HEALTHCARE COST AND UTILIZATION PROJECT — HCUP
A FEDERAL-STATE-INDUSTRY PARTNERSHIP IN HEALTH DATA
Sponsored by the Agency for Healthcare Research and Quality

INTRODUCTION TO

THE HCUP NATIONWIDE EMERGENCY DEPARTMENT SAMPLE (NEDS)

2006
(Version 2)

These pages provide introductory-level information about the NEDS.

For full documentation and notification of changes, visit the HCUP User Support (HCUP-US) Website at http://www.hcup-us.ahrq.gov.

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HCUP NATIONWIDE EMERGENCY DEPARTMENT SAMPLE (NEDS)
SUMMARY OF DATA USE LIMITATIONS

******* REMINDER *******

All users of the NEDS must take the on-line HCUP Data Use Agreement (DUA) training course, and read and sign a Data Use Agreement. †

Authorized users of HCUP data agree to the following restrictions: ‡

- Will not use the data for any purpose other than research or aggregate statistical reporting.
- Will not re-release any data to unauthorized users.
- Will not redistribute HCUP data by posting on any Website or other publically-accessible online repository**.**
- Will not identify or attempt to identify any individual, including by the use of vulnerability analysis or penetration testing. Methods that could be used to identify individuals directly or indirectly shall not be disclosed or published.
- Will not publish information that could identify individual establishments (e.g., hospitals) and will not contact establishments.
- Will not use the data concerning individual establishments for commercial or competitive purposes involving those establishments, and will not use the data to determine rights, benefits, or privileges of individual establishments.
- Will not use data elements from the proprietary severity adjustment software packages (3M APR-DRGs, HSS APS-DRGs, and Thomson Reuters Disease Staging) for any commercial purpose or to disassemble, decompile, or otherwise reverse engineer the proprietary software.
- Will acknowledge in reports that data from the "Healthcare Cost and Utilization Project (HCUP)" were used, including names of the specific databases used for analysis.
- Will acknowledge that risk of individual identification of persons is increased when observations (i.e., individual discharge records) in any given cell of tabulated data is less than or equal to 10.

Any violation of the limitations in the Data Use Agreement is punishable under Federal law by a fine of up to $10,000 and up to 5 years in prison. Violations may also be subject to penalties under State statutes.

† The on-line Data Use Agreement training session and the Data Use Agreement are available on the HCUP User Support (HCUP-US) Website at http://www.hcup-us.ahrq.gov.
‡ Specific provisions are detailed in the Data Use Agreement for the Nationwide Databases.

HCUP CONTACT INFORMATION

All HCUP data users, including data purchasers and collaborators, must complete the online HCUP Data Use Agreement (DUA) Training Tool, and read and sign the HCUP Data Use Agreement. Proof of training completion and signed Data Use Agreements must be submitted to the HCUP Central Distributor as described below.

The on-line DUA training course is available at: http://www.hcup-us.ahrq.gov/tech_assist/dua.jsp.

The HCUP Nationwide Data Use Agreement is available on the AHRQ-sponsored HCUP User Support (HCUP-US) Web site at: http://www.hcup-us.ahrq.gov

HCUP Central Distributor

Data purchasers will be required to provide their DUA training completion code and will execute their DUAs electronically as a part of the online ordering process. The DUAs and training certificates for collaborators and others with access to HCUP data should be submitted directly to the HCUP Central Distributor using the contact information below.

The HCUP Central Distributor can also help with questions concerning HCUP database purchases, your current order, training certificate codes, or invoices, if your questions are not covered in the Purchasing FAQs on the HCUP Central Distributor Web site.

Purchasing FAQs:
https://www.distributor.hcup-us.ahrq.gov/Purchasing-Frequently-Asked-Questions.aspx

Phone: 866-556-HCUP (4287) (toll free)
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HCUP User Support:

Information about the content of the HCUP databases is available on the HCUP User Support (HCUP-US) Web site (http://www.hcup-us.ahrq.gov). If you have questions about using the HCUP databases, software tools, supplemental files, and other HCUP products, please review the HCUP Frequently Asked Questions or contact HCUP User Support:

HCUP FAQs:
http://www.hcup-us.ahrq.gov/tech_assist/faq.jsp

Phone: 866-290-HCUP (4287) (toll free)
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WHAT IS THE NATIONWIDE EMERGENCY DEPARTMENT SAMPLE (NEDS)?

- The Nationwide Emergency Department Sample (NEDS) tracks information about emergency department (ED) visits across the country. Information includes geographic characteristics, hospital characteristics, patient characteristics, and the nature of visits (e.g., common reasons for ED visits, acute and chronic conditions, and injuries).
- The NEDS was constructed using the HCUP State Emergency Department Databases (SEDD) and the State Inpatient Databases (SID). The SEDD capture discharge information on ED visits that do not result in an admission (i.e., treat-and-release visits and transfers to another hospital). The SID contain information on patients initially seen in the emergency room and then admitted to the same hospital.
- The 2006 NEDS is a publicly available database that can be purchased through the HCUP Central Distributor. Version 2 of the 2006 NEDS with a revised approach to categorizing children's hospitals with trauma centers is available starting in May 2010.
- There are 24 HCUP Partner States that contributed 2006 ED data to the NEDS: AZ, CA, CT, FL, GA, HI, IA, IN, KS, MA, MD, ME, MN, MO, NE, NH, NJ, OH, SC, SD, TN, UT, VT, and WI.
- The NEDS describes over 120 million ED visits for 2006, an exceptional resource for conducting research on high-profile emergent health delivery issues. One of the most distinctive features of the NEDS is its large sample size, which allows for analysis across hospital types and the study of relatively uncommon disorders and procedures.
- Users must complete an on-line Data Use Agreement training prior to receiving the data.

UNDERSTANDING THE NEDS

- This document, *Introduction to the NEDS, 2006,* summarizes the content of the NEDS and describes the development of the NEDS sample and weights.
- Important considerations for data analysis are highlighted and references to further resources are provided.
- In-depth documentation for the NEDS is available on the HCUP User Support (HCUP-US) Website (www.hcup-us.ahrq.gov). Please refer to detailed documentation before using the data.

HCUP Nationwide Emergency Department Sample (NEDS)

ABSTRACT

The Nationwide Emergency Department Sample (NEDS) is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ). The 2006 NEDS is a publicly available database that can be purchased through the HCUP Central Distributor.

The NEDS was created to enable analyses of emergency department (ED) utilization patterns and support public health professionals, administrators, policymakers, and clinicians in their decision-making regarding this critical source of care. The ED serves a dual role in the U.S. healthcare system infrastructure as a point of entry for approximately 50% of inpatient hospital admissions and as a setting for treat-and-release outpatient visits.[1] The NEDS has many research applications, as it contains information about geographic characteristics, hospital characteristics, patient characteristics, and the nature of visits (e.g., common reasons for ED visits, including injuries).

The NEDS is the largest all-payer ED database that is publicly available in the United States, containing information from about 26 million records for ED visits at over 950 hospitals that approximate a 20-percent stratified sample of U.S. hospital-based EDs. Weights are provided to calculate national estimates pertaining to over 120 million ED visits in 2006.

The NEDS is drawn from among the States providing ED data (resulting in admission to the hospital and not) to HCUP. Twenty-four HCUP Partner States participated in the 2006 NEDS: AZ, CA, CT, FL, GA, HI, IA, IN, KS, MA, MD, ME, MN, MO, NE, NH, NJ, OH, SC, SD, TN, UT, VT, and WI. See Appendix I, Table 1 for a list of data organizations participating in the NEDS.

By stratifying on important hospital characteristics, the NEDS represents a microcosm of U.S. hospital-based EDs. Stratification is based on the following five characteristics:

- Geographic region (Northeast, Midwest, South, and West)
- Trauma center designation (trauma level I, II, III, and non-trauma)
- Urban-rural location of the hospital (large metropolitan, small metropolitan, micropolitan, and non-urban residual)
- Teaching hospitals in metropolitan areas
- Hospital ownership or control (public, for-profit, and not-for-profit).

Access to the NEDS is open to users who sign Data Use Agreements. Uses are limited to research and aggregate statistical reporting.

For more information on the NEDS, visit the AHRQ-sponsored HCUP User Support (HCUP-US) Website at http://www.hcup-us.ahrq.gov.

[1] Merrill and Owens, 2007

INTRODUCTION TO THE HCUP NATIONWIDE EMERGENCY DEPARTMENT SAMPLE (NEDS)

Overview of NEDS Data

The Healthcare Cost and Utilization Project (HCUP) Nationwide Emergency Department Sample (NEDS) was created to enable analyses of emergency department (ED) utilization patterns and support public health professionals, administrators, policymakers, and clinicians in their decision-making regarding this critical source of care. The ED serves a dual role in the U.S. healthcare system infrastructure as a point of entry for approximately 50% of inpatient hospital admissions and as a setting for treat-and-release outpatient visits.[2] The NEDS has many research applications, as it contains information about geographic characteristics, hospital characteristics, patient characteristics, and the nature of visits (e.g., common reasons for ED visits, acute and chronic conditions, and injuries).

Twenty-four States participated in the 2006 NEDS. These States include: AZ, CA, CT, FL, GA, HI, IA, IN, KS, MA, MD, ME, MN, MO, NE, NH, NJ, OH, SC, SD, TN, UT, VT, and WI. Appendix I, Table 1 identifies the specific data organizations contributing to the NEDS.

Appendix I, Figure 1 represents the geographic distribution of the 24 participating HCUP Partner States. Based on 2006 U.S. Census Bureau data, the HCUP NEDS States account for 51.6% (153,874,876) of the U.S. population. The 24 States account for 48% (58,123,709) of the ED visits reported in the 2006 American Hospital Association (AHA) Annual Survey Database. Details on the percentage of population and ED visits by region are provided in Appendix I, Table 2.

Identification of HCUP Records with Emergency Department Services

Information on patients with ED events are contained in two existing HCUP databases:

- State Emergency Department Databases (SEDD) capture discharge information on all emergency department visits that do not result in an admission to that hospital (i.e., treat-and-release visits and transfers to another hospital).

