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)

2008

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 complete the on-line Data Use Agreement (DUA) training, sign a Data Use Agreement, and send a copy to AHRQ. †

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

- 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 identify or attempt to identify any individual. **Will not report any statistics where the number of observations (i.e., individual discharge records) in any given cell of tabulated data is less than or equal to 10.**
- Will not link HCUP data to data from another source that identifies individuals.
- Will not report information that could identify individual establishments (e.g., hospitals).
- Will not use the data concerning individual establishments for commercial or competitive purposes involving those establishments.
- Will not use the data to determine rights, benefits, or privileges of individual establishments.
- Will not identify or attempt to identify any establishment when its identity has been concealed on the database.
- Will not contact establishments included in the data.
- Will not attribute to data contributors any conclusions drawn from the data.
- Must acknowledge the "Healthcare Cost and Utilization Project, (HCUP)," as described in the Data Use Agreement, in reports.

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 NEDS Database.

HCUP CONTACT INFORMATION

The NEDS Data Use Agreement Training Tool and the Data Use Agreement are available on the AHRQ-sponsored HCUP User Support (HCUP-US) Website:

http://www.hcup-us.ahrq.gov

After completing the on-line training, please submit signed data use agreements to HCUP at:

Agency for Healthcare Research and Quality
Healthcare Cost and Utilization Project (HCUP)
540 Gaither Road, 5th Floor
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Fax: (301) 427-1430
Website: http://www.ahrq.gov/data/hcup/

For technical assistance:

Visit the HCUP-US Website at

http://www.hcup-us.ahrq.gov

Or send an e-mail to HCUP User Support at

hcup@ahrq.gov

Or contact the HCUP Central Distributor at

Phone: (866) 556-4287 (toll-free between the hours of 9 a.m. and 5 p.m. (ET). If the HCUP Central Distributor is not immediately available, please leave a message on voice mail, and your call will be returned within one business day.)

Fax: (866) 792-5313
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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 2008 NEDS is a publicly available database that can be purchased through the HCUP Central Distributor.
- There are 28 HCUP Partner States that contributed 2008 ED data to the NEDS: AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, MA, MD, ME, MN, MO, NC, NE, NH, NJ, NY, OH, RI, SC, SD, TN, UT, VT, and WI.
- The NEDS describes almost 125 million ED visits for 2008, 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, 2008,* summarizes the content of the NEDS and describes the development of the 2008 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 2008 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 over 28 million ED visits at 980 hospitals that approximate a 20-percent stratified sample of U.S. hospital-based EDs. Weights are provided to calculate national estimates pertaining to almost 125 million ED visits in 2008.

The NEDS is drawn from States that provide HCUP with both ED visits resulting in admission and those that do not. Twenty-eight HCUP States participated in the 2008 NEDS: AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, MA, MD, ME, MN, MO, NC, NE, NH, NJ, NY, OH, RI, 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-eight States participated in the 2008 NEDS. These States include: AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, MA, MD, ME, MN, MO, NC, NE, NH, NJ, NY, OH, RI, 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 28 participating HCUP Partner States. Based on 2008 U.S. Census Bureau data, the HCUP NEDS States account for 62.8% of the U.S. population. The 28 States account for 61.3% of the ED visits reported in the 2008 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 28 Partners (CA, HI, MA, NC, 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 States was evaluated on a State-by-State basis.

- CA, HI, MA, and NC: In each case, the HCUP Partner provided a source file that contained only ED treat-and-release 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 2008, the NEDS Core File has over 28 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 2008, the NEDS Supplemental ED File has about 24 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 2008, the NEDS Supplemental Inpatient File has over 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 2008, the NEDS Hospital Weights File has 980 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://www.hcup-us.ahrq.gov).

NEDS Data Files

The 2008 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 Nationwide Inpatient Sample (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

A feasibility study performed in 2008 assessed several possible data sources for the universe of hospital-based EDs in the United States: the American Hospital Association (AHA) Annual Survey Database (Health Forum, LLC © 2007); Verispan, LLC databases (now called SDI Health LLC); 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 II for two quarters of 2008 and trauma level III for two quarters of 2008, then the hospital-based ED was considered a level III trauma center for the 2008 NEDS. Alternatively, if a hospital-based ED was reported as a trauma level III for 2 quarters of 2008 and did not report for two quarters, the ED was considered a trauma level III for the 2008 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 2008 NEDS 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.

