCS estimates 1.5 times more injury-related ED visits than either of the other 2 data sources (41.9 million). Although variation exists across the data sources in estimates of ED visits for the specific mechanism of unintentional injuries (struck by/against, motor vehicle traffic, and unspecified mechanism), all 3 data sources estimate similar numbers of total ED visits for unintentional injuries (24.0 million to 28.4 million visits). More variation is observed across the data sources in estimates of ED visits for intentional injuries and those with no reported cause of injury. The NEDS estimates fewer ED visits for intentional injuries (specifically those related to assault) compared with the NHAMCS and the NEISS-AIP (1.4 million ED visits versus 2.1 million to 2.2 million ED visits, respectively). The NEDS also estimates fewer ED visits for injuries that do not have a reported cause of injury compared with the NHAMCS (2.1 million versus 7.5 million). The NEISS-AIP reports only injury-related ED visits with a cause of injury.

## LIMITATIONS OF COMPARISONS

Comparisons of the 7 data sources were limited by available information and differences in operational definitions. The types of information available in the data sources varied. For example, ED visits by type of payer is available from only 2 sources, NEDS and NHAMCS, and each source defines the expected payer differently. In the NEDS, it is the primary expected source of payment. In NHAMCS, the expected payer

**Table 7.** Most common reasons for treat and release ED visits and ED visits that result in admission, 2005.

| | Data Sources, 2005: Samples of EDs | | | |
|---|---|---|---|---|
| | NEDS | | NHAMCS | |
| **Reasons for ED Visits** | **Estimate** | **Rank** | **Estimate** | **Rank** |
| **Total number of ED visits, in thousands** | 116,291 | | 115,323 | |
| Average number of diagnoses reported | 2.9 | | 1.5 | |
| Maximum number of diagnoses reported | 15 | | 3 | |
| **Number of treat and release records, in thousands** | 98,545 | | 101,455 | |
| **Top 10 all-listed diagnoses, %*** | | | | |
| Essential hypertension (CCS 98) | 9.1 | 1 | | |
| Superficial injury (CCS 239) | 8.8 | 2 | 8.2 | 1 |
| Other upper respiratory infections (CCS 126) | 7.9 | 3 | 7.5 | 3 |
| Sprains and strains (CCS 232) | 7.4 | 4 | 7.6 | 2 |
| Abdominal pain (CCS 251) | 6.3 | 5 | 4.8 | 4 |
| Screening and history of MHSA codes (CCS 663) | 5.6 | 6 | | |
| Spondylosis, disc and other back problems (CCS 205) | 5.0 | 7 | 3.5 | 7 |
| Other lower respiratory disease (CCS 133) | 4.7 | 8 | | |
| Headache, including migraine (CCS 84) | 4.3 | 9 | 3.2 | 10 |
| Diabetes mellitus without complication (CCS 49) | 4.2 | 10 | | |
| Other injuries due to external causes (CCS 244) | | | 3.9 | 5 |
| Open wounds of head, neck, and trunk (CCS 235) | | | 3.8 | 6 |
| Open wounds of extremities (CCS 236) | | | 3.3 | 8 |
| Skin and subcutaneous tissue infections (CCS 197) | | | 3.3 | 9 |
| **Number of records for ED visits that result in admission, in thousands** | 17,746 | | 13,867 | |
| **Top 10 all-listed diagnoses, %*** | | | | |
| Essential hypertension (CCS 98) | 37.6 | 1 | 4.4 | 7 |
| Fluid and electrolyte disorders (CCS 55) | 24.6 | 2 | 7.0 | 2 |
| Coronary atherosclerosis and other heart disease (CCS 101) | 22.4 | 3 | | |
| Cardiac dysrhythmias (CCS 106) | 18.3 | 4 | 4.1 | 10 |
| Disorders of lipid metabolism (CCS 53) | 18.0 | 5 | | |
| Congestive heart failure (CCS 108) | 17.3 | 6 | 5.4 | 5 |
| Screening and history of MHSA codes (CCS 663) | 16.9 | 7 | | |
| Chronic obstructive pulmonary disease (CCS 127) | 16.3 | 8 | 4.1 | 9 |
| Diabetes mellitus without complication (CCS 49) | 15.9 | 9 | | |
| Deficiency and other anemia (CCS 59) | 15.4 | 10 | | |
| Nonspecific chest pain (CCS 102) | | | 11.4 | 1 |
| Pneumonia (except that caused by tuberculosis or sexually transmitted disease) (CCS 122) | | | 6.9 | 3 |
| Abdominal pain (CCS 251) | | | 6.2 | 4 |
| Residual codes; unclassified (CCS 259) | | | 5.1 | 6 |
| Other lower respiratory disease (CCS 133) | | | 4.3 | 8 |