- State Inpatient Databases (SID) contain information on patients initially seen in the emergency room and then admitted to the same hospital.

Both of these HCUP databases contain a core set of clinical and non-clinical information elements defined in a uniform scheme for all patients, regardless of payer, making it possible to combine records across databases.

Selection of ED records from the SEDD and SID for use in the NEDS was based on evidence of ED services reported on the record. The HCUP criteria for identifying an ED record (i.e., a discharge record for a patient with an ED event) require that at least one of the following conditions is true:

- Revenue center code of 450-459 reported on discharge record, indicating emergency department services.

[2] Merrill and Owens, 2007

- Emergency department charge greater than zero dollars, when revenue center codes were not available.

- CPT code of 99281-99285 reported on discharge record, indicating emergency department physician services.

- Admission source of ED (used for inpatient discharges only).

Because five of the 24 Partners (AZ, CA, HI, MA, and OH) did not provide ED charge information (either in revenue codes or a separate charge field) on records in the SEDD, this limited the ability to clearly identify ED visits using the HCUP criteria. Therefore, the identification of ED records in these five States was evaluated on a State-by-State basis.

- AZ, CA, HI, and MA: In each case, the HCUP Partner provided a source file that contained only ED records. Because the data source uniquely identified ED records, all of the SEDD records were considered to be ED records, even though information was not available to determine if HCUP criteria were met.

- OH: The HCUP Partner provided a large outpatient database that combined records for ED services with records for other outpatient visits, such as ambulatory surgery, outpatient clinic, lab, etc. Each record contained a State-defined indicator of the type of outpatient service. Ohio outpatient records with an ED designation were considered to be ED records, even though information was not available to determine if HCUP criteria were met.

State-Specific Restrictions

Some sources that contributed data to the NEDS imposed restrictions on the release of certain data elements or on the number and types of hospitals that could be included in the database. In addition, because of confidentiality laws, some data sources were prohibited from providing HCUP with discharge records that indicated specific medical conditions, such as HIV/AIDS or behavioral health. Detailed information on these State-specific restrictions is available in Appendix II.

File Structure of the NEDS

Because of the size of the NEDS and the difference in information collected on records for patients admitted into the hospital directly from the ED (SID records) and for ED patients that are not admitted (SEDD records), the NEDS is divided into four different files:

- **Core File:** This file contains 100% of the ED events – whether resulting in admission or not – from the sample of hospitals in participating States. In 2006, the NEDS Core File has about 26 million ED records. Refer to Appendix III, Table 1 for a list of data elements in the NEDS Core File.

- **Supplemental ED File:** This file contains information on CPT-4 and ICD-9-CM procedures that were performed in the ED for patients who are not admitted directly to the hospital. This information came from the SEDD. In 2006, the NEDS Supplemental ED File has almost 22 million ED records. The unique NEDS record identifier (KEY_ED) provides the linkage between the NEDS Core File and the Supplemental ED File. Refer to Appendix III, Table 2 for a list of data elements in the NEDS Supplemental ED File.

For patients seen in the ED and admitted to the same hospital (SID records), information about procedures is contained in the Supplemental Inpatient File.

- **Supplemental Inpatient File:** This file contains data elements that are not specific to the emergency department, such as total charges for the inpatient stay, length of inpatient stay, and ICD-9-CM procedures from the SID record. Procedures reported on the SID records may have been performed in the ED, but currently there is no way to verify this information. In 2006, the NEDS Supplemental Inpatient File has about 4 million records. The unique NEDS record identifier (KEY_ED) provides the linkage between the NEDS Core File and the Supplemental Inpatient File. Refer to Appendix III, Table 3 for a list of data elements in the NEDS Supplemental Inpatient File.

- **Hospital Weights File:** This hospital-level file contains one observation for each hospital included in the NEDS and contains weights and variance estimation data elements. In 2006, the NEDS Hospital Weights File has over 950 hospital-specific records. The HCUP ED hospital identifier (HOSP_ED) provides the linkage between the NEDS Core File and the Hospital Weights File. A list of data elements in the Hospital Weights File is provided in Appendix III, Table 4.

NEDS Data Elements

The coding of data elements in the NEDS is consistent with other HCUP databases. The following three objectives guided the definition of data elements in all HCUP databases:

- Ensure usability without extensive editing by analysts.

- Retain the largest amount of information available from the original sources, while still maintaining consistency among sources.

- Structure the information for efficient storage, manipulation, and analysis.

More information on the coding of HCUP data elements is available on HCUP User Support (HCUP-US) Website (http://www.hcup-us.ahrq.gov/db/coding.jsp).

After analyzing the availability of information from the HCUP Partner States, a set of common fields to be available in the NEDS was created. The NEDS contains more than 100 clinical and non-clinical variables provided in a hospital discharge abstract, such as:

- ICD-9-CM diagnoses and external cause of injury codes

- ICD-9-CM and CPT procedures

- Patient demographics (e.g., gender, age, urban-rural designation of residence, national quartile of the median household annual income for the patient's ZIP Code)

- Expected payment source (e.g., Medicare, Medicaid, private insurance, self-pay)

- Hospital characteristics (e.g., indicator of trauma center level, , including pediatric trauma centers, urban-rural designation of county, ownership, teaching status, region of the U.S.)

- ED charges and total hospital charges for patients admitted as an inpatient through the ED.

Appendix III identifies the data elements in each NEDS file:

- Table 1 for the NEDS Core File (record = ED event)
- Table 2 for the NEDS Supplemental ED File (record = ED event that did not result in direct inpatient admission to the same hospital)
- Table 3 for the NEDS Supplemental Inpatient File (record = ED event that resulted in a direct inpatient admission to the same hospital)
- Table 4 for the Hospital Weights File (record = hospital).

Not all data elements in the NEDS are uniformly coded or available across all States. The tables in Appendix III provide summary documentation for the data. Please refer to the NEDS documentation located on the HCUP-US Website (http://www.hcup-us.ahrq.gov) for comprehensive information about data elements and the files.

Getting Started

Comprehensive documentation for the NEDS files is available on the HCUP-US Website (http://hcup-us.ahrq.gov).

NEDS Data Files

The 2006 NEDS is a publicly available database that can be purchased through the HCUP Central Distributor. Contact the HCUP Central Distributor with questions about the NEDS and to purchase your own copy.

NEDS Documentation

On the HCUP-US Website (http://www.hcup-us.ahrq.gov), users of the NEDS can access complete file documentation, including variable notes, file layouts, summary statistics, and related technical reports. Similarly, data users can download SAS, SPSS, and Stata load programs. Refer to these important resources to understand the structure and content of the NEDS and to aid in using the database.

To locate the NEDS documentation on HCUP-US:

- Choose “Databases” from the home page (http://www.hcup-us.ahrq.gov)
- Select the section labeled “Nationwide Emergency Department Sample (NEDS)”

Appendix 1, Table 3 details the comprehensive NEDS documentation available on HCUP-US.

SAMPLING DESIGN OF THE NEDS

Similar to the design of the NIS, the NEDS is built using a 20% stratified sample of institutions. For the NIS, it is a sample of U.S. hospitals. For the NEDS, it is a sample of U.S. hospital-based EDs. The main objective of a stratified sample is to ensure that the sample is representative of the target universe. By stratifying on important hospital characteristics, the NEDS represents a "microcosm" of EDs in the U.S. For example, by including trauma center designation in the sampling strategy, the NEDS has the same percentage of trauma hospitals as the entire U.S. The NEDS contains all of the ED visits for the sample of hospital-based EDs selected.

Universe of Hospital-Based Emergency Departments

The universe of hospital-based EDs in the United States was built by assessing several possible data sources, including the American Hospital Association (AHA) Annual Survey Database (Health Forum, LLC © 2007); Verispan, LLC databases; and the Centers for Medicare and Medicaid (CMS) Hospital Cost Reports. The AHA Annual Survey Database is the best data to apply for a number of reasons. First, the AHA data provides the necessary hospital characteristics, such as ownership type and teaching status, and also reports total ED visits for hospitals. Second, the crosswalk linkage from the HCUP databases to the AHA data is already established. Third, the AHA Annual Survey Database is used as the target universe for the NIS. The universe of hospital-based EDs is therefore defined as AHA community, non-rehabilitation hospitals that reported total ED visits. The AHA defines community hospitals as "all non-Federal, short-term, general, and other specialty hospitals."

Sampling Frame of the NEDS

The sampling frame of the NEDS is limited to a subset of the universe: hospital-based EDs in the States for which HCUP ED data (SID and SEDD) are available. The list of hospital-based EDs in the frame consists of all AHA community, non-rehabilitation hospitals that report total ED visits in each of the frame States *that could be matched to the ED data provided to HCUP*. If an ED in the AHA survey could not be matched to the ED data provided by the HCUP data source, it is eliminated from the sampling frame (but not from the target universe).

Stratification Variables

The following hospital characteristics were used for sample stratification: U.S. Census region, trauma center designation, urban-rural location of the hospital, ownership, and teaching status. ED bed size was not used because no data source for this information could be identified. A number of data sources report the bed size of the hospital, but no source distinguishes between inpatient and ED beds.

The NEDS stratification variables are described below and detailed in Appendix I, Table 5.

U.S. Census Region

The four Census regions – Northeast, Midwest, South, and West – were used to stratify EDs by geographic location because practice patterns may vary substantially by region. Appendix I, Figure 1 shows the NEDS States by region.

Trauma Centers

A trauma center is a hospital equipped to provide comprehensive emergency medical services 24 hours a day, 365 days per year to patients suffering traumatic injuries. For the NEDS, trauma centers treating adults and children were identified through the Trauma Information Exchange Program database (TIEP), a national inventory of trauma centers in the U.S. Information is collected by the American Trauma Society and the Johns Hopkins Center for Injury Research and Policy and funded by the Centers for Disease Control and Prevention[3,4]. A separate process, described below, was used to identify trauma centers within children's hospitals.