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[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.

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

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.

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

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:

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

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 Q_i represented the number of quarters of ED visits contributed by hospital i to the NEDS (usually $Q_i = 4$). 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 2008 AHA Annual Survey Database and reported total ED visits. Excluded were a handful of non-rural hospitals that reported less than ten ED visits in a year.

The NEDS sampling frame included hospital-based ED events from community, non-rehabilitation hospitals in the 28 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 28 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://www.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 over 28 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. SAS, SPSS, and Stata users are provided programs for converting CSV files.

- In total, the comma-delimited version of the NEDS is almost 13 gigabytes (GB).
- The NEDS files loaded into SAS are almost 11 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 files would require about 33 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.
- The NEDS files loaded into SPSS are about 26 GB.
- Because Stata loads the entire file into memory, it may not be possible to load every data element in the NEDS Core file into Stata. Stata users will need to maximize memory and use the "_skip" option to select a subset of variables. More details are provided in the Stata load programs.

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. A researcher needs approximately 60 to 100 GB of space to work comfortably with the NEDS files.

- In 2008, about 18% of the ED visits (weighted) are missing information about ED charges. For ED visits that result in admission, 34% of records are missing ED charges. For ED visits that do not result in admissions, 15% of records are missing ED charges. The missing information is concentrated in the West. 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 is 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 NIS, and cannot be used for state-level analyses. In fact, states are not identified in the NEDS.

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 2008 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 (http://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. **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 (http://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 (http://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.

[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.

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.

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 2008.

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.
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 for 2008 ED visits was not available from the National Emergency Department Inventory (NEDI) created by the Emergency Medicine Network (EMNet) as of October 2010.

Information on total ED visits in 2008 for the U.S. was available from four data sources (AHA, 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 ED visits by region and the percentage of all ED visits resulting in inpatient admissions are available from two data sources (NHAMCS and NEDS) and are displayed in Appendix IV, Table 2.

Estimates of the number of hospital-based EDs by ED visit volume are available from two data sources (NEDS and AHA) and are displayed in Appendix IV, Table 3.

Estimates of 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 4.

Appendix I: NEDS Introductory Information

Table 1. HCUP Partners Participating in the 2008 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 Association
Iowa	Iowa Hospital Association
Kansas	Kansas Hospital Association
Kentucky	Kentucky Cabinet for Health and Family Services
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
North Carolina	North Carolina Department of Health and Human Services
Nebraska	Nebraska Hospital Association
New Hampshire	New Hampshire Department of Health & Human Services
New Jersey	New Jersey Department of Health and Senior Services
New York	New York State Department of Health
Ohio	Ohio Hospital Association
Rhode Island	Rhode Island Department of Health
South Carolina	South Carolina State Budget & Control Board
South Dakota	South Dakota Association of Healthcare Organizations
Tennessee	Tennessee Hospital Association
Utah	Utah Department of Health and Utah Department of Health, Bureau of Emergency Medical Services
Vermont	Vermont Association of Hospitals and Health Systems
Wisconsin	Wisconsin Department of Health Services