*CCS,* Clinical Classification Software; *MHSA,* mental health and substance abuse.
*Diagnoses classified by the CCS.

is based on a hierarchy of all-listed expected sources of payment. Additionally, although both the NEDS and NHAMCS capture *ICD-9-CM* diagnoses and external cause of injury codes, the NHAMCS also captures the patient's reason for visit coded from free-text responses. Similar information is not available from the NEDS. Four data sources (AHA Annual Survey™, Hospital Market Profiling Solution©, NEDS, and NHAMCS) estimate ED visits by trauma facilities, but each source uses a different criterion for identifying a trauma facility. There is no one definitive source for all types of ED visits counts. Moreover, differences in estimates across these data sources are likely related to differences in target population, sampling design, operational definitions of constructs, and variation in reporting/recording, although we did attempt to determine the extent to which these differences can be explained by design issues.

In addition, none of the data sources profiled here can adequately examine important ED issues such as the quality of urgent care in freestanding walk-in clinics, the impact of ambulance diversion, or the preparedness of EDs to adequately address unexpected catastrophic emergencies.

## SUMMARY OF DATA SOURCES AND COMPARISONS

This study clearly demonstrates that there is a wide variety of national data sources available to estimate ED utilization, examine the disparities and quality of ED care, and understand systemic problems affecting EDs. Depending on the data source, there were approximately 109 to 116 million visits in more than 4,500 EDs in 2005, representing a substantial portion of hospital-based care in the United States. Regardless

**Table 8.** Number of ED visits (in thousands) by specific acute and chronic conditions, 2005.

| | Data Sources, 2005: Samples of EDs | | | |
|---|---|---|---|---|
| | NEDS | | NHAMCS | |
| **Reasons for ED Visits** | **Number of Visits*** | **95% CI** | **Number of Visits*** | **95% CI** |
| **Number of ED visits** | 116,291 | 111,409–121,173 | 115,323 | 103,339–127,307 |
| **Chronic conditions**† | | | | |
| **Respiratory disease (CCS 122-134)** | | | | |
| First-listed diagnosis | 16,495 | 15,705–17,284 | 15,654 | 13,673–17,634 |
| All-listed diagnoses | 26,783 | 25,544–28,022 | 19,677 | 17,240–22,115 |
| **Asthma (CCS 128)** | | | | |
| First-listed DX | 1,824 | 1,704–1,944 | 1,770 | 1,505–2,035 |
| All-listed DX | 5,190 | 4,873–5,508 | 2,661 | 2,247–3,075 |
| **Diabetes (CCS 49-50)** | | | | |
| First-listed diagnosis | 874 | 831–917 | 418 | 315–521 |
| All-listed diagnoses | 8,721 | 8,290–9,152 | 1,506 | 1,198–1,813 |
| **Heart disease (CCS 96-121)** | | | | |
| First-listed DX | 9,665 | 9,197–10,133 | 8,303 | 7,346–9,261 |
| All-listed DX | 28,212 | 26,850–29,574 | 11,774 | 10,458–13,089 |
| **Mood disorders (CCS 657)** | | | | |
| First-listed DX | 1,044 | 951–1,137 | 1,027 | 793–1,261 |
| All-listed DX | 4,339 | 4,075–4,604 | 1,552 | 1,270–1,834 |
| **Acute conditions**† | | | | |
| **Gastrointestinal (CCS 135-155)** | | | | |
| First-listed DX | 8,795 | 8,421–9,169 | 7,779 | 6,809–8,749 |
| All-listed DX | 17,290 | 16,537–18,043 | 11,151 | 9,785–12,518 |
| **Pneumonia (CCS 122)** | | | | |
| First-listed DX | 1,873 | 1,784–1,962 | 1,560 | 1,327–1,792 |
| All-listed DX | 2,958 | 2,820–3,096 | 2,259 | 1,927–2,590 |
| **MRSA (*ICD-9-CM* code V09.0)** | | | | |
| First-listed DX | 0.5 | 0–0.9 | 5 | 0–13 |
| All-listed DX | 291 | 273–308 | 50 | 21–79 |

*DX,* Diagnosis.
*In thousands.
†Diagnoses classified by the CCS.

of the data source, regional variation in ED utilization exists. Estimates of ED utilization and admission status also vary by patient characteristics, expected payer, hospital characteristics, and clinical conditions, although the extent of the variation in estimates depends on the data source used.

