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) 2017

Please read all documentation carefully.

THE NEDS CONTAINS A FULL YEAR OF ICD-10-CM/PCS CODES BEGINNING WITH DATA YEAR 2016

Beginning with data year 2016, the NEDS includes a full calendar year of data with diagnosis and procedure codes reported using the ICD-10-CM/PCS coding system. Data elements derived from AHRQ software tools are not available for ICD-10-CM/PCS data on the NEDS.

These pages provide an introduction to the 2017 NEDS.

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

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SUMMARY OF DATA USE LIMITATIONS

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

All users of the NEDS must take the online HCUP Data Use Agreement (DUA) training course, and read and sign a Data Use Agreement. [a]

Authorized users of HCUP data agree to the following restrictions:[b]

- Will not use the data for any purpose other than research, analysis, and aggregate statistical reporting.
- Will not re-release any data to unauthorized users.
- Will not redistribute HCUP data by posting on any website or publishing in any other publicly accessible online repository. If a journal or publication requests access to data or analytic files, will cite restrictions on data sharing in the Data Use Agreement and direct them to AHRQ HCUP (www.hcup-us.ahrq.gov) for more information on accessing HCUP data.
- 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 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 (≤10).
- 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 affecting establishments, or to determine rights, benefits, or privileges of individual establishments.
- Will not use the data for criminal and civil litigation, including expert witness testimony or for law enforcement activities.
- 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.[c]

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

[a] The online Data Use Agreement training session and the Data Use Agreement are available on the HCUP-US website at www.hcup-us.ahrq.gov.
[b] This is a summary of key terms of the Data Use Agreement for Nationwide Databases; please refer to the DUA for full terms and conditions.
[c] Suggested citations for the HCUP databases are provided in the Requirements for Publishing with HCUP Data available at www.hcup-us.ahrq.gov/db/publishing.jsp.

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 online DUA training course is available at:
www.hcup-us.ahrq.gov/tech_assist/dua.jsp.

The HCUP Nationwide Data Use Agreement is available on the AHRQ-sponsored HCUP-US website at: 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, current orders, training certificate codes, or invoices, if your questions are not covered in the Purchasing FAQs on the Online HCUP Central Distributor website.

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

Phone: (866) 556-HCUP (4287) (toll free)
Email: HCUPDistributor@AHRQ.gov
Fax: (866) 792-5313 (toll free in the United States)

Mailing address:
HCUP Central Distributor
Social & Scientific Systems, Inc.
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Silver Spring, MD 20910

HCUP User Support

Information about the content of the HCUP databases and Requirements for Publishing with HCUP Data is available on the HCUP-US website (www.hcup-us.ahrq.gov). For questions about using the HCUP databases, software tools, supplemental files, and other HCUP products, or about data use restrictions and publishing with the data, please review the HCUP Frequently Asked Questions or contact HCUP User Support:

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

Phone: (866) 290-HCUP (4287) (toll free)
Email: hcup@ahrq.gov

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.

- There are 37 HCUP Partner organizations that contributed to the 2017 NEDS: AR, AZ, CA, CO, CT, DC, FL, GA, IA, IL, IN, KS, KY, MA, MD, ME, MN, MO, MS, MT, NC, ND, NE, NJ, NV, NY, OH, OR, RI, SC, SD, TN, TX, UT, VT, WI, and WY. These States are geographically dispersed and account for 80.9 percent of the total U.S. resident population and 79.2 percent of all U.S. ED visits.

- Unweighted, the NEDS contains data from 33.5 million ED visits in 2017. Weighted, the 2017 NEDS describes 145 million ED visits. 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. The NEDS is an exceptional resource for conducting research on high-profile emergent health delivery issues.

- The NEDS is a publicly available database that can be purchased through the HCUP Central Distributor. Annual data files are available from 2006 to 2017.

- Users must complete the HCUP Data Use Agreement Training Course prior to receiving the data.

WHAT'S NEW IN THE 2017 NEDS?

- Beginning with the 2017 NEDS, two data elements that identify whether the ED visit was related to an initial injury encounter based on ICD-10-CM diagnoses have been added.
    - Whether an ICD-10-CM injury diagnosis for an initial encounter was reported on the record (HCUP data element I10_INJURY)
    - Whether more than one ICD-10-CM injury diagnoses for an initial encounter were reported on the record (HCUP data element I10_MULTINJURY)

- Beginning with the 2017 NEDS, separate data elements for external cause diagnosis codes are discontinued (formerly HCUP data elements I10_ECAUSEn). External cause codes are now included at the end of the ICD-10-CM diagnosis array (HCUP data elements I10_DXn). The length of the diagnosis array has been increased from 30 to 35 codes to accommodate this change. Also, the length of the ICD-10-PCS procedure array has increased from 9 to 15 codes, and the length of the CPT procedure array has increased from 15 to 35 codes.

UNDERSTANDING THE NEDS

- This document, *Introduction to the NEDS, 2017,* summarizes the content of the NEDS and describes the development of the 2017 NEDS sample and weights.

- Important considerations for data analysis are provided along with references detailed reports.

- In-depth documentation for the NEDS is available on the HCUP-US website (www.hcup-us.ahrq.gov/db/nation/neds/nedsdbdocumentation.jsp). Please refer to the detailed documentation before using the data.

- The coding system used to report diagnoses and *inpatient* procedures has changed over time (while the coding of ED procedures continues to use CPT codes):
    - Beginning with data year 2016, the NEDS includes a full calendar year of data with diagnosis and inpatient procedure codes reported using the ICD-10-CM/PCS coding system.
    - In data year 2015, the first nine months of NEDS contains ICD-9-CM codes and the last three months contain ICD-10-CM/PCS codes.
    - In data year 2014 and prior years, the NEDS contains ICD-9-CM diagnosis and procedure codes.

- The HCUP-US website has a section on ICD-10-CM/PCS Resources that summarizes key issues for researchers using HCUP and other administrative databases that include ICD-9-CM and ICD-10-CM/PCS coding. The web page provides general guidance and forewarning to users analyzing outcomes that may be affected by the transition to the ICD-10-CM/PCS coding system and lists other related web resources.

HCUP NATIONWIDE EMERGENCY DEPARTMENT SAMPLE (NEDS)

ABSTRACT

The Nationwide Emergency Department Sample (NEDS) is part of the Healthcare Cost and Utilization Project (HCUP) that is sponsored by the Agency for Healthcare Research and Quality (AHRQ).

The NEDS was created to enable analyses of emergency department (ED) utilization patterns and to support research, 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 percent of inpatient hospital admissions and as a setting for treat-and-release outpatient visits.[1] The NEDS has many research applications, because it contains information about geographic, hospital, and patient characteristics as well as descriptions of the nature of the visits (i.e., 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 33.5 million ED visits at 984 hospitals that approximate a 20-percent stratified sample of U.S. hospital-owned EDs. Weights are provided to calculate national and encounter-level estimates representing about 145 million ED visits in the United States in 2017.

The NEDS is made possible by the voluntary participation of statewide data organizations that provide HCUP with data from ED visits that may or may not have resulted in hospital admission. Thirty-seven HCUP Partner organizations participated in the 2017 NEDS. See Appendix A, Table A.1 for a list of HCUP Partner organizations participating in the NEDS.

By stratifying on important hospital characteristics, the NEDS is designed to be representative of U.S. hospital-owned EDs. Stratified sampling is based on the following five hospital characteristics:

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

Because ICD-10-CM/PCS was introduced October 1, 2015, trends that rely on diagnosis and procedures may be interrupted. Analyses that do not rely on diagnosis and procedure coding should not be affected.

[1] Merrill, C. T. and Owens, P. L. (2007). Hospital Admissions That Began in the Emergency Department for Children and Adolescents, 2004. HCUP Statistical Brief #32. June 2007. Agency for Healthcare Research and Quality, Rockville, MD. Retrieved June 9, 2008 from www.hcup-us.ahrq.gov/reports/statbriefs/sb32.pdf

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-US website at www.hcup-us.ahrq.gov/db/nation/neds/nedsdbdocumentation.jsp.

INTRODUCTION TO THE 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 to support research, 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 percent of inpatient hospital admissions and as a setting for treat-and-release outpatient visits.[2] The NEDS has many research applications, because it contains information about geographic, hospital, and patient characteristics as well as the nature of visits (e.g., common reasons for ED visits, acute and chronic conditions, and injuries).

NEDS Data Sources, Hospitals, and ED Visits

The number of States, hospital-owned EDs, and ED visits included in the NEDS varies by year (Table 1). The specific HCUP Partner organizations that contribute to the NEDS are identified in Appendix A, Table A.1.