The TIEP database is updated quarterly and identifies all U.S. hospitals that are designated as trauma centers 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 are based on criteria developed by the ACS/COT. Level I and II centers have comprehensive resources and are able to care for the most severely injured. Level I centers also provide leadership in education and research. Level III centers provide prompt assessment and resuscitation, emergency surgery and, if needed, transfer to a level I or II center. Level IV and V centers are State-defined and often located in remote areas. These centers resuscitate and stabilize patients and arrange transfer to an appropriate trauma facility. For the NEDS, levels I, II and III were used to identify a trauma center. Level IV and V centers were set aside within the context of these data because many states choose not to designate hospitals at these levels of trauma care and their institutional characteristics have many similarities to community (non-trauma) hospitals in other areas. It is also important to note that while all level I, II, and III trauma centers offer a high level of trauma care, that there may be differences in the services and resources offered by hospitals of different levels. Further, hospitals of different levels may be utilized in diverse ways within the context of individual state trauma systems or the geographic areas in which they operate.

Hospital information from TIEP was matched to the AHA via the corresponding AHA hospital identifier and then added to the HCUP ED data. If the trauma level of a hospital changed during the calendar year, the highest trauma level (indicating the lowest level of care) was used. For example, if a hospital-based ED was reported as trauma level 2 for two quarters of 2006 and trauma level III for two quarters of 2006, then the hospital-based ED was considered a level III trauma center for the 2006 NEDS. Alternatively, if a hospital-based ED was reported as a trauma level III for 2 quarters of 2006 and did not report for two quarters, the ED was considered a trauma level III for the 2006 NEDS.

The description above refers to trauma centers treating adults and children. For trauma centers within children's hospitals, the following process was employed:

- A combination of information from TIEP, ACS/COT and State-specific Websites on trauma certification was used to identify trauma centers within children's hospitals and their associated trauma levels.

- Trauma centers within children's hospitals were included in the 2006 NEDS, Version 2,

[3] MacKenzie EJ, Hoyt DB, Sacra JC, et al. National inventory of hospital trauma centers. *JAMA.* 2003;289:1515-1522.
[4] American Trauma Society. Trauma Information Exchange Program. Available at: http://www.amtrauma.org/tiep/index.html. Accessed April 2005.

sample frame within the appropriate trauma level strata. These hospitals are either trauma level I or level II. None of these hospitals had a level III designation.

In the NEDS, trauma centers that are level I, II, and III are distinguished. If the strata size in the universe or frame was less than two hospitals, a collapsed stratification of level I and level II or levels I, II, and III was necessary.

Urban-Rural Location of the ED

The urban-rural location of hospital-based EDs was determined based on the county in which the hospital is located. The categorization is a simplified adaptation of the 2003 version of the Urban Influence Codes (UIC).[5] The 12 categories of the UIC are combined into four broader categories:

- Large metropolitan area – areas with at least one million residents
- Small metropolitan area – areas with less than one million residents
- Micropolitan area – non-metropolitan area with at least 10,000 people or more
- Non-urban residual.

If the strata size in the universe or frame was less than two hospitals, a collapsed stratification of metropolitan (large and small) or non-metropolitan (micropolitan and non-urban residual) was necessary.

Teaching Status

A hospital-based ED is considered to be a teaching facility if the associated hospital has an American Medical Association (AMA) approved residency program, is a member of the Council of Teaching Hospitals (COTH), or has a ratio of full-time equivalent interns and residents to beds of 0.25 or higher according to the AHA Annual Survey Database. Because there are very few teaching hospitals in micropolitan and rural areas, teaching status was only used to stratify EDs in metropolitan areas.

Hospital Ownership

Hospital ownership or control was categorized according to information reported in the AHA Annual Survey Database. Ownership categories include:

- Public – government, non-Federal
- Voluntary – private, not-for-profit
- Proprietary – private, investor-owned/for-profit.

When there were enough hospitals of each type, EDs were stratified into public, voluntary, and proprietary categories. If necessary, because of small strata size in the universe, a collapsed stratification of public versus private was used, with the voluntary, non-profit and proprietary/ for-profit hospitals combined to form a single “private” category. Stratification based on ownership or control was not advisable in some regions because of the dominance of one type of hospital (e.g., Northeast).

Sample Weights

[5] United States Department of Agriculture Economic Research Service, 2007

To obtain nationwide estimates, weights were developed using the AHA universe as the standard. These were developed separately for analyses of hospital-based EDs and ED visits. Hospital-level weights were developed to extrapolate NEDS sample EDs to the universe of hospital-based EDs. Similarly, discharge-level discharge weights were developed to extrapolate NEDS sample ED visits to the universe of ED visits.

Hospital Weights

Hospital weights to the universe were calculated by poststratification. Hospital-based EDs were stratified on the same variables that were used for sampling: geographic region, trauma center designation, urban-rural location, teaching status, and ownership or control. The strata that were collapsed for sampling were also collapsed for sample weight calculations. Within each stratum, *s*, each ED in the NEDS sample received a weight:

$$HOSPWT = W_s(universe) = N_s(universe) \div N_s(sample)$$

where $W_s(universe)$ was the ED universe weight, and $N_s(universe)$ and $N_s(sample)$ were the number of hospital-based EDs within stratum *s* in the universe and sample, respectively. Thus, each hospital's universe weight (HOSPWT) is equal to the number of universe hospitals it represents during that year. Because 20% of the hospitals in each stratum were sampled when possible, the ED weights were usually near 5.

Discharge Weights

Discharge weights to the universe were calculated by poststratification. Hospital-based EDs were stratified in a manner similar to that for universe hospital weight calculations. Within stratum, *s*, for hospital, i, the universe weight for each visit in the NEDS sample was calculated as:

$$DISCWT = DW_{is}(universe) = [DN_s(universe) \div ADN_s(sample)] * (4 \div Qi)$$

where $DW_{is}(universe)$ was the discharge weight; $DN_s(universe)$ represented the number of ED visits from community, non-rehabilitation hospitals in the universe within stratum *s*; $ADN_s(sample)$ was the number of adjusted ED visits from sample hospitals selected for the NEDS; and Qi represented the number of quarters of ED visits contributed by hospital i to the NEDS (usually Qi = 4). Thus, each discharge's weight (DISCWT) is equal to the number of universe ED visits it represents in stratum *s* during that year.

Final NEDS Sample

The target universe for the NEDS was community, non-rehabilitation hospitals in the United States that were included in the 2006 AHA Annual Survey Database and reported total ED visits. Excluded were a handful of non-rural hospitals that reported less than 10 ED visits in a year.

The NEDS sampling frame included hospital-based ED events from community, non-rehabilitation hospitals in the 24 HCUP Partner States that provide discharge abstracts on patients admitted to the hospital through the ED and patients treated and released or transferred to another hospital from the ED. The HCUP hospitals were required to be represented in the AHA data and have no more than 90% of their ED visits resulting in admission. Appendix I, Table 6 lists the final target universe and sampling frame for the NEDS.

The NEDS is a stratified probability sample of hospital-based EDs in the frame, with sampling probabilities calculated to select 20% of the universe contained in each stratum, defined by region, trauma designation, urban-rural location, teaching status, and hospital ownership or control. A sample size of 20 percent was based on previous experience with similar research databases. A larger sample would be cumbersome for data users given that a 20% sample contains over 25 million records. A 20% sample also enables the user to split the NEDS into two 10% subsamples for estimation and validation of models.

To further ensure accurate geographic representation, hospitals were implicitly stratified by State and three-digit ZIP Code (i.e., the first three digits of the hospital's five-digit ZIP Code). This was accomplished by sorting by three-digit ZIP Code within each stratum prior to drawing a systematic random sample of hospitals. Within the three-digit ZIP Code, hospitals were sorted by a random number to ensure further geographic generalizability of hospitals within the frame States; otherwise, generally, three-digit ZIP Codes that are proximal in value are geographically near one another within a State. Furthermore, the U.S. Postal Service locates regional mail distribution centers at the three-digit level. Thus, the boundaries tend to be a compromise between geographic size and population size.

Using the universe of U.S. hospital-based EDs, strata were defined by region, trauma designation, urban-rural location, teaching status, and hospital ownership or control. Strata with less than two hospitals in the universe and frame were collapsed with adjacent stratum based on urban-rural location, trauma designation, or ownership or control.

After stratifying and sorting the universe of hospitals, a random sample of up to 20% of the total number of hospital-based EDs in the U.S. was selected within each stratum. A shortfall was defined as an insufficient number of EDs in the frame to meet the threshold of 20% of the universe. In strata with shortfalls, the sampling rate from the universe was less than 20% and all possible EDs in the frame are selected for the NEDS. In contrast, the sampling rate is larger than 20% in some strata because protecting hospital confidentiality required a minimum of two sampled EDs in each stratum. Appendix I, Table 7 lists the sampling rates by stratum for the NEDS.

HOW TO USE THE NEDS FOR DATA ANALYSIS

This section provides a brief synopsis of special considerations when using the NEDS. For more details, refer to the comprehensive documentation on the HCUP-US Website (http://hcup-us.ahrq.gov/).

If anyone (regardless of whether they are the original recipient of the data) uses the NEDS, be sure s/he reads and signs a Data Use Agreement, after completing the on-line Data Use Agreement training available on the HCUP-US Website (http://www.hcup-us.ahrq.gov). A copy of the signed Data Use Agreements must be sent to AHRQ. See page 2 for the mailing address.

Limitations of the NEDS

The NEDS contains about 26 million ED records and over 100 clinical and non-clinical data elements. This allows for a multitude of research studies, yet there are some limitations.

- The NEDS is an extremely large database that requires sophisticated, statistical software for analysis. In total, the comma-delimited version of the files is almost 11 gigabyte (GB); the NEDS loaded into SAS is almost 9 GB. In SAS, the largest use of space typically occurs during a sort, which requires work space about three times the size of the file. Thus, the NEDS Core File would require about 27 GB of available workspace to perform a sort. Even most SAS data steps will require twice the storage of the file so that both the input and output files can coexist. With a file this size and without careful planning, space could easily become a problem in a multi-step program. Because it is not unusual to have several versions of a file marking different steps while preparing it for analysis and more versions for the actual analyses, the amount of space required could escalate rapidly. We estimate that a researcher needs 75 to 100 GB of space to work comfortably with the NEDS files.