Figure 1. HCUP States Participating in the 2008 NEDS

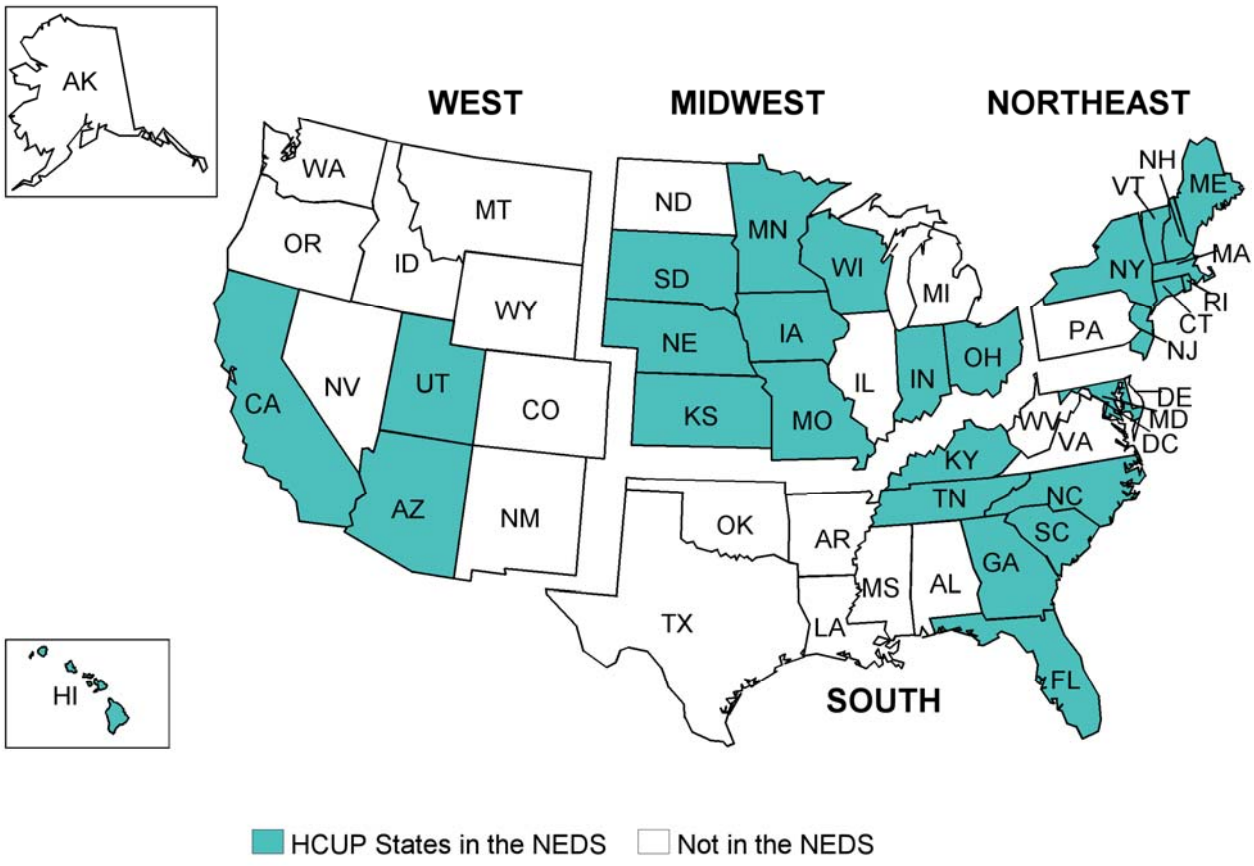


Table 2. Percentage of U.S Population and AHA ED Visits Accounted for by the 28 HCUP States Participating in the NEDS, 2008

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	42,398,195	77.0	18,388,019	75.1
Midwest	42,924,902	64.5	19,335,530	66.0
South	57,798,650	51.6	25,129,192	51.4
West	47,904,146	67.8	13,729,839	61.6
Nation	**191,025,893**	**62.8**	**76,582,580**	**61.3**

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 • Requirements for publishing with HCUP data	**Corrections to the NEDS** • 2006 and 2007
Description of the NEDS Files • Introduction to the NEDS, 2008 – *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	**Load Programs** Programs to load the ASCII data files into statistical software: • SAS Load Programs • SPSS Load Programs • Stata Load Programs
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	**HCUP Tools: Labels and Formats** • Overview of Clinical Classifications Software (CCS) • Format library programs to create value labels o DRG formats o HCUP formats o HCUP diagnoses and procedure groups, including CCS categories o ICD-9-CM formats **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	102,833,485	82.3
ED visit in which the patient is admitted to this same hospital	19,406,101	15.5
ED visit in which the patient is transferred to another short-term hospital	1,639,779	1.3
ED visit in which the patient died in the ED	195,127	0.2
ED visit in which patient is not admitted to this same hospital, destination unknown	869,797	0.7
ED visit in which the patient is discharged alive, destination unknown (but not admitted)	975	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. 2008 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	4,864	124,945,264
Sampling Frame	EDs in the 28 HCUP States that provide information on ED visits that result and do not result in admission	2,466	69,431,236
2008 NEDS	20% sample of target universe drawn from the sampling frame	980	28,447,148