Table 1. Number of States, Hospital-Owned Emergency Departments, and Records in the NEDS by Year

Data Year	HCUP States in the NEDS	Number of Hospital-Owned EDs	Number of ED Visits, Unweighted	Number of ED Visits, Weighted for National Estimates
2017	AR, AZ, CA, CO, CT, DC, FL, GA, IA, IL, IN, KS, KY, MA, MD, ME, MN, MO, MS, MT, NC, ND, NE, NJ, NV, NY, OH, OR, RI, SC, SD, TN, TX, UT, VT, WI, and WY (Added CO; HI data were not available)	984	33,506,645	144,814,803
2016	AR, AZ, CA, CT, DC, FL, GA, HI, IA, IL, IN, KS, KY, MA, MD, ME, MN, MO, MS, MT, NC, ND, NE, NJ, NV, NY, OH, OR, RI, SC, SD, TN, TX, UT, VT, WI, and WY (Added OR and MS)	953	32,680,232	144,842,742
2015	AR, AZ, CA, CT, DC, FL, GA, HI, IA, IL, IN, KS, KY, MA, MD, ME, MN, MO, MT, NC, ND, NE, NJ, NV, NY, OH, RI, SC, SD, TN, TX, UT, VT, WI, and WY (Added TX)	953	31,465,407	143,469,670

[2] Merrill, C. T. and Owens, P. L. (2007). Hospital Admissions That Began in the Emergency Department for Children and Adolescents, 2004. HCUP Statistical Brief #32. June 2007. Agency for Healthcare Research and Quality, Rockville, MD. Retrieved June 9, 2008 from www.hcup-us.ahrq.gov/reports/statbriefs/sb32.pdf

Data Year	HCUP States in the NEDS	Number of Hospital-Owned EDs	Number of ED Visits, Unweighted	Number of ED Visits, Weighted for National Estimates
2014	AR, AZ, CA, CT, DC, FL, GA, HI, IA, IN, KS, KY, IL, MA, MD, ME, MN, MO, MT, NC, ND, NE, NJ, NV, NY, OH, RI, SC, SD, TN, UT, VT, WI, and WY (Added DC, MT, and WY)	945	31,026,417	137,807,901
2013	AR, AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, IL, MA, MD, MN, MO, NC, ND, NE, NJ, NV, NY, OH, RI, SC, SD, TN, UT, VT, and WI (Added AR; ME data were not available)	947	29,581,718	134,869,015
2012	AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, IL, MA, MD, ME, MN, MO, NC, ND, NE, NJ, NV, NY, OH, RI, SC, SD, TN, UT, VT, and WI	950	31,091,029	134,399,179
2011	AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, IL, MA, MD, ME, MN, MO, NC, ND, NE, NJ, NV, NY, OH, RI, SC, SD, TN, UT, VT, and WI (Added ND; NH data were not available)	951	29,421,411	131,048,605
2010	AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, IL, MA, MD, MN, MO, NC, NE, NJ, NV, NY, OH, RI, SC, SD, TN, UT, VT, and WI (Added NV; ME and NH data were not available)	961	28,584,301	128,970,364
2009	AZ, CA, CT, FL, GA, HI, IA, IN, KS, KY, IL, MA, MD, ME, MN, MO, NC, NE, NH, NJ, NY, OH, RI, SC, SD, TN, UT, VT, and WI (Added IL)	964	28,861,047	128,885,040
2008	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 (Added KY)	980	28,447,148	124,945,264
2007	AZ, CA, CT, FL, GA, HI, IA, IN, KS, MA, MD, ME, MN, MO, NC, NE, NH, NJ, NY, OH, RI, SC, SD, TN, UT, VT, and WI (Added NC, NY, RI)	966	26,627,923	122,331,739
2006	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	955	25,702,597	120,033,570

Appendix A, Figure A.1 represents the geographic distribution of the 37 HCUP Partner organizations participating in the 2017 NEDS. Based on U.S. Census Bureau data, the HCUP NEDS States with the District of Columbia account for 80.9 percent of the U.S. population in 2017. The 37 Partner organizations account for 79.2 percent of the ED visits reported in the 2017 American Hospital Association (AHA) Annual Survey Database. Details on the percentage of population and ED visits by region are provided in Appendix A, Table A.2.

Identification of HCUP Records with Emergency Department Services

Records for ED events are contained in two existing HCUP databases:

- State Emergency Department Databases (SEDD) capture discharge information on all ED visits that do not result in an admission to that hospital (e.g., treat-and-release visits, transfers to another hospital, deaths).
- 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 data elements that are defined in a uniform scheme for all patients, regardless of payer. This scheme makes 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. Differing methods are used by HCUP Partner organizations for identifying ED records. The HCUP criteria for identifying an ED record (i.e., a discharge record for a patient with an ED event) look for at least one of the following conditions to be true:

- Revenue center code of 450-459 reported on discharge record, indicating ED services.
- ED charge greater than zero dollars, when revenue center codes were not available.
- Physicians' Current Procedural Terminology (CPT) code of 99281-99285 reported on discharge record, indicating ED physician services.
- ED identified by admission source (National Uniform Billing Committee (NUBC) preferred coding prior to October 1, 2007), point of origin (NUBC preferred coding from October 1, 2007 to June 30, 2010), or condition code of P7 (NUBC preferred coding for public reporting as of July 1, 2010). These criteria are used primarily for ED admissions.

Five of the 37 HCUP Partner organizations (AR, AZ, CA, MA, and MS) provided a source file that contained only ED treat-and-release records. Because the data source provided a dedicated outpatient ED file, all of the SEDD records were considered to be ED records, even though information may not have been available to determine if HCUP criteria were met.

Partner-Specific Restrictions

Some HCUP Partner organizations 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 Partner-

specific restrictions is available in Appendix B.

ICD-10-CM/PCS Started October 1, 2015 at the Beginning of Fiscal Year 2016

On October 1, 2015, the United States transitioned from using ICD-9-CM to ICD-10-CM/PCS code sets for reporting medical diagnoses and inpatient procedures.[3] ICD-10-CM/PCS consists of two parts:

- ICD-10-CM: diagnosis coding on inpatient and outpatient data
- ICD-10-PCS: procedure coding on inpatient data.

The HCUP-US website has a section on ICD-10-CM/PCS Resources that summarizes key issues for researchers using HCUP and other administrative databases that include ICD-9-CM and ICD-10-CM/PCS coding. The web page provides general guidance and forewarning to users analyzing outcomes that may be affected by the transition to the ICD-10-CM/PCS coding system and lists other related web resources.

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 types of files:

- **Core File:** This file contains records for 100 percent of the ED visits – whether resulting in admission or not – from the sample of hospitals in participating States and the District of Columbia.
    - This file is available in all years of the NEDS.
- **Supplemental ED File:** This file contains additional information for patients who were treated in the ED and not admitted directly to the hospital (e.g., released home, transferred, etc.). This information came from the SEDD.
    - This file is available in all years of the NEDS.
    - The unique NEDS record identifier (KEY_ED) provides the linkage between the NEDS Core File and the Supplemental ED File. For patients seen in the ED and admitted to the same hospital (SID records), information about the stay is contained in the Supplemental Inpatient File.
- **Supplemental Inpatient File:** This file contains data elements that are specific to the inpatient stay, such as total charges, length of inpatient stay, and procedure codes 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.
    - This file is available in all years of the NEDS.
    - The unique NEDS record identifier (KEY_ED) provides the linkage between the NEDS Core File and the Supplemental Inpatient File.
- **Hospital Weights File:** This file contains one observation for each hospital-owned ED included in the NEDS and contains weights and variance estimation data elements. The unit of observation is the *ED*.

[3] ICD-10-CM/PCS: International Classification of Diseases, Tenth Revision, Clinical Modification/Procedure Coding System

- This file is available for all years of the NEDS.
- The HCUP ED hospital identifier (HOSP_ED) provides the linkage between the NEDS Core File and the Hospital Weights File.

File Structure of the NEDS Beginning Data Year 2016

Beginning with data year 2016, the NEDS is an annual, calendar year file that includes data with diagnosis and inpatient procedure codes reported using the ICD-10-CM/PCS coding system. The file structure of the NEDS is similar to the file structure of the NEDS prior to 2015.

Data elements based on the AHRQ software tools that are derived from ICD-10-CM/PCS codes are not available. For users interested in applying the AHRQ software tools to the ICD-10-CM/PCS data, the AHRQ software tools are available for download on the HCUP Tools & Software section of the HCUP-US website. The *Tools Loading* tutorial is available to users interested in applying the AHRQ software tools at www.hcup-us.ahrq.gov/tech_assist/tutorials.jsp.

File Structure of the 2015 NEDS

The NEDS data files are annual, calendar-year files based on discharge date for all years except 2015. The introduction of ICD-10-CM/PCS in the United States on October 1, 2015 means that the 2015 NEDS includes a combination of codes:

- Nine months of the data with ICD-9-CM codes (January 1, 2015 to September 30, 2015)
- Three months of data with ICD-10-CM/PCS codes (October 1, 2015 to December 31, 2015).

To alert users to this change in the ICD coding scheme, the file structure of the 2015 NEDS differs from the annual files for other data years in three primary ways:

- The names of diagnosis- and procedure-related data elements under ICD-10-CM/PCS have been changed to identify the coding scheme with a prefix of “I10_”.
- Diagnoses and procedures, and related data elements, have been moved out of the Core File and into Supplemental ED and Inpatient Files where the first three quarters of data (with ICD-9-CM codes) are stored separately from the fourth quarter of data (with ICD-10-CM/PCS codes).
- Data elements based on the AHRQ software tools that are derived from ICD-10-CM/PCS codes are not included in the fourth quarter data.

More information about the file structure of the 2015 NEDS is available in the Introduction to the NEDS, 2015, and on HCUP-US website at www.hcup-us.ahrq.gov/db/nation/neds/nedsdbdocumentation.jsp.

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-US website at: www.hcup-us.ahrq.gov/db/coding.jsp.