- In 2006, about 23% of the ED visits (unweighted) are missing information about ED charges. For ED visits that result in admission, 41% of records are missing ED charges. For ED visits that do not result in admissions, 20% of records are missing ED charges. Estimates of the sum of charges should use the product of the number of cases times the average charge to account for records with missing information.

- The NEDS contains event-level records, not patient-level records. This means that individual patients who visit the ED multiple times in one year may be present in the NEDS multiple times. There is no uniform patient identifier available that allows a patient-level analysis with the NEDS. In contrast, the HCUP state databases may be used for this type of analysis.

- If a patient is directly admitted from the ED to the same hospital, one discharge record is included in the NEDS. If a patient is transferred from the ED to another ED or hospital, the resulting record may or may not be included in the NEDS because the NEDS is created from a sample of hospital-based EDs. This type of transfer only occurs in about 1% of the NEDS.

- For a patient who was directly admitted to the same hospital through the ED, clearly identifying whether a procedure was performed in the ED or as part of the inpatient stay is not currently possible. Information on procedures for ED admissions are stored in the NEDS Supplemental Inpatient File.

- For hospital confidentiality purposes, trauma centers levels I and II, and sometimes levels I, II and III, were grouped together in the HCUP data element HOSP_TRAUMA. This limits the analyses that can be performed by individual levels of trauma centers.

- The NEDS is not linkable to other HCUP databases, does not intentionally contain the same hospitals as the HCUP Nationwide Inpatient Sample, and cannot be used for state-level analyses.

Identifying Different Types of ED Events

The HCUP data element EDevent distinguishes among the different types of ED events. Appendix 1, Table 4 provides the number and percent of records in the 2006 NEDS for each of the five ED event types.

There may be a bias to the records in which the type of ED event is unknown. Some States have a large percent of missing information.

Calculating National Estimates

To produce national estimates, use the weighting data elements provided to weight ED events in the NEDS to hospital-based ED visits from all U.S. community, non-rehabilitation hospitals. **In order to produce national estimates, weights MUST be used.**

- The hospital weight (HOSPWT) should be used for producing nationwide hospital-level statistics for analyses that use the hospital-based ED as the unit of analysis.

- The discharge weight (DISCWT) should be used for producing nationwide visits-level statistics for analyses that use the ED visit as the unit of analysis.

Because the NEDS is a stratified sample, proper statistical techniques must be used to calculate standard errors and confidence intervals. For detailed instructions, refer to the special report *Calculating Nationwide Inpatient Sample Variances* on the HCUP-US Website (www.hcup-us.ahrq.gov). The HCUP Nationwide Inpatient Sample (NIS) uses the same stratified sample design, so techniques appropriate for the NIS are also appropriate for the NEDS.

When creating national estimates, it is a good idea to check results against other data sources, if available. Summary benchmarks for national estimates from the NEDS are provided in Appendix IV. Also included in Appendix IV are comparable estimates from other ED data sources. For example, the National Hospital Ambulatory Medical Care Survey (NHAMCS) has an emergency department component and publishes national health statistics annually.

To ensure that weights are used appropriately and estimates and variances are calculated accurately, researchers can also use HCUPnet, the free online query system (http://www.hcupnet.ahrq.gov). HCUPnet is a Web-based query tool for identifying, tracking, analyzing, and comparing statistics on hospitals at the national, regional, and State levels. HCUPnet offers easy access to national statistics and trends as well as selected State statistics about hospital stays and ED visits. This tool provides step–by–step guidance, helping researchers to quickly obtain the statistics they need. HCUPnet generates statistics using the HCUP databases.

Choosing Data Elements for Analysis

For all data elements to be used in the analysis, first perform descriptive statistics and examine the range of values, including number of missing cases. When anomalies (such as large numbers of missing cases) are detected, perform descriptive statistics by region for that variable to detect if there are region-specific differences. Sometimes performing descriptive statistics by hospital (HOSP_ED) can be helpful in detecting hospital-specific data anomalies.

ICD-9-CM Diagnosis and Procedure Codes

ICD-9-CM diagnosis and procedure codes provide valuable insights into the reasons for ED visits and hospitalizations as well as what procedures patients receive, but these codes need to be carefully used and interpreted. ICD-9-CM codes change every October as new codes are introduced and some codes are retired. See the Conversion Table at http://www.cdc.gov/nchs/datawh/ftpserv/ftpicd9/ftpicd9.htm which shows ICD-9-CM code

changes over time. **It is essential to check all ICD-9-CM codes used for analysis to ensure the codes are in effect during the time period(s) studied.**

The meaning of the first listed diagnosis (DX1) differs based on the type of ED visit.

- On the records for an ED visit in which the patient is admitted to the same hospital (identified by HCUPFILE="SID"), the first listed diagnosis (DX1) is the principal diagnosis.

- On the records for an ED visit that did not result in an admission to this same hospital (identified by HCUPFILE="SEDD"), the first listed diagnosis (DX1) is not necessarily the principal diagnosis. It may be the reason for the visit. For example, the reason for the visit may be chest pain, but the principal diagnosis might be congestive heart failure.

Diagnoses reported on an ED admission may be from both the ED and hospital setting. It may be useful to compare diagnostic-specific ED visits that do not result in hospitalization to those resulting in hospitalization.

CPT procedure codes also provide valuable insight into the procedures performed. CPT codes can change dramatically each year. CPTs are copyrighted by the American Medical Association. Please refer to their web site for more information about coding (http://www.ama-assn.org/ama/pub/category/3884.html). **It is essential to check all CPT procedure codes used for analysis to ensure the codes are in effect during the time period(s) studied.**

Up to four external cause of injury codes (E codes) are retained in separate data elements (ECODE1-ECODE4). The first listed E code (ECODE1) is not necessarily the underlying or principal cause of the injury.

The collection and reporting of E codes varies greatly across States. Some States have laws or mandates for the collection of E codes; others do not. In addition, some States do not require hospitals to report E codes in the range E870-E879--"misadventures to patients during surgical and medical care"--which means that these occurrences will be underreported.

Although the NEDS contains fields for up to 15 diagnoses, four E codes, 15 CPT procedures, and 9 ICD-9-CM procedures per ED event, the number of code fields populated varies by State due to reporting differences. Some States provide more than the maximum code fields retained on the NEDS. To reduce the file size of the NEDS, the number of diagnosis and procedure codes retained was limited. Less than 2% of all ED records report more fields than the maximum allowed on the NEDS. Four data elements are provided which tell users exactly how many diagnoses and procedures were on the original records (NDX for diagnoses, NECODE for E codes, NCPT for CPT procedures, and NPR for ICD-9-CM procedures).

Missing Values

Missing data values can compromise the quality of estimates. For instance, if the outcome for ED visits with missing values is different from the outcome for ED visits with valid values, then sample estimates for that outcome will be biased and inaccurately represent the ED utilization patterns. There are several techniques available to help overcome this bias. One strategy is to use imputation to replace missing values with acceptable values. Another strategy is to use sample weight adjustments to compensate for missing values. Descriptions of such data preparation and adjustment are outside the scope of this report; however, it is recommended that researchers evaluate and adjust for missing data, if necessary.

Alternatively, if the cases with and without missing values are assumed to be similar with respect to their outcomes, no adjustment may be necessary for estimates of means and rates because the non-missing cases would be representative of the missing cases. However, some adjustment may still be necessary for the estimates of totals. Sums of data elements (such as aggregate ED charges) containing missing values would be incomplete because cases with missing values would be omitted from the calculations. Estimates of the sum of charges should use the product of the number of cases times the average charge to account for records with missing information.

Variance Calculations

It may be important for researchers to calculate a measure of precision for some estimates based on the NEDS sample data. Variance estimates must take into account both the sampling design and the form of the statistic. The sampling design consisted of a stratified, single-stage cluster sample. A stratified random sample of hospital-based EDs (clusters) was drawn and then all ED visits were included from each selected hospital. **To accurately calculate variances from the NEDS, appropriate statistical software and techniques must be used.** For details**,** see the special report *Calculating Nationwide Inpatient Sample Variances* on the HCUP-US Website (www.hcup-us.ahrq.gov). The NIS uses the same stratified sample design, so techniques appropriate for the NIS are also appropriate for the NEDS.

If hospitals inside the sampling frame are similar to hospitals outside the frame, the sample hospitals can be treated as if they were randomly selected from the entire universe of hospitals within each stratum. Standard formulas for a stratified, single-stage cluster sample without replacement could be used to calculate statistics and their variances in most applications.

A multitude of statistics can be estimated from the NEDS data. Several computer programs that calculate statistics and their variances from sample survey data are listed in the next section. Some of these programs use general methods of variance calculations (e.g., the jackknife and balanced half-sample replications) that take into account the sampling design. However, it may be desirable to calculate variances using formulas specifically developed for certain statistics.

These variance calculations are based on finite-sample theory, which is an appropriate method for obtaining cross-sectional, nationwide estimates of outcomes. According to finite-sample theory, the intent of the estimation process is to obtain estimates that are precise representations of the nationwide population at a specific point in time. In the context of the NEDS, any estimates that attempt to accurately describe characteristics and interrelationships among hospitals and ED visits during a specific year should be governed by finite-sample theory. Examples would be estimates of expenditure and utilization patterns.

Alternatively, in the study of hypothetical population outcomes not limited to a specific point in time, the concept of a "superpopulation" may be useful. Analysts may be less interested in specific characteristics of the finite population (and time period) from which the *sample* was drawn than they are in hypothetical characteristics of a conceptual superpopulation from which any particular finite *population* in a given year might have been drawn. According to this superpopulation model, the nationwide population in a given year is only a snapshot in time of the possible interrelationships among hospital, market, and discharge characteristics. In a given year, all possible interactions between such characteristics may not have been observed, but analysts may wish to predict or simulate interrelationships that may occur in the future.