Table 7. NEDS Sampling Rates, 2008

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	4,864	1,005	2,466	25	980	20.1%	39.7%
Northeast							
10100	148	30	93	0	30	20.3%	32.3%
10110	89	18	68	0	18	20.2%	26.5%
10200	103	21	62	0	21	20.4%	33.9%
10210	23	5	13	0	5	21.7%	38.5%
10320	79	16	43	0	16	20.3%	37.2%
10420	52	11	41	0	11	21.2%	26.8%
11110	48	10	36	0	10	20.8%	27.8%
11210	11	3	4	0	3	27.3%	75.0%
12100	6	2	4	0	2	33.3%	50.0%
12110	14	3	9	0	3	21.4%	33.3%
12200	9	2	5	0	2	22.2%	40.0%
12210	18	4	10	0	4	22.2%	40.0%
13110	2	2	2	0	2	100.0%	100.0%
13800	6	2	4	0	2	33.3%	50.0%
13920	8	2	6	0	2	25.0%	33.3%
18320	6	2	2	0	2	33.3%	100.0%
Midwest							
20100	195	39	109	0	39	20.0%	35.8%
20110	60	12	30	0	12	20.0%	40.0%
20200	170	34	96	0	34	20.0%	35.4%
20210	35	7	23	0	7	20.0%	30.4%
20321	61	13	46	0	13	21.3%	28.3%
20324	170	34	113	0	34	20.0%	30.1%
20421	199	40	166	0	40	20.1%	24.1%
20424	252	51	163	0	51	20.2%	31.3%
21110	38	8	22	0	8	21.1%	36.4%
21210	21	5	11	0	5	23.8%	45.5%
22110	17	4	7	0	4	23.5%	57.1%
22210	33	7	17	0	7	21.2%	41.2%
22324	10	2	2	0	2	20.0%	100.0%
23100	17	4	16	0	4	23.5%	25.0%
23110	5	2	4	0	2	40.0%	50.0%
23200	30	6	28	0	6	20.0%	21.4%
23210	16	4	16	0	4	25.0%	25.0%
23321	4	2	2	0	2	50.0%	100.0%
23324	31	7	28	0	7	22.6%	25.0%
23420	21	5	18	0	5	23.8%	27.8%
28800	48	10	16	0	10	20.8%	62.5%

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
South							
30101	41	9	16	0	9	22.0%	56.3%
30102	157	32	86	0	32	20.4%	37.2%
30103	189	38	58	0	38	20.1%	65.5%
30110	89	18	39	0	18	20.2%	46.2%
30201	83	17	34	0	17	20.5%	50.0%
30202	146	30	74	0	30	20.5%	40.5%
30203	170	34	43	0	34	20.0%	79.1%
30210	40	8	8	0	8	20.0%	100.0%
30321	81	17	27	0	17	21.0%	63.0%
30322	121	25	67	0	25	20.7%	37.3%
30323	85	17	31	0	17	20.0%	54.8%
30421	204	41	56	0	41	20.1%	73.2%
30422	185	37	74	0	37	20.0%	50.0%
30423	89	18	30	0	18	20.2%	60.0%
31110	30	6	10	0	6	20.0%	60.0%
31210	26	6	14	0	6	23.1%	42.9%
32110	14	3	10	0	3	21.4%	30.0%
32210	17	4	5	0	4	23.5%	80.0%
33800	44	9	11	0	9	20.5%	81.8%
33810	25	5	3	2	3	12.0%	100.0%
38800	22	5	4	1	4	18.2%	100.0%
39920	40	8	4	4	4	10.0%	100.0%
West							
40101	25	5	19	0	5	20.0%	26.3%
40104	194	39	142	0	39	20.1%	27.5%
40110	50	10	33	0	10	20.0%	30.3%
40201	31	7	18	0	7	22.6%	38.9%
40202	77	16	54	0	16	20.8%	29.6%
40203	47	10	16	0	10	21.3%	62.5%
40210	27	6	18	0	6	22.2%	33.3%
40321	40	8	12	0	8	20.0%	66.7%
40324	68	14	28	0	14	20.6%	50.0%
40421	97	20	12	8	12	12.4%	100.0%
40424	81	17	18	0	17	21.0%	94.4%
43800	37	8	4	4	4	10.8%	100.0%
43920	36	8	2	6	2	5.6%	100.0%
48800	34	7	16	0	7	20.6%	43.8%
49810	67	14	35	0	14	20.9%	40.0%