The AHA Annual Survey™, the Hospital Market Profiling Solution©, and the NEDI-USA are designed to enumerate ED visits from the hospital perspective, whereas the NEDS and the NHAMCS also capture visit-level information. The NEDS data are taken from a sample of the universe of billing records in a year, whereas the NHAMCS data are derived from a sample of medical records during a 4-week period. The NEISS-AIP is a specialty data source focused on the detailed information about nonfatal, first-time injuries as reported in a sample of medical records. The NHIS provides information about the number of ED visits as experienced and reported by a sample of individuals.

## Applications of Data Sources

These national data sources are a rich source of information that can be used to address issues related to ED care, although the differences in the data sources in terms of availability of information, sampling design, and variability in estimates suggest that some data sources are better suited to answer specific questions (Table 10). The AHA Annual Survey™, the Hospital Market Profiling Solution©, the NEDI-USA, and the NEDS, for example, may be able to address some of the pressing problems faced by the health care system, such as ED crowding and overburdened EDs, as well as to help enable policymakers to better plan for gaps in care. Each of these data sources can examine the volume of ED visits by various hospital characteristics including trauma designation, an indication of availability of resources. The NEDS, however, is the only sampled data source that incorporates trauma designation of the hospital in the sampling frame. Moreover, the NEDS, with detailed visit information, can be used to examine the volume of ED visits in terms of case mix or severity of the patients (acuity of the ED) and seasonal or weekend versus weekday variation. None of the data sources, however, provides complete information on capacity or number of beds in the ED.

As highlighted in the Institute of Medicine report, problems with the ED infrastructure affect patients' access to the ED and the quality and safety of the care provided in the ED.[3] The

**Table 9.** Number of ED visits (in thousands) for most common causes of injury treated in EDs, 2005.

| | Data Sources, 2005: Samples of EDs | | | | | |
|---|---|---|---|---|---|---|
| | NEDS | | NHAMCS* | | NEISS-AIP | |
| **Reasons for ED Visits** | **Number of Visits†** | **95% CI†** | **Number of Visits†** | **95% CI†** | **Number of Visits†** | **95% CI†** |
| **Number of nonfatal injury-related ED visits** | 27,703 | 26,564–28,842 | 41,937 | 38,093–45,781 | 29,259 | 25,951–32,567 |
| Average number of E codes on injury record | 1.7 | | 1.6 | | 1.0 | |
| Maximum number of E codes on injury record | 4.0 | | 3.0 | | 1.0 | |
| **Unintentional injuries** | 24,038 | 23,006–25,070 | 28,375 | 25,639–31,111 | 27,157 | 23,918–30,395 |
| **Mechanism of unintentional injuries** | | | | | | |
| Falls | 6,916 | 6,597–7,236 | 8,728 | 7,836–9,620 | 7,938 | 6,899–8,978 |
| Struck by/against | 3,361 | 3,191–3,531 | 3,327 | 2,923–3,731 | 4,337 | 3,728–4,945 |
| Motor vehicle traffic | 2,962 | 2,815–3,110 | 4,241 | 3,694–4,788 | 4,370 | 3,700–5,040 |
| Cut/Pierce | 2,331 | 2,221–2,440 | 2,522 | 2,155–2,889 | 2,237 | 1,923–2,551 |
| Other mechanism | 7,194 | 6,852–7,536 | 9,409 | — | 7,596 | — |
| Mechanism unspecified | 1,275 | 1,181–1,368 | — | — | 679 | 527–831 |
| **Intentional injuries** | 1,411 | 1,324–1,499 | 2,198 | 1,879–2,517 | 2,102 | 1,807–2,397 |
| **Mechanism of intentional injuries** | | | | | | |
| Assault | 1,057 | 985–1,129 | 1,744 | 1,472–2,016 | 1,661 | 1,388–1,933 |
| Self-inflicted | 313 | 294–333 | 420 | 316–524 | 373 | 305–440 |
| Other causes of violence | 41 | 35–46 | — | — | 69 | 50–87 |
| **Undetermined intent** | 100 | 86–114 | 269 | 181–357 | — | — |
| **No cause of injury code on record** | 2,081 | 1,504–2,657 | 7,460 | 6,435–8,485 | — | — |