Under the finite-population model, the variances of estimates approach zero as the sampling

fraction approaches one. This is the case because the population is defined at that point in time and because the estimate is for a characteristic as it existed when sampled. This is in contrast to the superpopulation model, which adopts a stochastic viewpoint rather than a deterministic viewpoint. That is, the nationwide population in a particular year is viewed as a random sample of some underlying superpopulation over time. Different methods are used for calculating variances under the two sample theories. The choice of an appropriate method for calculating variances for nationwide estimates depends on the type of measure and the intent of the estimation process.

Computer Software for Weighted and Variance Calculations

The hospital weights are useful for producing hospital-level statistics for analyses that use the *hospital-based ED* as the unit of analysis. In contrast, the discharge weights are useful for producing visit-level statistics for analyses that use the *ED visit* as the unit of analysis.

In most cases, computer programs are readily available to perform these calculations. Several statistical programming packages allow weighted analyses.[6] For example, nearly all SAS procedures incorporate weights. In addition, several statistical analysis programs have been developed to specifically calculate statistics and their standard errors from survey data. Version 8 or later of SAS contains procedures (PROC SURVEYMEANS and PROC SURVEYREG) for calculating statistics based on specific sampling designs. STATA and SUDAAN are two other common statistical software packages that perform calculations for numerous statistics arising from the stratified, single-stage cluster sampling design. Examples of the use of SAS, SUDAAN, and STATA to calculate NIS variances are presented in the special report *Calculating Nationwide Inpatient Sample Variances* on the HCUP-US Website (www.hcup-us.ahrq.gov). While the examples using the NIS also apply to the NEDS, it should be noted that the NEDS is a much larger data set. Please consult the documentation for the different software packages concerning the use of large databases. For an excellent review of programs to calculate statistics from survey data, visit the following Website: http://www.hcp.med.harvard.edu/statistics/survey-soft/.

The NEDS includes a Hospital Weights File with variables required by these programs to calculate finite-population statistics. The file includes synthetic hospital identifiers (Primary Sampling Units or PSUs), stratification variables, and stratum-specific totals for the numbers of ED visits and hospitals so that finite-population corrections can be applied to variance estimates.

In addition to these subroutines, standard errors can be estimated by validation and cross-validation techniques. Given that a very large number of observations will be available for most NEDS analyses, it may be feasible to set aside a part of the data for validation purposes. Standard errors and confidence intervals then can be calculated from the validation data.

If the analytic file is too small to set aside a large validation sample, cross-validation techniques may be used. For example, ten-fold cross-validation would split the data into ten subsets of equal size. The estimation would take place in ten iterations. In each iteration, the outcome of interest is predicted for one-tenth of the observations by an estimate based on a model fit to the other nine-tenths of the observations. Unbiased estimates of error variance are then obtained by comparing the actual values to the predicted values obtained in this manner.

[6] Carlson BL, Johnson AE, Cohen SB. "An Evaluation of the Use of Personal Computers for Variance Estimation with Complex Survey Data." *Journal of Official Statistics*, vol. 9, no. 4, 1993: 795-814.

COMPARABLE ED DATA SOURCES

To aid in understanding of NEDS, national estimates from the NEDS are compared to available sources of similar data. Each of the following ED data sources has potential for use in research addressing ED utilization and policy and has data available for 2006.

Type of ED Data	ED Data Source	Description
National inventories of hospital-based EDs	American Hospital Association Annual Survey of Hospitals (AHA)	Database containing characteristics and descriptions of U.S. hospitals reported by hospitals via survey. Sponsored by American Hospital Association.
	Verispan Hospital Market Profiling Solution	Data set containing information on U.S. hospitals collected through surveying government agencies and direct contact with hospitals. Sponsored by Verispan, now called SDI Health.
ED visit information from a sample of hospital-based EDs	HCUP Nationwide Emergency Department Sample (NEDS)	Nationwide sample drawn from the HCUP SID and SEDD, stratified and weighted to be nationally representative of ED visits and facilities. Sponsored by the Agency for Healthcare Research and Quality (AHRQ) of the U.S. Department of Health and Human Services (DHHS).
	National Hospital Ambulatory Medical Care Survey (NHAMCS)	National probability sample survey of utilization and provision of ambulatory services in hospital emergency and outpatient departments. Sponsored by National Center for Health Statistics (NCHS) of the DHHS' Centers for Disease Control and Prevention (CDC).
	National Electronic Injury Surveillance System – All Injury Program (NEISS-AIP)	National probability sample providing counts of injuries seen in the ED. Sponsored by National Center for Injury Prevention and Control (NCIPC) of the DHHS' CDC and US Consumer Product Safety Commission (CPSC).

ED visit information from a sample of patients	National Health Interview Survey (NHIS)	A comprehensive survey of the civilian noninstitutionalized population residing in the United States at the time of the interview. Sponsored by National Center for Health Statistics (NCHS) of the DHHS' CDC.

Information on total ED visits in 2006 for the U.S. was available from five data sources (AHA, Verispan, NEDS, NHAMCS, and NHIS). Appendix IV, Figure 1 displays the range of total ED visits; Appendix IV, Table 1 lists the total ED visits in the U.S and by census region. Total U.S. ED visit counts are relatively consistent across the data sources. The South consistently has the highest number of ED visits and the West had the lowest number of ED visits.

Information on the total number of hospital-based EDs and their volume of visits are available from three data sources (AHA, Verispan, and NEDS) and are displayed in Appendix IV, Table 2.

Estimates on the number of injury-related ED visits are available from three data sources (NEDS, NHAMCS, and NEISS-AIP) and are displayed in Appendix IV, Table 3.

Appendix I: NEDS Introductory Information

Table 1. HCUP Partners Participating in the 2006 NEDS

State	HCUP Data Source
Arizona	Arizona Department of Health Services
California	Office of Statewide Health Planning and Development
Connecticut	Connecticut Hospital Association
Florida	Florida Agency for Health Care Administration
Georgia	Georgia Hospital Association
Hawaii	Hawaii Health Information Corporation
Indiana	Indiana Hospital&Health Association
Iowa	Iowa Hospital Association
Kansas	Kansas Hospital Association
Maine	Maine Health Data Organization
Maryland	Health Services Cost Review Commission
Massachusetts	Division of Health Care Finance and Policy
Minnesota	Minnesota Hospital Association
Missouri	Hospital Industry Data Institute
Nebraska	Nebraska Hospital Association
New Hampshire	New Hampshire Department of Health & Human Services
New Jersey	New Jersey Department of Health and Senior Services
Ohio	Ohio Hospital Association
South Carolina	South Carolina State Budget & Control Board
South Dakota	South Dakota Association of Healthcare Organizations
Tennessee	Tennessee Hospital Association
Utah	Office of Health Care Statistics, Utah Department of Health
Vermont	Vermont Association of Hospitals and Health Systems
Wisconsin	Wisconsin Department of Health Services

Figure 1. HCUP States Participating in the 2006 NEDS

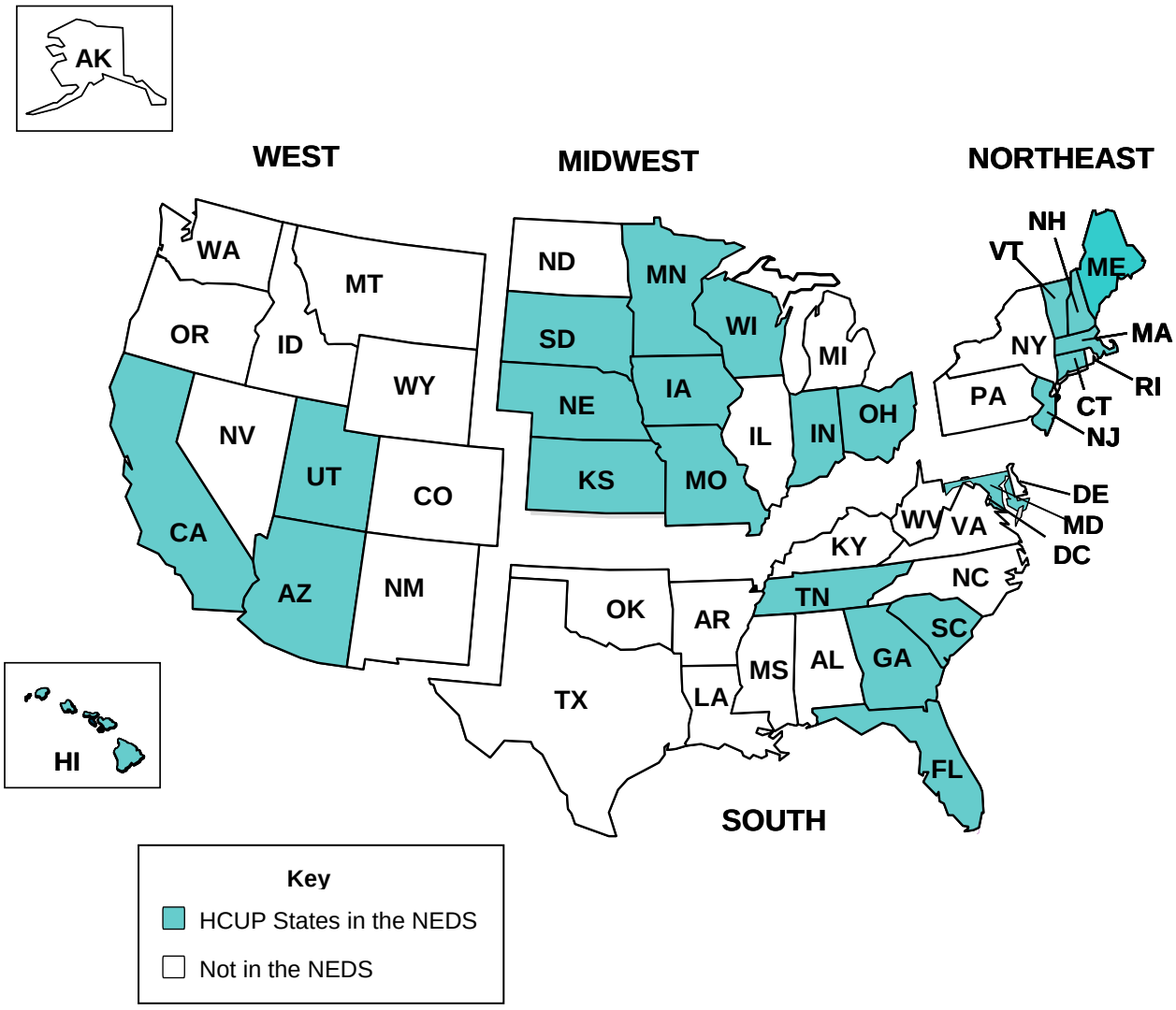


Table 2. Percentage of U.S Population and AHA ED Visits Accounted for by the 24 HCUP States Participating in the NEDS, 2006