After analyzing the availability of information from the HCUP Partner organizations, 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:

- Patient demographics (e.g., sex, 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.)
- ICD-9-CM diagnoses and external cause of injury codes (prior to October 1, 2015) and ICD-10-CM diagnoses and external cause of morbidity codes (starting October 1, 2015 at the beginning of fiscal year 2016).
- Identification of injury-related ED visits and, for ICD-9-CM data only, the mechanism, intent, and severity of the injury
- ICD-9-CM, ICD-10-PCS, and CPT procedure codes
- ED charges and total hospital charges for patients admitted as an inpatient through the ED.

Appendix C identifies the data elements in each NEDS file:

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

The tables in Appendix C provide summary documentation for the data. Please refer to the NEDS documentation on the HCUP-US website (www.hcup-us.ahrq.gov/db/nation/neds/nedsdde.jsp) for comprehensive information about the data elements.

Getting Started

The HCUP NEDS is distributed as comma-separated value (CSV) files delivered via secure digital download from the Online HCUP Central Distributor. The files are compressed and encrypted with SecureZIP® from PKWARE.

The NEDS product is downloaded in a single zipped file for each year which contains several data-related files and accompanying documentation. The four data-related files include the following compressed files:

1) Core File (NEDS_2017_Core.zip)
2) Hospital Weights File (NEDS_2017_Hospital.zip)
3) Supplemental ED File (NEDS_2017_ED.zip)
4) Supplemental Inpatient File (NEDS_2017_IP.zip).

To load and analyze the NEDS data on a computer, users will need the following:

- The password provided by the HCUP Central Distributor
- A hard drive with 50 to 100 gigabytes (GB) of space available
- A third-party zip utility such as ZIP Reader, SecureZIP®, WinZip®, or Stuffit Expander®
- SAS®, SPSS®, Stata® or similar analysis software.

The total size of the CSV version of the NEDS is12 GB. The NEDS files loaded into SAS are about 10 GB. In SAS, the largest use of space typically occurs during PROC SORT, which requires work space about three times the size of the file. Thus, the NEDS files would require at least 30 GB of available workspace to perform a sort procedure. 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 27 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 data elements. More details are provided in the Stata load programs.

With a file of this size and without careful planning, space could easily become a problem in a multi-step program. It is not unusual to have several versions of a file marking different steps while preparing it for analysis, and there may be more versions for the actual analyses. Therefore, the amount of space required could escalate rapidly.

Decompressing the NEDS Files

To extract the data files from the compressed download file, follow these steps:

1) Create a directory for the NEDS on your hard drive.

2) Unzip the compressed NEDS product file into the new directory using a third-party zip utility. This will place four compressed, encrypted data-related files in the new directory. You will be prompted to enter the encryption password (sent separately by email) to decrypt the file.

   Please note that attempts to unzip encrypted files using the built-in zip utility in Windows® (Windows Explorer) or Macintosh® (Archive Utility) will produce an error message

warning of incorrect password and/or file or folder errors. The solution is to use a third-party zip utility.

Third-party zip utilities are available from the following reputable vendors on their official websites.

- ZIP Reader (Windows) (free download offered by the PKWARE corporation)
- SecureZIP® for Mac or Windows (free evaluation and licensed/fee software offered by the PKWARE corporation)
- WinZip (Windows) (evaluation and fee versions offered by the WinZip corporation)
- Stuffit Expander® (Mac) (free evaluation and licensed/fee software offered by Smith Micro corporation)

3) Unzip each of the compressed, encrypted data-related files using the same password and third-party zip utility method. This will place the data-related CSV files in this same directory by default.

Downloading and Running the Load Programs

Programs to load the data into SAS, SPSS, or Stata, are available on the HCUP-US website. To download and run the load programs, follow these steps:

1) Go to the NEDS Database Documentation page on HCUP-US at www.hcup-us.ahrq.gov/db/nation/neds/nedsdbdocumentation.jsp.
2) Go to the "File Specifications and Load Programs" section on this page.
3) Click on "Nationwide SAS Load Programs", "Nationwide SPSS Load Programs", or "Nationwide Stata Load Programs" to go to the corresponding Load Programs page.
4) Select the data year and the database ("NEDS") from the drop down lists on this page. Or you may select "NEDS Load All Years" to obtain a zipped file with all load programs for multiple years at once.
5) Select and save the load programs you need. **The load programs are specific to the data year and data-related file**. For example, the load program for the 2017 NEDS Core file is found under the link "SAS NEDS 2017 Core File" in the list generated by selecting "2017" and "NEDS." Save the load programs into the same directory as the NEDS CSV files on your computer.
6) Edit and run the load programs as appropriate for your computing environment to create the analysis files. For example, modify the directory paths to point to the location of your input and output files.

NEDS Documentation

Comprehensive documentation for the NEDS files is available on the HCUP -US website (www.hcup-us.ahrq.gov/db/nation/neds/nedsdbdocumentation.jsp). 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. These important resources help the user understand the structure and content of the NEDS and aid in using the database. Appendix A, Table A.3 details the comprehensive NEDS documentation available on HCUP-US.

HCUP Online Tutorials

For additional assistance, AHRQ has created the HCUP Online Tutorial Series, a series of free, interactive courses that provide information on using HCUP data and tools and training on technical methods for conducting research with HCUP data. Topics include an HCUP Overview Course and these tutorials:

- The Load and Check HCUP Data tutorial provides instructions on how to unzip (decompress) HCUP data, save it on your computer, and load the data into a standard statistical software package. This tutorial also describes how to verify that the data have loaded correctly.
- The HCUP Tools Loading Tutorial provides instructions on how to unzip (decompress) the HCUP Software Tools for ICD-10-CM/PCS, save it on the computer, and load the Tool into a standard statistical software package for application to HCUP or other administrative databases. Users will also learn how to verify that the Tool has loaded correctly. Information about the transition to ICD-10-CM/PCS is also included in this tutorial. While the instructions are specific to the Clinical Classifications Software (CCS) for ICD-10-CM/PCS, the steps are broadly applicable to other HCUP Tools.
- The HCUP Sampling Design tutorial is designed to help users learn how to account for sample design in their work with HCUP nationwide databases.
- The Producing National HCUP Estimates tutorial is designed to help users understand how three of the nationwide databases – the NIS, NEDS, and KID – can be used to produce national and regional estimates.
- The Calculating Standard Errors tutorial shows how to accurately determine the precision of the estimates produced from the HCUP nationwide databases. Users will learn two methods for calculating standard errors for estimates produced from the HCUP nationwide databases.
- The Multi-year Analysis tutorial presents solutions that may be necessary when conducting analyses that span multiple years of HCUP data.

New tutorials are added periodically. The Online Tutorial Series is located on the HCUP-US website at www.hcup-us.ahrq.gov/tech_assist/tutorials.jsp.

SAMPLING DESIGN OF THE NEDS

The NEDS is built using a 20 percent stratified sample of hospital-owned EDs in the United States. The main objective of a stratified sample is to ensure that it 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-owned EDs selected.

Universe of Hospital-Owned Emergency Departments

A feasibility study performed in 2008 assessed several possible data sources for the universe of hospital-owned EDs in the United States: the American Hospital Association (AHA) Annual Survey Database (Health Forum, LLC © 2007); Verispan, LLC databases (now called IMS Health, Inc.); and the Centers for Medicare and Medicaid (CMS) Hospital Cost Reports. The AHA Annual Survey Database has the best data to apply for a couple of reasons. First, the AHA data provide the necessary hospital characteristics, such as ownership type and teaching status, and also report total ED visits for hospitals. Second, the crosswalk linkage from the HCUP databases to the AHA data is already established. The universe of hospital-owned EDs is therefore defined as the AHA community, nonrehabilitation hospitals that reported total ED visits. The AHA defines community hospitals as "all non-Federal, short-term, general, and other specialty hospitals open to the public".[4] Included among community hospitals are pediatric institutions, public hospitals, and academic medical centers.

Sampling Frame of the NEDS

The sampling frame of the NEDS is limited to a subset of the universe: hospital-owned EDs in the States and District of Columbia for which HCUP ED data (SID and SEDD) are available. The list of hospital-owned EDs in the frame consists of all AHA community, nonrehabilitation hospitals that report total ED visits in each of the frame States and District of Columbia *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 was 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 A, Table A.4.

[4] More of the AHA "community hospital designation" is available at www.ahadataviewer.com/glossary.

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 A, Figure A.1 shows the NEDS States by region.

Trauma Centers

A trauma center is a hospital that is equipped to provide comprehensive emergency medical services 24 hours a day, 365 days per year to patients with traumatic injuries. In 1976, the American College of Surgeons Committee on Trauma (ACS/COT) defined five levels of trauma centers:[5]

- Level I centers have comprehensive resources, are able to care for the most severely injured, and provide leadership in education and research.
- Level II centers have comprehensive resources and are able to care for the most severely injured, but do not 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/V centers provide trauma support in remote areas in which no higher level of care is available. These centers resuscitate and stabilize patients and arrange transfer to an appropriate trauma facility.

The ACS/COT has a program that verifies hospitals as trauma level I, II, or III.[6] It is important to note that although all level I, II, and III trauma centers offer a high level of trauma care, there may be differences in the specific services and resources offered by hospitals of different levels. Trauma levels IV and V are designated at the State level (and not by ACS/COT) with varying criteria applied across States.