Dashes indicate information either not collected or not applicable to data.
*Data from Nawar EW, Niska RW, Xu J. *National Hospital Ambulatory Medical Care Survey: 2005 Emergency Department Summary. Advance Data From Vital and Health Statistics; No. 386*. Hyattsville, MD: National Center for Health Statistics; 2007.
†In thousands.

NEDS and the NHAMCS, data sources that contain more detailed visit information, hold promise for examining disparities in and quality of ED care. Both data sources provide information on patient characteristics, including age, sex, and expected payer, but only the NEDS contains detailed information to examine patient urban/rural and economic variation in care and only the NHAMCS contains detailed information to examine racial/ethnic variation in care. Differences in the estimates between the 2 data sources, however, suggest that one of the data sources may be better suited for particular questions than the other data source. For example, the NEDS, which captures a greater number of ED visits for the older population (and similarly those being billed to Medicare) than the NHAMCS, may be better able to address questions on the quality of care among the elderly or those enrolled in Medicare.

Quality of ED care, in terms of safety and effectiveness, can be studied using the NEDS and the NHAMCS. Both data sources contain information on procedures and patient disposition from the ED. The NEDS contains all-listed *ICD-9-CM* procedures (up to 9), whereas the NHAMCS contains selected procedures, diagnostic screening and medications, and care by specific providers. Quality of care, in terms of timeliness, can be studied with the NHAMCS, which contains information on wait times.

Quality of care for relatively rare events or related conditions might best be conducted with the NEDS, given its large sample size and greater number of diagnoses and E codes relative to NHAMCS. However, chronic comorbid conditions listed on a NEDS record may not be directly related to the reason for the ED encounter. For example, a person with diabetes may experience a fall and visit the ED because of an injury. Diabetes may be listed as a diagnosis on the record even though it was not the reason for the ED encounter. Therefore, it would be inaccurate for a researcher to regard all ED visits that listed a chronic condition on a NEDS record as being the reason for visit. However, the presence of comorbidities that are unrelated to the reason for the visit on the record can help researchers understand their effect on utilization of services, decision to admit, cost, and patient disposition.

Moreover, the timing and point at which a diagnosis is made influence diagnostic coding on the 2 databases. The NEDS captures diagnostic information that is known at the ED visit for treat and release visits and diagnostic information that is determined either during the ED visit or the hospital stay for visits that result in hospitalization. The NHAMCS, on the other hand, captures only diagnostic information that is known at the ED visit, regardless of whether the visit resulted in hospitalization. No clinical information is available about hospital stays after ED visits from the NHAMCS. This difference in timing of diagnosis could partially but not entirely explain differences in the prevalence of conditions that require testing and time to determine definitive diagnosis, MRSA being one example. In comparing information that by definition can