Region	U.S. Population in HCUP ED States	Percentage of U.S. Population in HCUP ED States (%)	AHA ED Visits in HCUP ED States	Percentage of AHA ED Visits in HCUP ED States (%)
Northeast	21,813,913	39.9	8,677,503	36.9%
Midwest	42,567,826	64.4	15,697,979	56.4%
South	43,333,171	39.9	16,678,913	35.6%
West	46,159,966	66.9	12,642,021	58.1%
Nation	**153,874,876**	**51.6**	**53,696,416**	**44.7**

Table 3. NEDS Related Reports and Database Documentation Available on HCUP-US

Restrictions on the Use of the NEDS • Data Use Agreement for the NEDS	**Load Programs** Programs to load the ASCII data files into statistical software: • SAS Load Programs • SPSS Load Programs • Stata Load Programs

Description of the NEDS Files
• Introduction to the NEDS, 2006 – *this document*
• HCUP Quality Control Procedures – describes procedures used to assess data quality
• File Specifications – details data file names, number of records, record length, and record layout
	HCUP Tools: Labels and Formats
	• Overview of Clinical Classifications Software (CCS)
	• Format library programs to create value labels
	  ○ DRG formats
	  ○ HCUP formats
	  ○ HCUP diagnoses and procedure groups, including CCS categories
	  ○ ICD-9-CM formats

Description of Data Elements in the NEDS • Description of Data Elements – details uniform coding and State-specific idiosyncrasies • Summary Statistics – lists means and frequencies on nearly all data elements • HCUP Coding Practices – describes how HCUP data elements are coded • HCUP Hospital Identifiers – explains data elements that characterize individual hospitals	**NEDS-Related Reports** • Calculating Nationwide Inpatient Sample Variances (methods also apply to the NEDS)

Table 4. Different Types of ED Events in the NEDS

ED Event	Number of ED Visits	Percent of ED Visits
ED visit in which the patient is treated and released	95,189,410	79.3
ED visit in which the patient is admitted to this same hospital	18,543,227	15.5
ED visit in which the patient is transferred to another short-term hospital	1,185,856	1.0
ED visit in which the patient died in the ED	180,769	0.2
ED visit in which patient is not admitted to this same hospital, destination unknown	4,933,411	4.1
ED visit in which the patient is discharged alive, destination unknown (but not admitted)	1,077	0.0

Table 5. NEDS Stratifiers

Stratifier	Values
Region	1: Northeast 2: Midwest 3: South 4: West
Trauma	0: Not a trauma center 1: Trauma center level I 2: Trauma center level II 3: Trauma center level III Collapsed categories used for strata with small sample sizes 8: Trauma center level I or II 9: Trauma center level I, II or III
Urban-Rural	1: Large metropolitan 2: Small metropolitan 3: Micropolitan 4: Non-urban residual Collapsed categories used for strata with small sample sizes 8: Metropolitan (large and small) 9: Non-metropolitan (micropolitan and non-urban location)
Teaching	0: Metropolitan non-teaching 1: Metropolitan teaching 2: Non-metropolitan teaching and non-teaching
Control	0: All (used for combining public, voluntary, and private) 1: Public – government, non-Federal 2: Voluntary – private, non-profit 3: Proprietary – private, investor-owned/for-profit 4: Private (used for combining private voluntary and proprietary)

Table 6. 2006 NEDS Target Universe, Sampling Frame, and Final Sample Characteristics

	Description	Number of Hospital-Based EDs	Number of ED Events
Target Universe	EDs in community, non-rehabilitation U.S. hospitals that reported total ED visits in the AHA Annual Survey Database	4,845	120,033,750
Sampling Frame	EDs in the 24 HCUP States that provide information on ED visits that result and do not result in admission	2,067	53,170,407
2006 NEDS, Version 2	20% sample of target universe drawn from the sampling frame	955	25,702,597

Table 7. NEDS Sampling Rates, 2006

NEDS Stratum	Number of Hospital-Based EDs					Sampling Rate	
NEDS Stratum	AHA Universe	20% of Universe	Frame	Frame Shortfall	NEDS	NEDS to Universe	NEDS to Frame
Total	4845	1000	2067	45	955	19.7%	46.2%
Northeast							
10100	152	31	50	0	31	20.4%	62.0%
10110	102	21	40	0	21	20.6%	52.5%
10200	94	19	30	0	19	20.2%	63.3%
10210	36	8	17	0	8	22.2%	47.1%
10320	79	16	18	0	16	20.3%	88.9%
10420	52	11	29	0	11	21.2%	37.9%
11110	48	10	9	1	9	18.8%	100.0%
11210	12	3	4	0	3	25.0%	75.0%
12110	13	3	5	0	3	23.1%	60.0%
12210	15	3	8	0	3	20.0%	37.5%
13110	5	2	5	0	2	40.0%	40.0%
19800	20	4	5	0	4	20.0%	80.0%
19920	13	3	6	0	3	23.1%	50.0%
Midwest							
20100	196	40	108	0	40	20.4%	37.0%
20110	72	15	36	0	15	20.8%	41.7%
20200	178	36	111	0	36	20.2%	32.4%
20210	45	9	30	0	9	20.0%	30.0%
20321	62	13	46	0	13	21.0%	28.3%
20324	187	38	124	0	38	20.3%	30.6%
20421	205	41	167	0	41	20.0%	24.6%
20424	264	53	174	0	53	20.1%	30.5%
21110	37	8	19	0	8	21.6%	42.1%
21210	20	4	11	0	4	20.0%	36.4%
22110	17	4	2	2	2	11.8%	100.0%
22210	36	8	18	0	8	22.2%	44.4%
22324	10	2	2	0	2	20.0%	100.0%
23100	4	2	3	0	2	50.0%	66.7%
23200	14	3	14	0	3	21.4%	21.4%
23321	3	2	2	0	2	66.7%	100.0%
23324	13	3	11	0	3	23.1%	27.3%
23420	4	2	2	0	2	50.0%	100.0%
23810	8	2	6	0	2	25.0%	33.3%
28800	43	9	16	0	9	20.9%	56.3%

South							
30101	40	8	12	0	8	20.0%	66.7%
30102	145	29	66	0	29	20.0%	43.9%
30103	181	37	54	0	37	20.4%	68.5%
30110	105	21	48	0	21	20.0%	43.8%
30201	78	16	21	0	16	20.5%	76.2%
30202	137	28	49	0	28	20.4%	57.1%
30203	160	32	33	0	32	20.0%	97.0%
30210	55	11	11	0	11	20.0%	100.0%
30321	80	16	18	0	16	20.0%	88.9%
30322	119	24	30	0	24	20.2%	80.0%
30323	78	16	23	0	16	20.5%	69.6%
30421	213	43	45	0	43	20.2%	95.6%
30422	178	36	25	11	25	14.0%	100.0%
30423	87	18	23	0	18	20.7%	78.3%
31110	26	6	10	0	6	23.1%	60.0%
31210	25	5	10	0	5	20.0%	50.0%
32110	14	3	11	0	3	21.4%	27.3%
32210	17	4	7	0	4	23.5%	57.1%
33800	54	11	11	0	11	20.4%	100.0%
33810	28	6	3	3	3	10.7%	100.0%
38800	19	4	4	0	4	21.1%	100.0%
39920	51	11	3	8	3	5.9%	100.0%
West							
40101	23	5	17	0	5	21.7%	29.4%
40102	102	21	79	0	21	20.6%	26.6%
40103	76	16	54	0	16	21.1%	29.6%
40110	61	13	44	0	13	21.3%	29.5%
40201	29	6	16	0	6	20.7%	37.5%
40202	73	15	53	0	15	20.5%	28.3%
40203	41	9	16	0	9	22.0%	56.3%
40210	24	5	16	0	5	20.8%	31.3%
40321	44	9	15	0	9	20.5%	60.0%
40324	66	14	27	0	14	21.2%	51.9%
40421	98	20	11	9	11	11.2%	100.0%
40424	82	17	18	0	17	20.7%	94.4%
43800	38	8	3	5	3	7.9%	100.0%
43920	36	8	2	6	2	5.6%	100.0%
48800	38	8	14	0	8	21.1%	57.1%
49810	65	13	37	0	13	20.0%	35.1%

Stratum:
1st digit – Region: (1) Northeast, (2) Midwest, (3) South, (4) West
2nd digit – Trauma: (0) Not a trauma center, (1) Trauma center level I, (2) Trauma center level II, (3) Trauma center level III, Collapsed categories used for strata with small sample sizes: (8) Trauma center level I or II, (9) Trauma center level I, II, or III. Note: In Version 2 of the 2006 and 2007 NEDS, children's hospitals with trauma centers are included with adult/pediatric trauma centers in the appropriate stratum.
3rd digit – Urban-rural location: (1) Large metropolitan, (2) Small metropolitan, (3) Micropolitan, (4) Non-urban residual, Collapsed categories used for strata with small sample sizes: (8) Metropolitan (large and small), (9) Non-metropolitan (micropolitan and non-urban location)
4th digit – Teaching: (0) Metropolitan non-teaching, (1) Metropolitan teaching, (2) Non-metropolitan teaching and non-teaching
5th digit – Control: (0) All (used for combining public, voluntary, and private), (1) Public – government, non-Federal, (2) Voluntary – private, non-profit, (3) Proprietary – private, investor-owned/for-profit, (4) Private (used for combining private voluntary and proprietary)

Appendix II: State-Specific Restrictions

The table below enumerates the types of restrictions applied to the 2006 Nationwide Emergency Department Sample. Restrictions include the following types:

- Confidentiality of hospitals
- Confidentiality of records
- Limited reporting of external cause of injury codes
- Missing discharges for specific populations of patients.