The level of the trauma centers in the NEDS was identified using the Trauma Information Exchange Program (TIEP) database, a national inventory of trauma centers in the U.S collected by the American Trauma Society.[7] The TIEP database identifies all U.S. trauma centers that are level I, II, and III that treat both adults and children. TIEP includes some information on trauma centers within children's hospitals, but this is not their focus. To ensure that all of trauma centers are identified for the NEDS, the ACS/COT list of trauma centers and all State-specific websites on emergency services are reviewed to identify any additional trauma centers within children's hospitals and their associated trauma levels.

The stratum for trauma center in the NEDS was limited to trauma levels I, II, and III. Level IV and V centers were not included because the criteria for designation varied across States. For hospital confidentiality purposes, a collapsed stratification was necessary if the strata size in the universe or frame was less than two hospitals. The grouping of trauma centers into collapsed categories varied by data year:

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[5] MacKenzie EJ, Hoyt DB, Sacra JC, et al. National inventory of hospital trauma centers. *JAMA.* 2003;289:1515-1522.

[6] American College of Surgeons Committee on Trauma, Verification, Review, and Consultation Program for Hospitals. Additional details are available at www.facs.org/quality-programs/trauma/vrc. Accessed September 2018.

[7] American Trauma Society. Trauma Information Exchange Program. Available at: www.amtrauma.org/?page=TIEP. Accessed December 2019.

- Trauma centers levels I and II could be grouped together in all years of the NEDS
- Trauma levels I through level III could be grouped together in the 2006-2010 NEDS
- Trauma level III could be grouped with nontrauma hospitals beginning in the 2011 NEDS.

The change between the 2010 and 2011 NEDS was prompted by differences between injury-related services provided by trauma level I and II centers versus injury-related services provided by trauma level III centers. Services at trauma level III centers were more similar to nontrauma hospitals.

Urban-Rural Location of the ED

The urban-rural location of hospital-owned EDs was determined based on the county in which the hospital was located. The categorization is based on Urban Influence Codes (UIC).[8] Starting in the 2014 NEDS, the categorization is a simplified adaptation of the 2013 version of the UIC. Prior to 2014, the categorization is a simplified adaptation of the 2003 version of the UIC. The twelve detailed UIC categories 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), non-metropolitan (micropolitan and non-urban residual), small metropolitan and micropolitan,[9] or all areas[10] was necessary.

Teaching Status

A hospital-owned ED is considered a teaching hospital if it has one or more Accreditation Council for Graduate Medical Education (ACGME) 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 .25 or higher. Beginning with the 2014 NEDS, there is an increase in the number of hospitals identified as teaching facilities because the AHA Annual Survey showed an increase in facilities with approved residency programs. About this time, the ACGME became the primary organization for residency training approval. Because there are very few teaching hospitals in micropolitan and rural areas, teaching status was only used to stratify EDs in metropolitan areas.

[8] United States Department of Agriculture Economic Research Service (www.ers.usda.gov/data-products/urban-influence-codes.aspx)
[9] The collapsing of small metropolitan and micropolitan areas was required in the South in 2011–2015.
[10] The collapsing of all areas was required in the South in 2014.

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; the voluntary, non-profit and proprietary/for-profit hospitals were 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-owned EDs and ED visits. Hospital-level weights were developed to extrapolate NEDS sample EDs to the universe of hospital-owned 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 after sampling and by strata. Hospital-owned 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-owned 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 percent of the hospitals in each stratum were sampled when possible, the ED weights were usually near five.

Discharge Weights

Discharge weights to the universe were calculated after sampling and by strata. Hospital-owned 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:

$$DISCWT = DWi_s(universe) = [DN_s(universe) \div ADN_s(sample)] * (4 \div Qi)$$

where $DWi_s(universe)$ was the discharge weight; $DN_s(universe)$ represented the number of ED

visits from community, nonrehabilitation 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: (1) community, nonrehabilitation hospital-owned EDs in the United States that were included in the 2017 AHA Annual Survey Database, and (2) 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-owned ED events from community, nonrehabilitation hospitals in the 37 HCUP Partner organizations that provided discharge abstracts on patients admitted to the hospital through the ED and on 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 percent of their ED visits resulting in admission. Appendix A, Table A.5 lists the final target universe and sampling frame for the NEDS.

The NEDS is a stratified probability sample of hospital-owned EDs in the frame. Sampling probabilities were calculated to select 20 percent of the universe contained in each stratum, which was 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 percent sample contains about 30 million records. A 20 percent sample also enables the user to split the NEDS into two 10 percent subsamples for estimation and validation of models.

Using the universe of U.S. hospital-owned 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. Prior to sampling, the list of frame hospitals within each stratum is sorted as follows to ensure geographic representation within strata: (1) sorted by the first three digits of the hospital's ZIP Code and (2) sorted by a random number within the three-digit ZIP Code.[11] After stratifying and sorting the frame hospitals, a random sample of up to 20 percent of the total number of hospital-owned EDs in the U.S. was selected within each stratum. A stratum with a shortfall was defined as having an insufficient number of EDs in the frame to meet the threshold of 20 percent of the universe for that stratum. In strata with shortfalls, the sampling rate from the universe was less than 20 percent and all possible EDs in the frame were selected for the NEDS. In contrast, the sampling rate is larger than 20 percent in some strata because protecting hospital confidentiality required a minimum of two sampled EDs in each stratum. Appendix A, Table A.6 lists the sampling rates by stratum for the NEDS.

[11] The ZIP Code of the hospital is not included in the NEDS data files.

HOW TO USE THE NEDS FOR DATA ANALYSIS

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

All persons using the NEDS (whether or not they are the original recipient of the data) must complete the on-line Data Use Agreement Training Course available on the HCUP-US website (www.hcup-us.ahrq.gov/tech_assist/dua.jsp) and then read and sign a Data Use Agreement. A copy of the signed Data Use Agreements must be sent to the HCUP Central Distributor.

Limitations of the NEDS

The NEDS contains over 30 million ED records and over 100 clinical and non-clinical data elements. A multitude of research studies can be conducted with the data, but there are some limitations.

- The NEDS is an extremely large database that requires sophisticated, statistical software for analysis and 50 to 100 GB of available computer space. The CSV version of the 2017 NEDS is 12 GB. When loaded into statistical software such as SAS or SPSS, the file size generally will increase.
- In 2017, about 13 percent of all ED visits (weighted) are missing information about ED charges. For ED visits that result in admission, 24 percent of records are missing ED charges. For ED visits that do not result in admissions, 11 percent 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 encounter-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 would allow a patient-level analysis to identify individuals with more than one ED visit. In contrast, some 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 an ED to another ED, there would be two discharge records—one from the "transfer out" hospital and one from the receiving hospital. However, both of these records will be included in the NEDS only if both hospitals were selected for inclusion in the NEDS sample. It is possible that only one of these two records will be included in the NEDS, if only one of the hospitals was sampled. This type of transfer (from an ED to another ED or acute care hospital) only occurs in about 1.5 percent of the NEDS records.
- 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.
- The reporting of outpatient surgery records that originate care in the ED (e.g., fracture and dislocation procedures, appendectomies, etc.) can vary by State. These types of events are captured in the NEDS if they are included in the SEDD.

- For hospital confidentiality purposes, trauma hospitals were grouped together in the HCUP data element HOSP_TRAUMA: trauma levels I and II (in all years of the NEDS), trauma levels I through III (in the 2006-2010 NEDS), and trauma level III and nontrauma (beginning in the 2011 NEDS). This protects hospital identification and limits the analyses that can be performed by individual levels of trauma centers, but does allow the general distinction of trauma versus nontrauma facilities.
- 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 and the District of Columbia are not identified in the NEDS.

Identifying Different Types of ED Events

The HCUP data element *ED event* distinguishes among the different types of ED events. Appendix A, Table A.7 provides the number and percentage of records in the 2017 NEDS for each of the five ED event types.

Calculating National Estimates

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-owned 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 HCUP Methods Series report #2003-02 *Calculating Nationwide Inpatient Sample Variances* on the HCUP-US website (www.hcup-us.ahrq.gov/). The HCUP Nationwide Inpatient Sample (NIS) prior to 2012 used stratified sample design similar to the NEDS, so techniques appropriate for the NIS prior to 2012 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 D. Also included in Appendix D are comparable estimates from other ED data sources. For example, the National Hospital Ambulatory Medical Care Survey (NHAMCS) has an ED component and published 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 (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, ED visits and ambulatory surgeries. 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, the user should first perform descriptive statistics and examine the range of values, including number of missing cases. Summary statistics are available on the HCUP-US website under Database Documentation for the NEDS (www.hcup-us.ahrq.gov/db/nation/neds/nedssummstats.jsp). When anomalies (such as large numbers of missing cases) are detected, descriptive statistics can be performed by region for that variable to determine whether or not 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 and ICD-10-CM/PCS Diagnosis and Procedure Codes and CPT Procedure Codes