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 the 2008 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 2008 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: o 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. o 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) o CHA is to be notified if more than 50% of their hospitals appear in the NEDS. The 2008 NEDS includes less than one-third 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) o Admission month (AMONTH) is set to missing on all records. • FL: Florida Agency for Health Care Administration o 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 o 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 2008, the median income quartiles are defined as: (1) $1 - $38,999; (2) $39,000 - $48,999; (3) $48,000 - $63,999; and (4) $64,000 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
	CPTCCS1-CPTCCS15	Clinical Classifications Software (CCS) category for all CPT/HCPCS procedures
	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

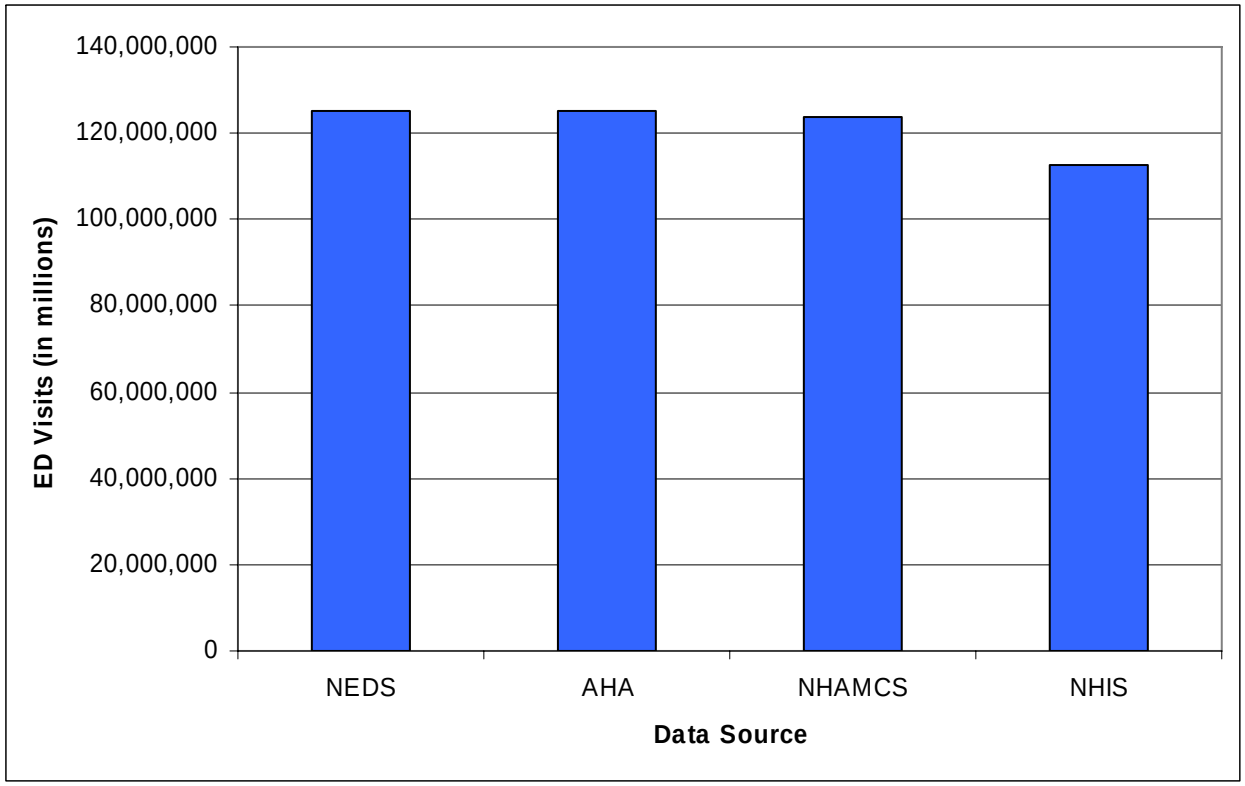
Type of Data Element	HCUP Data Element	Coding Notes
Disposition of patient from the hospital	DISP_IP	Disposition from hospital admission: (1) routine, (2) transfer to short-term hospital, (5) other transfers, including skilled nursing facility, intermediate care, and another type of facility, (6) home 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
	DRG_NoPOA	DRG assignment made without the use of the present on admission flags for the diagnoses
	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 the 2008 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, 2008