For each restriction type the data sources are listed alphabetically by State. Only data sources that have restrictions are included. Data sources that do not have restrictions are not included.

Table 1. State-Specific Restrictions

Confidentiality of Hospitals

Limitations on sampling are required to ensure hospital confidentiality:
 	
• All States:
  ○ Prior to collapsing stratum: if there is a "unique" hospital in the State, it is excluded from sampling. "Unique" is defined as the only hospital in the state universe for a stratum. For example, if there is only one rural, non-teaching, trauma level III hospital in a State, then it is excluded from the sampling frame.
  ○ After sampling: stratifier data elements are set to missing if the stratum had fewer than two hospitals in the universe of the State's hospitals.
 	
• CT: Connecticut Hospital Association (CHA)
  ○ CHA is to be notified if more than 50% of their hospitals appear in the NEDS. The 2006 NEDS includes exactly 50% of CT hospitals.

Confidentiality of Records

Limitations on selected data elements are required by the following data sources to ensure patient confidentiality:
 	
• CT: Connecticut Hospital Association (CHA)
  ○ Admission month (AMONTH) is set to missing on all records.
 	
• FL: Florida Agency for Health Care Administration
  ○ Admission month (AMONTH) is set to missing on all records.

Limited Reporting of External Cause of Injury Codes
The following data sources have limitations on the reporting of external cause of injury codes (E codes): • CA: Office of Statewide Health Planning and Development   ○ California does not require the reporting of E codes in the range E870-E879 (medical misadventures and abnormal reactions).

- GA: Georgia Hospital Association (GHA)
    - GHA removes E codes in the range E870-E879 (medical misadventures) and E930-E949 (adverse effects) from the data files supplied to HCUP.

- SC: South Carolina State Budget & Control Board
    - South Carolina removes E codes in the range E870-E879 (medical misadventures and abnormal reactions) from the data files supplied to HCUP.

Missing Discharges for Specific Populations of Patients

The following data sources may be missing discharge records for specific populations of patients:

- IA: Iowa Hospital Association
    - The Iowa Hospital Association prohibits the release of two types of discharges: HIV infections (defined by MDC of 25) and behavioral health including chemical dependency care or psychiatric care (defined by a service code of BHV). These discharges were not included in the source file provided to HCUP and were therefore not included in the NEDS.

- NE: Nebraska Hospital Association
    - The Nebraska Hospital Association prohibits the release of discharge records for patients with HIV diagnoses. These discharges were not included in the source file provided to HCUP and were therefore not included in the NEDS.

Appendix III: NEDS Data Elements and Codes

Table 1. Data Elements in the NEDS Core File

Type of Data Element	HCUP Data Element	Coding Notes
Admission timing	AWEEKEND	Admission on weekend: (0) admission on Monday-Friday, (1) admission on Saturday-Sunday
	AMONTH	Admission month coded from (1) January to (12) December
Age at admission	AGE	Age in years coded 0-124 years
Diagnosis information	DX1 – DX15	ICD-9-CM diagnoses
	DXCCS1 – DXCCS15	Clinical Classifications Software (CCS) category for all diagnoses
	CHRON1 – CHRON15	Chronic condition indicator for all diagnoses: (0) non-chronic condition, (1) chronic condition
	NDX	Number of diagnoses coded on the original record. A maximum of 15 codes are retained on the NEDS.
	INTENT_SELF_HARM	Diagnosis reported on records indicates intended self harm: (0) not intended self harm, (1) intended self harm
Discharge timing	DQTR	Coded: (1) Jan - Mar, (2) Apr - Jun, (3) Jul - Sep, (4) Oct - Dec
	YEAR	Calendar year of ED visits
Disposition of patient from the ED	DISP_ED	Disposition from ED: (1) routine, (2) transfer to short-term hospital, (5) other transfers, including skilled nursing facility, intermediate care, and another type of facility, (6) home health care, (7) against medical advice, (9) admitted as an inpatient to this hospital, (20) died in ED, (98) not admitted, destination unknown, (99) discharged alive, destination unknown (but not admitted)
	DIED_VISIT	Died in ED: (0) did not die (1) died in the ED, (2) died in the hospital
ED event	EDevent	Type of ED event: (1) ED visit in which the patient is treated and released, (2) ED visit in which the patient is admitted to this same hospital, (3) ED visit in which the patient is transferred to another short-term hospital, (9) ED visit in which the patient died in the ED, (98) ED visits in which patient was not admitted, destination unknown, (99) ED visit in which patient was discharged alive, destination unknown (but not admitted)
External causes of injury and poisoning	ECODE1 – ECODE4	External cause of injury and poisoning codes (ICD-9-CM).
	E_CCS1 – E_CCS4	CCS category for the external cause of injury and poisoning codes

Type of Data Element	HCUP Data Element	Coding Notes
	NECODE	Number of external cause of injury codes on the original record. A maximum of 4 codes are retained on the NEDS.
Gender of patient	FEMALE	Indicates gender: (0) male, (1) female
Urban-rural location of the patient's residence	PL_NHCS2006	Urban–rural designation for patient's county of residence: (1) large central metropolitan, (2) large fringe metropolitan, (3) medium metropolitan, (4) small metropolitan, (5) micropolitan, (6) not metropolitan or micropolitan
National quartile for median household income of patient's ZIP Code	ZIPINC_QRTL	Median household income quartiles for patient's ZIP Code. For 2006, the median income quartiles are defined as: (1) $1 - $37,999; (2) $38,000 - $46,999; (3) $47,000 - $61,999; and (4) $62,000 or more.
Payer information	PAY1	Expected primary payer, uniform: (1) Medicare, (2) Medicaid, (3) private including HMO, (4) self-pay, (5) no charge, (6) other
	PAY2	Expected secondary payer, uniform: (1) Medicare, (2) Medicaid, (3) private including HMO, (4) self-pay, (5) no charge, (6) other
Total ED charges	TOTCHG_ED	Total charges for ED services, edited
HCUP source file	HCUPFILE	Source of HCUP record: (SEDD) from SEDD file, (SID) from SID file
Discharge weight	DISCWT	Discharge weight used to calculate national estimates. Weights ED visits to AHA universe.
Hospital identifier, synthetic	HOSP_ED	Unique HCUP NEDS hospital number – links to NEDS Hospital Weights file, but not to other HCUP databases
Hospital information	HOSP_REGION	Region of hospital: (1) Northeast, (2) Midwest, (3) South, (4) West
	NEDS_STRATUM	Stratum used to sample hospitals, based on geographic region, trauma, location/teaching status, and control. Stratum information is also contained in the Hospital Weights file.
Record identifier, synthetic	KEY_ED	Unique HCUP NEDS record number – links to NEDS Supplemental files, but not to other HCUP databases

Table 2. Data Elements in the NEDS Supplemental ED File

Type of Data Element	HCUP Data Element	Coding Notes
CPT procedure information	CPT1 – CPT15	CPT/HCPCS procedures performed in the ED
	NCPT	Number of procedures coded on the original record. A maximum of 15 CPT codes are retained on the NEDS.
ICD-9-CM procedure information	PR_ED1 – PR_ED9	ICD-9-CM procedures performed in ED
	PRCCS_ED1 – PRCCS_ED9	Clinical Classifications Software (CCS) category for all ICD-9-CM procedures
	PCLASS_ED1 – PCLASS_ED9	Procedure class for all ICD-9-CM procedures: (1) Minor Diagnostic, (2) Minor Therapeutic, (3) Major Diagnostic, (4) Major Therapeutic
	NPR_ED	Number of procedures coded on the original record. A maximum of 9 ICD-9-CM procedure codes are retained on the NEDS.
HCUP source file	HCUPFILE	Source of HCUP record: (SEDD) from SEDD file, (SID) from SID file
Discharge weight	DISCWT	Discharge weight used to calculate national estimates. Weights ED visits to AHA universe.
Hospital identifier, synthetic	HOSP_ED	Unique HCUP NEDS hospital number – links to NEDS Hospital Weights file, but not to other HCUP databases
Record identifier, synthetic	KEY_ED	Unique HCUP NEDS record number – links to NEDS Supplemental files, but not to other HCUP databases