- The HCUP-US website has a section on ICD-10-CM/PCS Resources that summarizes key issues for researchers using HCUP and other administrative databases that include ICD-9-CM and ICD-10-CM/PCS coding. The web page provides general guidance and forewarning to users analyzing outcomes that may be affected by the transition to the ICD-10-CM/PCS coding system and lists other related web resources.
- The meaning of the first listed diagnosis (DX1) differs based on the type of ED visit. Please refer to the HCUP Methods Series Report on the Meaning of the First-Listed Diagnosis on Emergency Department and Ambulatory Surgery Records.[12] Diagnoses reported on an inpatient admission from the ED may be from both the ED and inpatient hospital settings. It may be useful to compare diagnostic-specific ED visits that do not result in hospitalization to those resulting in hospitalization.
- The NEDS include ICD-9-CM diagnosis and procedure codes on inpatient discharges prior to October 1, 2015. Starting on October 1, 2015, diagnosis and procedure codes are reported using ICD-10-CM/PCS. HCUP has developed recommendations for reporting statistics (e.g., counts, rates, averages) that are based on HCUP data with a mixture of ICD-9-CM and ICD-10-CM/PCS codes. These recommendations apply to calendar year 2015 data (which includes both ICD-9-CM and ICD-10-CM/PCS codes), as well as reporting trends that span the October 1, 2015 transition date (before and after the introduction of ICD10-CM/PCS).
- ICD-9-CM and ICD-10-CM diagnosis and ICD-10-PCS procedure codes provide valuable insights into the reasons for hospitalization and what procedures patients receive, but these codes need to be carefully used and interpreted. ICD-9-CM and ICD-10-CM/PCS codes change every October as new codes are introduced and some codes are retired. It is critical to check all ICD-9-CM and/or ICD-10-CM/PCS codes used for analysis to ensure the codes are in effect during the time period studied.
- The NEDS contains fields for up to 35 diagnoses starting in data year 2017 (30 diagnoses for data years 2014 through 2016; and 15 diagnoses prior to 2014), and E codes are now included at the end of the ICD-10-CM diagnosis array (prior to data year 2017, four E codes per ED record were included as a separate array). Some States provide more than the maximum code fields retained on the NEDS. To reduce the file size of the NEDS, the

[12] This HCUP Methods Series report is available at www.hcup-us.ahrq.gov/reports/methods/2011_03.pdf.

number of codes retained was limited. Less than one percent of all ED records report more fields than the maximum allowed on the NEDS.

- The NEDS contains fields for up to 15 ICD-9-CM or ICD-10-PCS procedures (nine prior to data year 2017) and 35 CPT procedures per ED record (15 prior to data year 2017), although 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 one percent of all ED records report more fields than the maximum allowed on the NEDS.

- The collection and reporting of external cause of injury (E codes under ICD-9-CM) and external cause of morbidity (V, W, X, and Y codes under ICD-10-CM) also varies across hospitals depending on the presence of State laws or mandates for the collection of these codes. Some States do not require hospitals to report codes for "misadventures to patients during surgical and medical care" (codes E870-E879 under ICD-9-CM) which means that these occurrences will be underreported. Beginning with the 2017 NEDS, separate data elements for external cause diagnosis codes are discontinued (formerly HCUP data elements I10_ECAUSEn). External cause codes are now included at the end of the ICD-10-CM diagnosis array. The length of the diagnosis array has increased from 30 to 35 codes to accommodate this change.

Missing Values

Missing data values can compromise the quality of estimates. For example, 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-owned 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 detailed instructions, refer to the HCUP Methods Series report #2003-02 *Calculating Nationwide Inpatient Sample Variances* on the HCUP-US website (www.hcup-us.ahrq.gov/). The HCUP Nationwide Inpatient Sample (NIS) prior to 2012 used stratified sample design similar to the NEDS, so techniques appropriate for the NIS prior to 2012 are also appropriate for the NEDS.

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-owned 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.[13] For example, nearly all SAS

[13] Carlson BL, Johnson AE, Cohen SB. An evaluation of the use of personal computers for variance estimation with complex survey data. *J Off Statistics*. 1993;9(4):795-814.

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). Although 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: 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 10 subsets of equal size. The estimation would take place in 10 iterations. In each iteration, the outcome of interest is predicted for one-tenth of the observations by an estimate based on a model that is 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 (Table 2). Each of the following ED data sources has potential for use in research addressing ED utilization and policy.

Table 2. Sources of Emergency Department (ED) Data by Type

Type of ED Data	ED Data Source	Description
National inventories of EDs	American Hospital Association (AHA) Annual Survey Database	Database containing characteristics and descriptions of hospitals in the U.S. reported by hospitals via survey. Owned by Health Forum.
	National Emergency Department Inventory (NEDI) – USA	Inventory of ED locations in the U.S. and annual ED visit volume that integrates information from the AHA Annual Survey Database, the Hospital Market Profiling Solution,© Internet searches, and direct communication with hospital staff. Created by the Emergency Medicine Network (EMNet).
ED visit information from a sample of 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 the 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 the National Center for Injury Prevention and Control (NCIPC) of the DHHS' CDC and the US Consumer Product Safety Commission (CPSC).

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

Information on total ED visits in 2017 for the U.S. was available from four data sources (AHA, NEDS, NEDI and NHIS).[14] Appendix D, Figure D.1 displays the range of total ED visits; Appendix D, Table D.1 lists the total ED visits in the U.S and the totals by census region. The total U.S. ED visit counts are relatively consistent across the data sources. The South consistently had the highest 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 one data source (NEDS) and are displayed in Appendix D, Table D.2.

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

Estimates of the number of ED visits related to nonfatal ED visits are available from two data sources (NEDS and NEISS-AIP) and are displayed in Appendix D, Table D.4.

[14] At the time this document was created, the 2017 NHAMCS public use file was not available for developing comparative estimates.

Appendix A: NEDS Introductory Information

Table A.1. States Participating in the 2017 NEDS

State	Data Organization
AR	Arkansas Department of Health
AZ	Arizona Department of Health Services
CA	California Office of Statewide Health Planning & Development
CO	Colorado Hospital Association
CT	Connecticut Hospital Association
DC	District of Columbia Hospital Association
FL	Florida Agency for Health Care Administration
GA	Georgia Hospital Association
IA	Iowa Hospital Association
IL	Illinois Department of Public Health
IN	Indiana Hospital Association
KS	Kansas Hospital Association
KY	Kentucky Cabinet for Health and Family Services
MA	Massachusetts Center for Health Information and Analysis
MD	Maryland Health Services Cost Review Commission
ME	Maine Health Data Organization
MN	Minnesota Hospital Association
MO	Missouri Hospital Industry Data Institute
MS	Mississippi State Department of Health
MT	Montana Hospital Association
NC	North Carolina Department of Health and Human Services
ND	North Dakota (data provided by the Minnesota Hospital Association)
NE	Nebraska Hospital Association
NJ	New Jersey Department of Health
NV	Nevada Department of Health and Human Services
NY	New York State Department of Health
OH	Ohio Hospital Association
OR	Oregon Association of Hospitals and Health Systems Oregon Office of Health Analytics
RI	Rhode Island Department of Health
SC	South Carolina Revenue and Fiscal Affairs Office
SD	South Dakota Association of Healthcare Organizations
TN	Tennessee Hospital Association
UT	Utah Department of Health

State	Data Organization
VT	Vermont Association of Hospitals and Health Systems
WI	Wisconsin Department of Health Services
WY	Wyoming Hospital Association