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

Table 1. Estimates of ED Visits by U.S. Geographic Region from Five ED Data Sources, 2008

	ED Data Source							
	NEDS[1]		AHA		NHAMCS		NHIS[2]	
ED Visits	N (weighted)	%	N	%	N (weighted)	%	N (weighted)	%
By Census Region								
Northeast	24,479,356	20%	24,479,356	20%	24,529,373	20%	19,525,599	17%
Midwest	29,287,905	23%	29,287,905	23%	27,004,449	22%	28,069,276	25%
South	48,882,866	39%	48,882,866	39%	48,152,979	39%	42,874,956	38%
West	22,295,137	18%	22,295,137	18%	24,074,618	19%	22,386,241	20%
Total U.S.	124,945,264	100%	124,945,264	100%	123,761,419	100%	112,856,071	100%

Notes: ED = emergency department; NEDS = HCUP Nationwide Emergency Department Sample; AHA = American Hospital Association Annual Survey Database; 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, and 13-15). For the upper range of visits in the survey (16 or more ED visits), 16 ED visits were used for the estimate.

Table 2. Estimates of the ED Visits Resulting in Inpatient Admissions (Admission Rate) by U.S. Geographic Region from Two ED Data Sources, 2008

ED Visits Resulting in Inpatient Admissions	ED Data Sources			
	NEDS		NHAMCS	
	N (weighted)	% of all ED Visits	N (weighted)	% of all ED Visits
By Census Region				
Northeast	4,321,481	18%	4,143,928	17%
Midwest	4,040,100	14%	4,066,182	15%
South	7,575,936	15%	5,331,884	11%
West	3,468,584	16%	3,027,783	13%
Total U.S.	19,406,101	16%	16,569,777	13%

Notes: ED = emergency department; NEDS = HCUP Nationwide Emergency Department Sample; NHAMCS = National Hospital Ambulatory Medical Care Survey.

Table 3. Estimates of the Number of Hospital-Based EDs by ED Visit Volume from Three ED Data Sources, 2008

	Data Sources			
	NEDS		AHA	
Volume of ED Visits in 2008	N (weighted)	%	N	%
Less than 10,000 visits	1,358	28%	1,723	35%
10,000 - 19,999 visits	930	19%	908	19%
20,000 - 29,999 visits	733	15%	657	14%
30,000 - 39,999 visits	608	12%	485	10%
40,000 - 49,999 visits	466	10%	350	7%
50,000 or more visits	770	16%	741	15%
All Hospital-based EDs	4,864	100%	4,864	100%

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

Table 4. Estimates of the Number of Injury-Related ED Visits from Three ED Data Sources, 2008

	Data Sources		
	NEDS[1]	NHAMCS[1]	NEISS-AIP[2]
Total number of ED visits for injuries (weighted)	27,430,007	29,657,010	29,953,395

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 non-fatal ED visit with an injury diagnosis of 800-909.2, 909.4, 090.9, 910-994.9, 995.5-995.59, 995.80-995.85. For the NEDS, injuries were identified using the principal diagnosis (DX1) for ED admissions and all diagnoses otherwise.

[2] 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 September 27, 2010.