Table 3. Data Elements in the NEDS Supplemental Inpatient File

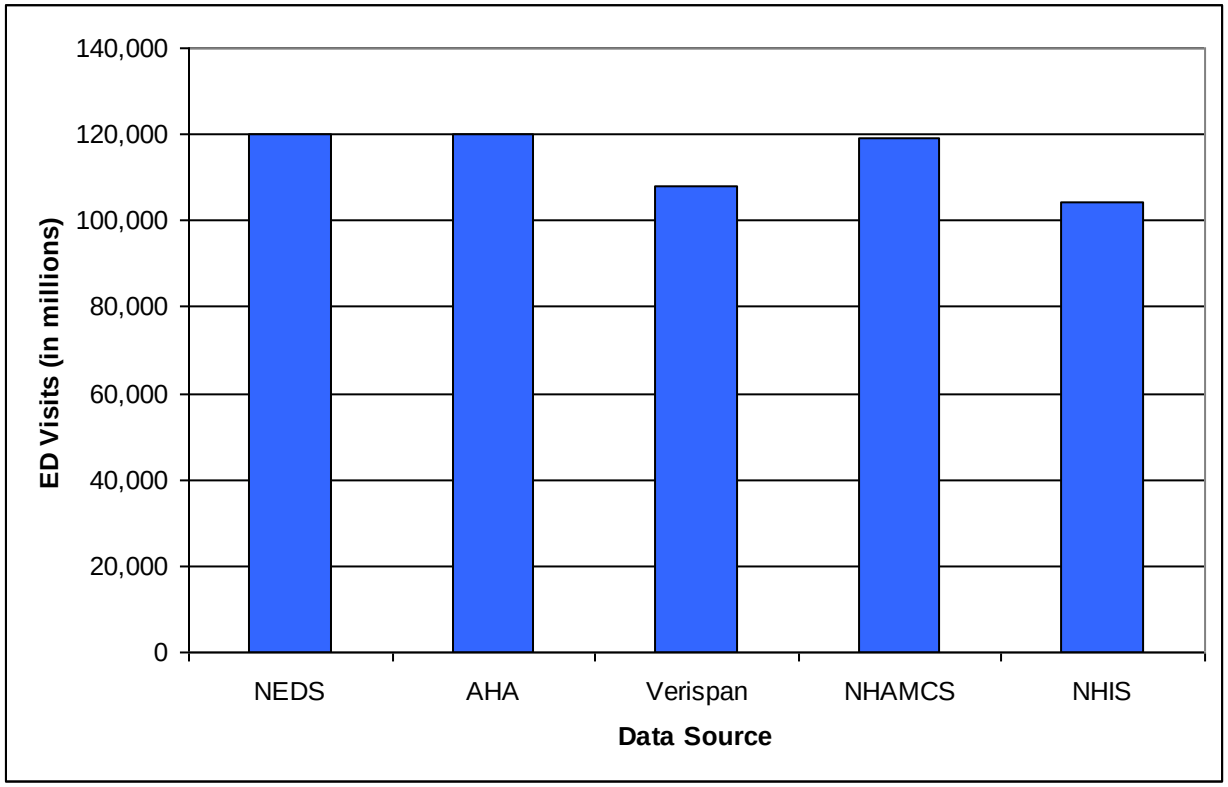
Type of Data Element	HCUP Data Element	Coding Notes
Disposition of patient from the hospital	DISP_IP	Disposition from hospital admission: (1) routine, (2) transfer to short-term hospital, (5) other transfers, including skilled nursing facility, intermediate care, and another type of facility, (6) home health care, (7) against medical advice, (20) died in hospital, (99) discharged alive, destination unknown
Diagnosis Related Group (DRG)	DRG	DRG in use on discharge date
	DRGVER	Grouper version in use on discharge date
	MDC	Major Diagnosis Category (MDC) in use on discharge date
Length of hospital inpatient stay	LOS_IP	Length of stay, edited
Total charges for inpatient stay	TOTCHG_IP	Total charges for ED and inpatient services, edited
ICD-9-CM procedure information	PR_IP1 – PR_IP9	ICD-9-CM procedures coded on ED admissions. Procedure may have been performed in the ED or during the hospital stay.
	PRCCS_IP1 – PRCCS_IP9	Clinical Classifications Software (CCS) category for all ICD-9-CM procedures
	PCLASS_IP1 – PCLASS_IP9	Procedure class for all ICD-9-CM procedures: (1) Minor Diagnostic, (2) Minor Therapeutic, (3) Major Diagnostic, (4) Major Therapeutic
	NPR_IP	Number of procedures coded on the original record. A maximum of 9 ICD-9-CM procedure codes are retained on the NEDS.
HCUP source file	HCUPFILE	Source of HCUP record: (SEDD) from SEDD file, (SID) from SID file
Discharge weight	DISCWT	Discharge weight used to calculate national estimates. Weights ED visits to AHA universe.
Hospital identifier, synthetic	HOSP_ED	Unique HCUP NEDS hospital number – links to NEDS Hospital Weights file, but not to other HCUP databases
Record identifier, synthetic	KEY_ED	Unique HCUP NEDS record number – links to NEDS Supplemental files, but not to other HCUP databases

Table 4. Data Elements in the NEDS Hospital Weights File

Type of Data Element	HCUP Data Element	Coding Notes
Discharge counts	N_DISC_U	Number of AHA universe ED visits in the stratum
	S_DISC_U	Number of sampled ED visits in the sampling stratum
	TOTAL_EDvisits	Total number of ED visits for this hospital in the NEDS
Discharge weights	DISCWT	Discharge weight used to calculate national estimates. Weights ED visits to AHA universe.
Discharge Year	YEAR	Discharge year
Hospital counts	N_HOSP_U	Number of AHA universe hospital-based EDs in the stratum
	S_HOSP_U	Number of sampled hospital-based EDs in the stratum
Hospital identifier, synthetic	HOSP_ED	Unique HCUP NEDS hospital number – links to NEDS Hospital Weights file, but not to other HCUP databases
Hospital characteristics	HOSP_URCAT4	Hospital urban-rural location: (1) large metropolitan areas with at least 1 million residents, (2) small metropolitan areas with less than 1 million residents, (3) micropolitan areas, (4) not metropolitan or micropolitan, (8) metropolitan, collapsed category of large and small metropolitan, (9) non-metropolitan, collapsed category of micropolitan and rural
	HOSP_CONTROL	Control/ownership of hospital: (0) government or private, collapsed category, (1) government, nonfederal, public, (2) private, non-profit, voluntary, (3) private, invest-own, (4) private, collapsed category
	HOSP_REGION	Region of hospital: (1) Northeast, (2) Midwest, (3) South, (4) West
	HOSP_TRAUMA	Trauma center level: (0) non-trauma center, (1) trauma level I, (2) trauma level II (3) trauma level III, (8) trauma level I or II, collapsed category (9) trauma level I, II, or III, collapsed category. Note: In Version 2 of the 2006 and 2007 NEDS, children's hospitals with trauma centers are classified with adult/pediatric trauma centers.
	HOSP_UR_TEACH	Teaching status of hospital: (0) metropolitan non-teaching, (1) metropolitan teaching, (2) non-metropolitan
	NEDS_STRATUM	Stratum used to sample EDs, includes geographic region, trauma, location/teaching status, and control
Hospital weight	HOSPWT	Weight to hospital-based EDs in AHA universe (i.e., total U.S.)

Appendix IV: Comparisons of the NEDS with Existing Sources of ED Data

Figure 1. Emergency Department Visit Counts (in thousands) in the United States, 2006



Notes: ED = emergency department; NEDS = HCUP Nationwide Emergency Department Sample, Version 2; AHA = American Hospital Association Annual Survey Database; Verispan = Verispan Hospital Market file; NHAMCS = National Hospital Ambulatory Medical Care Survey; NHIS = National Health Interview Survey.

Table 1. Estimates of Emergency Department Visits by U.S. Geographic Region from Five ED Data Sources, 2006

	ED Data Source									
	NEDS, Version 2[1]		AHA		Verispan		NHAMCS		NHIS[2]	
ED Visits	N (weighted)	%	N	%	N	%	N (weighted)	%	N (weighted)	%
By Census Region										
Northeast	23,547,915	20%	23,547,915	20%	20,616,379	19%	22,668,521	19%	20,060,168	19%
Midwest	27,836,811	23%	27,836,811	23%	24,083,176	22%	25,735,213	22%	24,343,240	23%
South	46,890,026	39%	46,890,026	39%	44,410,893	41%	50,642,447	42%	42,062,502	40%
West	21,758,998	18%	21,758,998	18%	19,011,478	18%	20,145,347	17%	17,725,379	17%
Total U.S.	120,033,750	100%	120,033,750	100%	108,121,926	100%	119,191,528	100%	104,191,289	100%

Notes: ED = emergency department; NEDS = HCUP Nationwide Emergency Department Sample; AHA = American Hospital Association Annual Survey Database; Verispan = Verispan Hospital Market file; NHAMCS = National Hospital Ambulatory Medical Care Survey; NHIS = National Health Interview Survey.

[1] NEDS weighted counts by geographic region exactly match the AHA counts because the AHA data were used as control totals for the NEDS discharge weights.

[2] NHIS estimates were calculated using the midpoint of the ranges provided in the survey (0, 1, 2-3, 4-5, 6-7, 8-9, 10-12, 13-15, and 16 or more ED visits).

Table 2. Estimates of the Number of Hospital-Based EDs by ED Visit Volume from Three ED Data Sources, 2006

Volume of ED Visits in 2006	Data Sources					
	NEDS, Version 2		AHA		Verispan	
	N (weighted)	%	N	%	N	%
Less than 10,000 visits	1,355	28%	1,736	36%	1,484	33%
10,000 - 19,999 visits	990	20%	913	19%	990	22%
20,000 - 29,999 visits	796	16%	656	14%	675	15%
30,000 - 39,999 visits	561	12%	525	11%	545	12%
40,000 - 49,999 visits	430	9%	352	7%	345	8%
50,000 or more visits	713	15%	663	14%	508	11%
All Hospital-based EDs	4,845	100%	4,845	100%	4,547	100%

Notes: ED = emergency department; NEDS = Nationwide Emergency Department Sample from the Healthcare Cost and Utilization Project; AHA = American Hospital Association Annual Survey Database; Verispan = Verispan Hospital Market file.

Table 3. Estimates of the Number of Injury-Related ED Visits from Three ED Data Sources, 2006

	Data Sources		
	NEDS, Version 2[1]	**NHAMCS[2]**	**NEISS-AIP[3]**
Total number of ED visits for injuries (weighted)	27,963,877	42,386,000	29,821,159

Notes: ED = emergency department; NEDS = Nationwide Emergency Department Sample from the Healthcare Cost and Utilization Project; NHAMCS = National Hospital Ambulatory Medical Care Survey; NEISS-AIP = National Electronic Injury Surveillance System All-Injury Program.

[1] Any ED visit (fatal and non-fatal) with an injury diagnosis of 800-909.2, 909.4, 090.9, 910-994.9, 995.5-995.59, 995.80-995.85.

[2] Data from Pitts SR, Niska RW, Xu J, Burt CW. National Hospital Ambulatory Medical Care Survey: 2006 emergency department summary. National health statistics reports; no 7. Hyattsville, MD: National Center for Health Statistics. 2008.

[3] Data from WISQARS Query System (http://webappa.cdc.gov/sasweb/ncipc/nfirates.html). Includes non-fatal, all-cause injuries. Patients who died on arrival to the ED or during treatment in the ED are excluded. Queried June 9, 2009.