Figure A.1. HCUP States and the District of Columbia Included in the 2017 NEDS

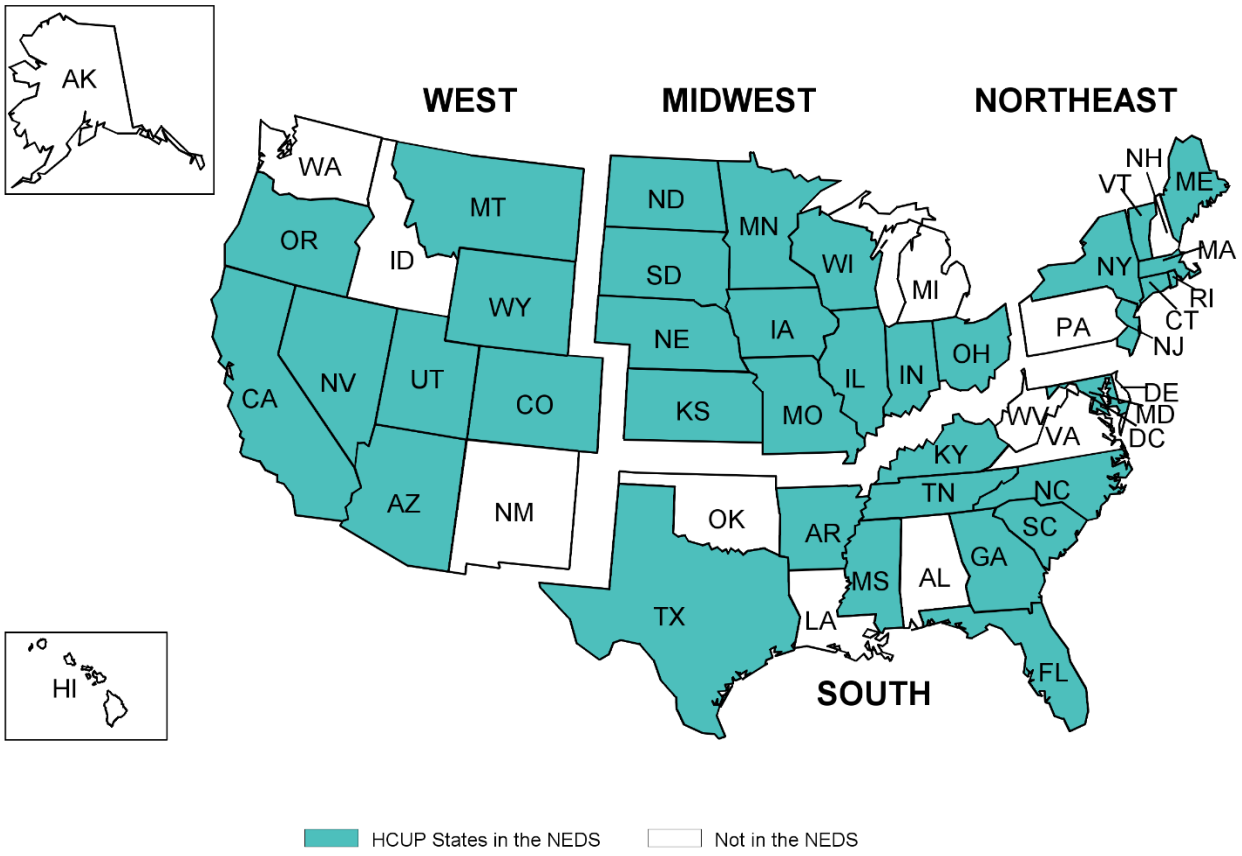


Table A.2. Percentage of U.S Population and ED Visits Accounted for by the 37 HCUP Organizations Participating in the NEDS, 2017

Region	U.S. Population, 2017	Percentage of U.S. Population in the NEDS (%)	ED Visits in the U.S., 2017	Percentage of U.S. ED Visits in the NEDS (%)
Northeast	56,072,676	74.8	26,185,553	72.3
Midwest	68,156,035	85.4	33,177,184	84.7
South	123,598,424	80.0	57,874,811	78.7
West	77,319,986	82.7	27,577,255	80.0
Nation	**325,147,121**	**80.9**	**144,814,803**	**79.2**

Source: Population count from the U.S. Census Bureau, Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2018 (NST-EST2018-01, released December 2018). ED visits in the U.S. from the American Hospital Association Annual Survey of Hospitals, 2017.

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

Description of NEDS Database

- NEDS Overview
  - HCUP Partners in the NEDS
- Introduction to the NEDS, 2017 (*this document*) and prior years
- NEDS Related Reports

Restrictions on the Use

- HCUP Data Use Agreement Training
- Data Use Agreement for the HCUP Nationwide Databases
- Requirements for Publishing with HCUP data

File Specifications and Load Programs

- NEDS File Specifications – details data file names, number of records, record length, and record layout
- Nationwide SAS Load Programs
- Nationwide SPSS Load Programs
- Nationwide Stata Load Programs

Data Elements

- NEDS Description of Data Elements – details uniform coding and State-specific idiosyncrasies
- Summary Statistics – lists means and frequencies on nearly all data elements

Additional Resources for NEDS Data Elements

- HCUP Quality Control Procedures – describes procedures used to assess data quality
- HCUP Coding Practices – describes how HCUP data elements are coded
- HCUP Hospital Identifiers – explains data elements that characterize individual hospitals

ICD-10-CM/PCS Data Included in the NEDS Starting With 2015

- NEDS Changes Beginning Data Year 2016
- Caution: 2015 NEDS includes ICD-9-CM and ICD-10-CM/PCS
  - 2015 NEDS Revised File Structure and New Data Elements
- Additional ICD-10-CM/PCS Resources – contains documentation to assist with the transition to ICD-10-CM/PCS
- Tutorial for Loading HCUP Software Tools for ICD-10-CM/PCS

Known Data Issues

- 2011
- 2006 and 2007

HCUP Tools: Labels and Formats

- Clinical Classifications Software (CCS)
- Format Programs – to create value labels
  - DRG Formats
  - HCUP Formats
  - HCUP Diagnoses and Procedure Groups Formats, including CCS Categories
  - ICD-9-CM Formats
  - ICD-10-CM Formats

Obtaining HCUP Data

- Purchase HCUP Data from the HCUP Central Distributor

Table A.4. NEDS Sampling 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 4: Nontrauma or trauma center level III (beginning in the 2011 NEDS) 8: Trauma center level I or II (in all years of the NEDS) 9: Trauma center level I, II or III (only in the 2006-2010 NEDS)
Urban-Rural	1: Large metropolitan 2: Small metropolitan 3: Micropolitan 4: Non-urban residual Collapsed categories used for strata with small sample sizes 6: Any urban-rural location (used in the South in 2014) 7: Small metropolitan and micropolitan (used in the South in 2011-2015) 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 A.5. NEDS Target Universe, Sampling Frame, and Final Sample Characteristics, 2017

	Description	Number of Hospital-owned EDs, 2017	Number of ED Events, 2017
Target Universe	EDs in community, nonrehabilitation U.S. hospitals that reported total ED visits in the AHA Annual Survey Database	4,677	144,814,803
Sampling Frame	EDs in the 36 States and the District of Columbia that provide information on ED visits that result and do not result in admission	3,371	110,697,065
2017 NEDS	20 percent sample of target universe drawn from the sampling frame	984	33,506,645

Source: HCUP Nationwide Emergency Department Sample, 2017

Table A.6. NEDS Sampling Rates by Region, 2017

NEDS stratum is defined by 5 digits:
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, (4) Trauma center level III and Non-Trauma.
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: (6) Any urban-rural location, (7) Small Metro and Micro, (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)

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	4,677	984	3,371	0	984	21.0%	29.2%

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
Northeast							
10100	83	17	50	0	17	20.5%	34.0%
10110	126	26	91	0	26	20.6%	28.6%
10200	74	15	41	0	15	20.3%	36.6%
10210	44	9	24	0	9	20.5%	37.5%
10420	52	11	38	0	11	21.2%	28.9%
11110	44	9	32	0	9	20.5%	28.1%
11210	13	3	5	0	3	23.1%	60.0%
12100	3	2	2	0	2	66.7%	100.0%
12110	23	5	15	0	5	21.7%	33.3%
12210	18	4	12	0	4	22.2%	33.3%
13110	9	2	9	0	2	22.2%	22.2%
13210	6	2	2	0	2	33.3%	100.0%
13800	6	2	2	0	2	33.3%	100.0%
14320	71	15	32	0	15	21.1%	46.9%
18320	4	2	2	0	2	50.0%	100.0%

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
Midwest							
20100	127	26	102	0	26	20.5%	25.5%
20110	85	17	73	0	17	20.0%	23.3%
20200	152	31	106	0	31	20.4%	29.2%
20210	40	8	28	0	8	20.0%	28.6%
20321	47	10	43	0	10	21.3%	23.3%
20324	165	33	140	0	33	20.0%	23.6%
20421	183	37	173	0	37	20.2%	21.4%
20422	247	50	201	0	50	20.2%	24.9%
20423	10	2	8	0	2	20.0%	25.0%
21110	41	9	37	0	9	22.0%	24.3%
21210	28	6	22	0	6	21.4%	27.3%
21800	3	2	2	0	2	66.7%	100.0%
22100	18	4	17	0	4	22.2%	23.5%
22110	33	7	21	0	7	21.2%	33.3%
22200	16	4	16	0	4	25.0%	25.0%
22210	43	9	35	0	9	20.9%	25.7%
22920	12	3	6	0	3	25.0%	50.0%
23100	16	4	14	0	4	25.0%	28.6%
23110	23	5	16	0	5	21.7%	31.3%
23200	23	5	20	0	5	21.7%	25.0%
23210	27	6	23	0	6	22.2%	26.1%
23321	5	2	3	0	2	40.0%	66.7%
23324	41	9	38	0	9	22.0%	23.7%
23424	13	3	12	0	3	23.1%	25.0%

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	25	5	18	0	5	20.0%	27.8%
30102	110	22	84	0	22	20.0%	26.2%
30103	138	28	104	0	28	20.3%	26.9%
30110	169	34	133	0	34	20.1%	25.6%
30201	58	12	33	0	12	20.7%	36.4%
30202	111	23	72	0	23	20.7%	31.9%
30203	116	24	57	0	24	20.7%	42.1%
30210	81	17	57	0	17	21.0%	29.8%
30321	62	13	51	0	13	21.0%	25.5%
30322	102	21	81	0	21	20.6%	25.9%
30323	49	10	30	0	10	20.4%	33.3%
30421	170	34	120	0	34	20.0%	28.3%
30422	166	34	122	0	34	20.5%	27.9%
30423	70	14	41	0	14	20.0%	34.1%
31100	2	2	2	0	2	100.0%	100.0%
31110	46	10	37	0	10	21.7%	27.0%
31210	32	7	23	0	7	21.9%	30.4%
32100	6	2	4	0	2	33.3%	50.0%
32110	26	6	23	0	6	23.1%	26.1%
32200	8	2	7	0	2	25.0%	28.6%
32210	46	10	33	0	10	21.7%	30.3%
32922	3	2	2	0	2	66.7%	100.0%
33100	16	4	13	0	4	25.0%	30.8%
33110	28	6	10	0	6	21.4%	60.0%
33201	8	2	3	0	2	25.0%	66.7%
33202	14	3	10	0	3	21.4%	30.0%
33203	21	5	14	0	5	23.8%	35.7%
33210	44	9	29	0	9	20.5%	31.0%
33921	23	5	11	0	5	21.7%	45.5%
33922	22	5	10	0	5	22.7%	50.0%
33923	16	4	6	0	4	25.0%	66.7%