**Table 10.** Strengths of data sources to examine ED care.

| | Data Sources | | | | | | |
|---|---|---|---|---|---|---|---|
| | Inventories of EDs | | | Samples of EDs | | | Sample of Households, NHIS |
| **Strengths** | **AHA Annual Survey™** | **Hospital Market Profiling Solution©** | **NEDI-USA*** | **NEDS*†** | **NHAMCS*†** | **NEISS-AIP†** | |
| **ED utilization by period** | | | | | | | |
| Annual | √ | √ | √ | √ | √ | — | √ |
| Monthly | — | — | — | √ | √ | — | — |
| Day of week | — | — | — | √ | √ | — | — |
| **ED utilization by hospital characteristic** | | | | | | | |
| Region | √ | √ | √ | √ | √ | — | — |
| Trauma center | √ | √ | — | √ | √ | — | — |
| Urban/rural location | √ | √ | — | √ | √ | — | — |
| Ownership | √ | √ | — | √ | √ | — | — |
| Teaching status | √ | √ | — | √ | — | — | — |
| Other | √ | √ | — | — | — | — | — |
| **ED utilization by patient characteristic** | | | | | | | |
| Age | — | — | — | √ | √ | — | √ |
| Sex | — | — | — | √ | √ | — | √ |
| Payer | — | — | — | √ | √ | — | — |
| Race/ethnicity | — | — | — | — | √ | — | — |
| Urban/rural location | — | — | — | √ | — | — | — |
| Community-level income quartile | — | — | — | √ | — | — | — |
| **ED utilization by reasons for visit** | | | | | | | |
| Diagnoses *(ICD-9-CM)*† | — | — | — | √ (15) | √ (3) | — | — |
| Patient report of reason for visit | — | — | — | — | √ (3) | — | — |
| Procedures (*ICD-9-CM and CPT*)† | — | — | — | √ | — | — | — |
| Specific diagnostic, screening services, and procedures | — | — | — | — | √ | — | — |
| Injuries | — | — | — | √ | √ | √ | — |
| External cause of injury codes† | — | — | — | √ (4) | √ | √ (3) | — |
| **Other** | | | | | | | |
| Charges for ED care | — | — | — | √ | — | — | — |
| ED visits resulting in admission | — | — | — | √ | √ | — | — |
| Mode of arrival | — | — | — | — | √ | — | — |
| Wait times | — | — | — | — | √ | — | — |
| Vital signs | — | — | — | — | √ | — | — |
| Medications | — | — | — | — | √ | — | — |
| Person/family experience at ED | — | — | — | — | — | — | √ |
| **Trends in utilization** | | | | | | | |
| Starting in year | Before 1977 | 1977 | 2001 | — | 1977 | 2000 | 1997 |
| **Facilities** | | | | | | | |
| Facility counts by ED visit volume | √ | √ | √ | √ | — | — | — |

*CPT*, Current Procedural Terminology.
Check mark indicates information available; dashes indicate information either not collected or not applicable to data.
*Additional details on hospital, patient, and clinical characteristics may be available on state-specific databases or for the national database. Access to a data center may be required.
†Up to the specified number of diagnoses or procedures, indicated in parentheses.

only be obtained at the ED visit, the NEDS estimates 68,000 MRSA-related treat and release ED visits, whereas the NHAMCS estimates 50,000 MRSA-related ED visits regardless of admission. The NEDS, however, estimates an additional 223,000 cases for patients who were treated in the ED and may or may not have received a diagnosis in the ED.

Beyond understanding system problems and examining disparities and quality of care, there is a need to address these problems through adequate monitoring, planning, and preventive care in the treatment of specific conditions. Only the NEDS and the NHAMCS provide information on all types of conditions treated in the ED, whereas the NEISS-AIP provides information specifically related to injuries. The NEDS, NHAMCS, and the NEISS-AIP can be used to enumerate injury-related visits. The NEDS has enough clinical detail to be able to examine severity of injuries with the ICDMAP-90 software,[29] whereas the NEISS-AIP collects very detailed information on the injury itself, as well as places particular emphasis on certain types of injuries, such as those related to poisonings, medication, firearms, work, and medical equipment.

The NEDS, based on billing data that have line-item detail (revenue codes and detailed charges), can be used to provide insight into the charges associated with ED care and inpatient care after an ED visit. No other national data source reported in this article has this type of information. In contrast to the other data sources, the NHAMCS, based on medical record abstraction, offers details about the patient's reason for an ED visit, wait times, mode of arrival, and medications. The NHIS, which surveys individuals, is unique in its ability to enumerate the number of ED visits for an individual person in a year by patient characteristics such as age and sex.

## CONCLUSION

Each of the data sources described in this article has unique advantages and drawbacks when used to examine patterns of ED care. Although the AHA Annual Survey™ and Hospital Market Profiling Solution© are the only sources of extensive detail on hospital characteristics, the NEDI-USA has some detail on hospital and ED characteristics by combining information from hospital-level data sources and including data from independent sources. At the visit level, the NEDS and NHAMCS are the only national sources of detailed visit and clinical data, whereas the NEISS-AIP contains the most comprehensive surveillance of injuries treated in the ED. The NHIS contains substantially more detail about the individuals treated in the ED.

Given the wealth of information on ED care, we recommend that researchers and policymakers carefully consider the available ED data sources to answer their research questions. In certain circumstances, it may be most prudent to consult more than one data source to produce estimates. Understanding the design, available information, and estimates from each of the data sources is therefore critical to making decisions about the most suitable data source to address the most pressing issues in ED care.

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