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
West							
40101	13	3	10	0	3	23.1%	30.0%
40102	74	15	63	0	15	20.3%	23.8%
40103	59	12	41	0	12	20.3%	29.3%
40110	107	22	97	0	22	20.6%	22.7%
40201	19	4	12	0	4	21.1%	33.3%
40202	58	12	44	0	12	20.7%	27.3%
40203	38	8	15	0	8	21.1%	53.3%
40210	48	10	22	0	10	20.8%	45.5%
40321	34	7	12	0	7	20.6%	58.3%
40324	64	13	39	0	13	20.3%	33.3%
40421	96	20	57	0	20	20.8%	35.1%
40424	72	15	48	0	15	20.8%	31.3%
41810	36	8	32	0	8	22.2%	25.0%
42110	33	7	28	0	7	21.2%	25.0%
42204	12	3	7	0	3	25.0%	42.9%
42210	31	7	24	0	7	22.6%	29.2%
43100	10	2	6	0	2	20.0%	33.3%
43110	13	3	8	0	3	23.1%	37.5%
43200	23	5	13	0	5	21.7%	38.5%
43210	23	5	9	0	5	21.7%	55.6%
43921	11	3	3	0	3	27.3%	100.0%
43924	30	6	19	0	6	20.0%	31.6%
48100	11	3	9	0	3	27.3%	33.3%

Source: HCUP Nationwide Emergency Department Sample, 2017

Table A.7. Different Types of ED Events in the NEDS, 2017

ED Event	**Number of ED Visits**	**Percent of ED Visits**
ED visit in which the patient is treated and released	121,733,550	84.1
ED visit in which the patient is admitted to this same hospital	20,241,628	14.0
ED visit in which the patient is transferred to another short-term hospital	2,333,630	1.6
ED visit in which the patient died in the ED	204,272	0.1
ED visit in which patient is not admitted to the same hospital, destination unknown	300,495	0.2
ED visit in which the patient is discharged alive, destination unknown (but not admitted)	1,227	0.0

Source: HCUP Nationwide Emergency Department Sample, 2017

Appendix B: Partner-Specific Restrictions

The table below enumerates the types of restrictions applied to the 2017 Nationwide Emergency Department Sample. Restrictions include the following types:

- Confidentiality of hospitals
- Confidentiality of records
- Limited reporting of diagnosis codes for medical misadventures and adverse effects
- Missing discharges for specific populations of patients.

Table B.1. Partner-Specific Restrictions

Confidentiality of Hospitals

Limitations on sampling to ensure hospital confidentiality:
• For a subset of Partners:
  ○ 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.

Confidentiality of Records
Limitations on selected data elements to ensure patient confidentiality: • Age (AGE) values greater than 90 are set to 90 for all NEDS records. • At least one Partner required ages in years (AGE) to be set to the midpoints of age ranges. • At least one Partner requires that admission month (AMONTH) is set to missing on all records.
Limited Reporting of Diagnosis Codes for Medical Misadventures and Adverse Effects
• At least one Partner removes diagnosis codes for medical misadventures and adverse effects from the data files supplied to HCUP.

Missing Information for Specific Populations of Patients

- Human Immunodeficiency Virus (HIV)
    - At least one Partner excludes records for HIV patients from the files provided to HCUP. Therefore, these records are not included in the NEDS.
    - Alternatively, at least one Partner includes records for HIV patients in the data provided to HCUP but removes the diagnosis codes identifying HIV.
- At least one Partner removes diagnosis codes from the records of children less than age 18 for the following conditions: mental, behavioral and neurodevelopmental disorders (including those related to pregnancy and childbirth and excluding those due to psychoactive substances); symptoms and signs involving emotional state (including suicide attempt); and poisoning and adverse effect of drugs and other biological substances.
- At least one Partner excludes records for patients treated in two types of alternate level of care units: skilled nursing and swing bed. Therefore, these records are not included in the NEDS.
- At least one Partner masks the type of abortion (e.g., spontaneous, legally induced) by setting all abortion-specific diagnosis and procedure codes to “unspecified” abortions.

Appendix C: NEDS Data Elements and Codes

Table C.1. Data Elements in the 2017 NEDS Core File

For data years prior to 2017, refer to the NEDS Description of Data Elements page on the HCUP-US website or to previous versions of the NEDS Introduction.

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 0-90 years. Any ages greater than 90 were set to 90.
Diagnosis information	I10_DX1 – I10_DX35	ICD-10-CM diagnoses, with external cause of morbidity codes at the end of the array
	I10_NDX	Number of diagnoses coded on the original record received from Partner organizations
	I10_INJURY	ICD-10-CM initial injury diagnosis[1] reported: (0) no injury diagnoses reported, (1) injury is reported in first-listed diagnosis, (2) injury is reported in a diagnosis other than the first-listed diagnosis
	I10_MULTINJURY	Multiple ICD-10-CM initial injury diagnoses[1] reported: (0) one or no injury diagnosis reported, (1) more than one injury diagnosis reported, regardless of position
	DXVER	Diagnosis version (ICD-10-CM)
Discharge timing	DQTR	Discharge quarter 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, (21) Discharged/transferred to court/law enforcement , (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

[1] Injury diagnoses include the following codes: Codes starting with S, codes starting with T07-T34, codes starting with T36 –T50 with a 6th character of 1, 2, 3, or 4 (exceptions: T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a 5th character of 1, 2, 3, or 4), codes starting with T51-T65, codes starting with T66-T76, codes starting with T79, codes starting with M97, and codes O9A.2-O9A.5. Injuries are limited to the initial encounter with a 7th character of A, B, C, or missing.

Type of Data Element	HCUP Data Element	Coding Notes
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)
Gender of patient	FEMALE	Indicates sex: (0) male, (1) female
Urban-rural location of the patient's residence	PL_NCHS	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 2017, the median income quartiles are defined as: 1) $1–$43,999; (2) $44,000– $55,999; (3) $56,000–$73,999; and (4) $74,000 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.
NEDS Hospital identifier, synthetic	HOSP_ED	Unique HCUP NEDS hospital number – links to NEDS Hospital Weights file, but not to other HCUP databases
NEDS Stratum	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 C.2. Data Elements in the 2017 NEDS Supplemental ED File

For data years prior to 2017, refer to the NEDS Description of Data Elements page on the HCUP-US website or to previous versions of the NEDS Introduction.

Type of Data Element	HCUP Data Element	Coding Notes
CPT procedure information	CPT1 – CPT35	CPT procedures performed in the ED
	CPTCCS1 – CPTCCS35	Clinical Classifications Software (CCS) category for all CPT procedures
	NCPT	Number of procedures coded on the original record. A maximum of 35 CPT codes are retained on the NEDS.
NEDS 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 C.3. Data Elements in the 2017 NEDS Supplemental Inpatient File

For data years prior to 2017, refer to the NEDS Description of Data Elements page on the HCUP-US website or to previous versions of the NEDS Introduction.

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
	MDC_NoPOA	MDC in use on discharge date, calculated without the use of the present on admission flags for the diagnoses
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-10-PCS procedure information	I10_PR_IP1 – I10_PRI_IP15	ICD-10-PCS procedures coded on ED admissions. Procedure may have been performed in the ED or during the hospital stay.
	I10_NPR_IP	Number of procedures coded on the original record.
	PRVER	Procedure version, ICD-10-PCS
NEDS 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 C.4. Data Elements in the 2017 NEDS Hospital Weights File

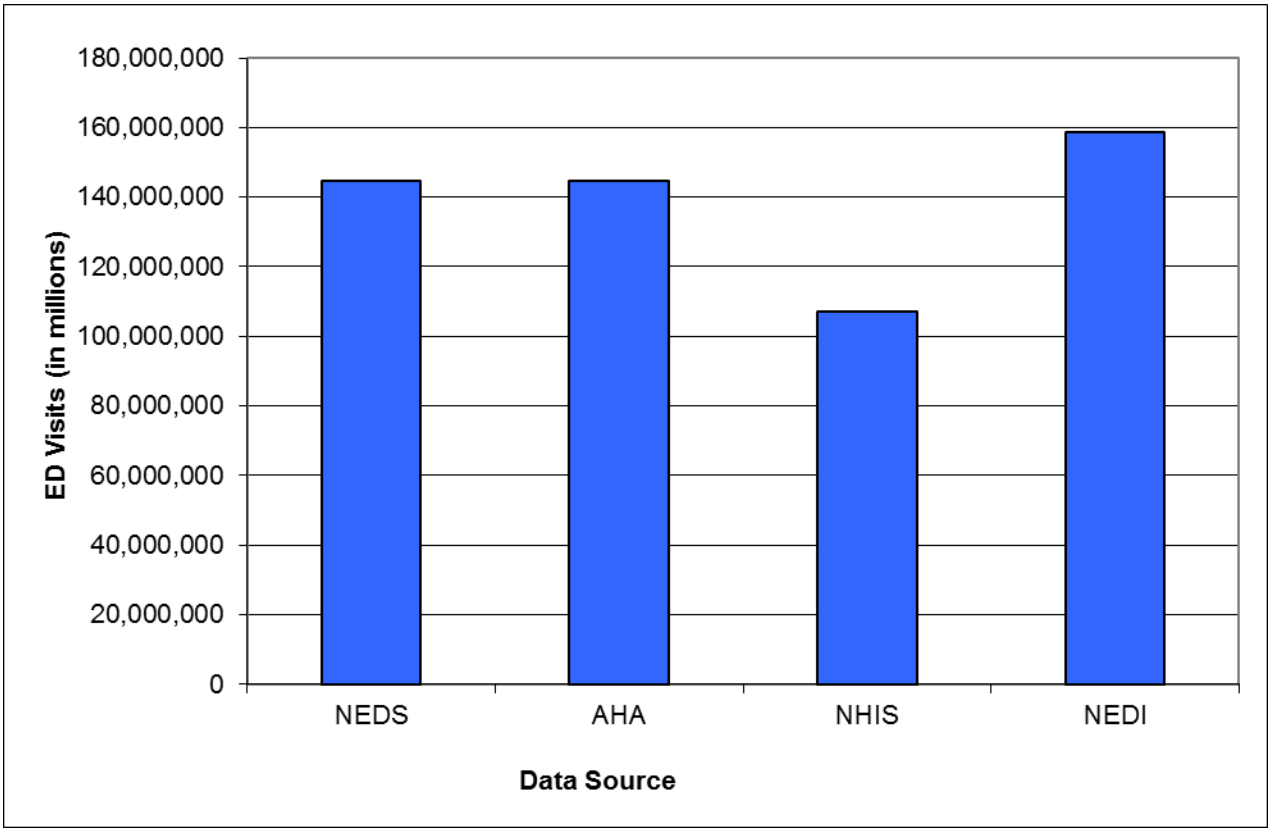
For data years prior to 2017, refer to the NEDS Description of Data Elements page on the HCUP-US website or to previous versions of the NEDS Introduction.

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
Weights	DISCWT	Discharge weight used to calculate national estimates. Weights ED visits to AHA universe.
	HOSPWT	Weight to hospital-owned EDs in AHA universe (i.e., total U.S.)
Discharge Year	YEAR	Discharge year
Hospital counts	N_HOSP_U	Number of AHA universe hospital-owned EDs in the stratum
	S_HOSP_U	Number of sampled hospital-owned EDs in the stratum
NEDS 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, (6) collapsed category of any urban-rural location, (7) collapsed category of small metropolitan and 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) nontrauma center, (1) trauma level I, (2) trauma level II (3) trauma level III, (4) nontrauma or trauma level III, collapsed category begining in the 2011 NEDS, (8) trauma level I or II, collapsed category (9) trauma level I, II, or III, collapsed category in the 2006-2010 NEDS. Children's hospitals with trauma centers are classified with adult/pediatric trauma centers.

Type of Data Element	HCUP Data Element	Coding Notes
	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

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

Figure D.1. Emergency Department Visit Counts in the United States, 2017



Abbreviations: AHA, American Hospital Association Annual Survey Database; ED, emergency department; NEDI, National Emergency Department Inventory; NEDS, Nationwide Emergency Department Sample; NHIS, National Health Interview Survey

Table D.1. Estimates of ED Visits by U.S. Geographic Region from Four ED Data Sources, 2017

Region	ED Data Sources							
	NEDS[1]		AHA		NHIS[2]		NEDI	
	ED visits, N (weighted)	%[3]	ED visits, N	%[3]	ED visits, N	%[3]	ED visits, N	%[3]
Census Region								
Northeast	26,185,553	18.1	26,185,553	18.1	17,937,683	16.7	NA[4]	NA[4]
Midwest	33,177,184	22.9	33,177,184	22.9	24,373,820	22.8	NA[4]	NA[4]
South	57,874,811	40.0	57,874,811	40.0	41,173,104	38.4	NA[4]	NA[4]
West	27,577,255	19.0	27,577,255	19.0	23,647,728	22.1	NA[4]	NA[4]
Total U.S.	144,814,803	100.0	144,814,803	100.0	107,132,334	100.0	158,719,684[5]	100.0

Abbreviations: AHA, American Hospital Association Annual Survey Database; ED, emergency department; NA, Not Available; NEDI, National Emergency Department Inventory; NEDS, Nationwide Emergency Department Sample; 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.

[3] Column percent indicates the percentage of the total records in the ED data source that are in the Census region.

[4] The number of ED visits by Census region is not available from NEDI. Only the total number of ED visits in the United States is available.

[5] NEDI reports on ED visits for all hospital-based EDs, satellite freestanding EDs (FSEDs), and autonomous FSEDs in the United States. The NEDS is limited to hospital-owned EDs in which the facility is a community, non-rehabilitation hospital.

Table D.2. Estimates of the ED Visits Resulting in Inpatient Admissions (Admission Rate) by U.S. Geographic Region, 2017

Region	ED Data Sources		
	NEDS		
	Number of ED Visits Resulting in Inpatient Admissions (weighted)	Total Number of ED Visits (weighted)	Percent of Total ED Visits
Census Region			
Northeast	4,295,173	26,185,553	16.4
Midwest	4,190,746	33,177,184	12.6
South	8,254,142	57,874,811	14.3
West	3,501,566	27,577,255	12.7
Total U.S.	20,241,627	144,814,803	14.0

Abbreviations: ED, emergency department; NEDS, Nationwide Emergency Department Sample.

Table D.3. Estimates of the Number of Hospital-Owned EDs by ED Visit Volume from Two ED Data Sources, 2017

Volume of ED Visits in 2016	Data Sources			
	NEDS		AHA	
	Number of Hospital-Owned EDs (weighted)	%[1]	Number of Hospital-Owned EDs	%[1]
Less than 10,000 visits	1,395	29.8	1,630	34.9
10,000 – 19,999 visits	810	17.3	755	16.1
20,000 – 29,999 visits	610	13.0	532	11.4
30,000 – 39,999 visits	511	10.9	442	9.5
40,000 – 49,999 visits	350	7.5	331	7.1
50,000 or more visits	1,001	21.4	987	21.1
All Hospital-owned EDs	4,677	100.0	4,677	100.0

Abbreviations: AHA, American Hospital Association Annual Survey Database; ED, emergency department; NEDS, Nationwide Emergency Department Sample.

[1] Column percent indicates the percentage of the total records in the ED data source that are in each group of ED visits.

Table D.4. Estimates of the Number of ED Visits Related to Nonfatal Injures from Two ED Data Sources, 2017

	ED Data Source					
	NEDS (All Injuries)[1]		NEDS (Initial Encounter for Injury)[1]		NEISS-AIP[2]	
	ED Visits, N (weighted)	95% Confidence Interval	ED Visits, N (weighted)	95% Confidence Interval	ED Visits, N (weighted)	95% Confidence Interval
Total number of ED visits for nonfatal injuries	29,675,665	(28,276,351, 31,074,979)	28,845,999	(27,483,795, 30,208,202)	30,320,552	(26,609,455, 34,031,648)
By discharge status from the ED						
Treated and released from the ED	26,308,258	(25,050,050, 27,566,466)	25,630,265	(24,403,100, 26,857,431)	25,516,333	(22,515,711, 28,516,955)
Admitted to the same hospital	2,654,298	(2,500,250, 2,808,347)	2,516,218	(2,368,916, 2,663,519)	2,991,673	(2,335,508, 3,647,837)
Transferred	480,058	(454,720, 505,396)	473,196	(448,120, 498,273)	605,690	(474,906, 736,474)
Other[3]	233,050	(211,077, 255,024)	226,319	(205,130, 247,509)	NA[3]	NA[3]

Abbreviations: ED, emergency department; NA, not available; NEDS, Nationwide Emergency Department Sample; NEISS-AIP = National Electronic Injury Surveillance System All-Injury

Program.

[1] Any diagnosis in the following range:

- Codes starting with S
- Codes starting with T07-T34
- Codes starting with T36 –T50 with a 6th character of 1, 2, 3, or 4
- Codes starting with T51-T65
- Codes starting with T66-T76
- Codes starting with T79
- Codes starting with M97
- Codes O9A.2-O9A.5.

Counts for all injuries allowed any 7th character for the injury diagnosis code; counts for the initial encounter limited injury diagnosis codes to those with a 7th character of A, B, C, or missing.
Codes starting with T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a 5th character of 1, 2, 3, or 4 and a 6th character of "X" should have been included in the injury criteria in the 2017 NEDS, but were not. The exclusion of these ICD-10-CM diagnosis codes resulted in 3,775 records (0.01 percent of the 2017 NEDS) not being identified as an injury.

[2] Data from WISQARS Query System (https://webappa.cdc.gov/sasweb/ncipc/nfirates.html). Includes non-fatal, all-cause injuries for all ages and sexes. Patients who died on arrival to the ED or during treatment in the ED are excluded. Queried November 25, 2019.

[3] For the NEISS-AIP, other includes left against medical advice, sent for observations, and unknown destination. For the NEDS, other include left against medical advice. Patients who are treated in the ED and then observed cannot be identified. If they were discharged home from observation, they are counted under "treated and released from the ED"; if they were admitted to the hospital from observation, they are counted under "admitted to the same hospital". The estimate for other in 2017 was not shown in the WISQARS Query System because it was unstable due to small sample size and/or a coefficient of variation > 30%.