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 NATIONAL INPATIENT SAMPLE (NIS) 2018

Please read all documentation carefully.

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

Beginning with data year 2016, the NIS includes a full calendar year of data with diagnosis and procedure codes reported using the ICD-10-CM/PCS[1] coding system. The file structure is similar to the file structure of the NIS in data years prior to 2015.

THE 2015 NIS CONTAINS ICD-9-CM AND ICD-10-CM/PCS CODES.

On October 1, 2015, hospital administrative data began using ICD-10-CM/PCS, so the first nine months of 2015 contain ICD-9-CM codes and the last three months contain ICD-10-CM/PCS codes. Data elements and data structure for the 2015 NIS have changed. Trends based on diagnoses or procedures will be affected.

Data elements derived from AHRQ software tools are not available for ICD-10-CM/PCS data on the NIS.

THE NIS WAS REDESIGNED BEGINNING WITH 2012

Starting in data year 2012, the NIS is a **sample of discharges** from all hospitals participating in HCUP. For prior years, the NIS was a **sample of hospitals**. For details, see the *2012 NIS Redesign Report*.

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HCUP NATIONAL INPATIENT SAMPLE (NIS)
SUMMARY OF DATA USE RESTRICTIONS

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

All users of the NIS 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 establishments.
- Will not use the data for criminal and civil litigation, including expert witness testimony or for law enforcement activities.
- Will not use data elements from the proprietary severity adjustment software packages (e.g., 3M™ APR-DRGs) for any commercial purpose or to disassemble, decompile, or otherwise reverse engineer the proprietary software.
- Will acknowledge in reports that data from the "Healthcare Cost and Utilization Project (HCUP)" were used, including names of the specific databases used for analysis.[c]

Any violation of the limitations in the Data Use Agreement is punishable under Federal law by a fine, up to five 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/tech_assist/centdist.jsp.

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 the specific questions are not covered in the Purchasing FAQs on the HCUP-US website.

Purchasing FAQs:
www.hcup-us.ahrq.gov/tech_assist/faq.jsp#PurchasingFAQ.

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

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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.

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

WHAT'S NEW IN THE 2018 NATIONAL INPATIENT SAMPLE (NIS)?

- Beginning with the 2018 NIS, the Diagnosis and Procedure Groups file is available again and includes data elements derived from the Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses.

UNDERSTANDING THE NIS

- This document, *Introduction to the NIS, 2018*, summarizes the content of the NIS and describes the development of the NIS sample and weights.
- In addition, 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-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.
- Important considerations for data analysis are provided along with references to detailed reports.
- In-depth documentation for the NIS is available on the HCUP User Support (HCUP-US) website (www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp). Please refer to detailed documentation before using the data.

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The Agency for Healthcare Research and Quality and the staff of the Healthcare Cost and Utilization Project (HCUP) thank users for purchasing the HCUP National Inpatient Sample (NIS).

HCUP National Inpatient Sample (NIS)

ABSTRACT

The National Inpatient Sample (NIS) is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ).

The NIS is a database of hospital inpatient stays derived from billing data submitted by hospitals to statewide data organizations across the U.S. These inpatient data include clinical and resource use information typically available from discharge abstracts. Researchers and policymakers use the NIS to make national estimates of health care utilization, access, charges, quality, and outcomes.

The NIS contains information on all hospital stays, regardless of expected payer for the hospital stay. For Medicare, the NIS includes Medicare Advantage patients, a population that is often missing from Medicare claims data but that comprises as much as 30 percent of Medicare beneficiaries.[1] The NIS' large sample size enables analyses of rare conditions, uncommon treatments, and special patient populations.

The NIS is sampled from the State Inpatient Databases (SID), which include all inpatient data that are currently contributed to HCUP. The 2018 NIS sampling frame includes data from 48 statewide data organizations (47 States plus the District of Columbia), covering more than 97 percent of the U.S. population (Appendix I, Figure 1) and including almost 96 percent of discharges from U.S. community hospitals (Appendix I, Table 4). A list of the 48 statewide data organizations participating in the NIS and a summary of NIS States, hospitals, and discharges by year are provided in Appendix 1 (Table 2 and Table 3). The NIS includes weights for calculating national estimates.

The 2012 National Inpatient Sample (NIS) was redesigned to improve national estimates. To highlight the design change, beginning with 2012 data, AHRQ renamed the NIS from the "***Nationwide*** Inpatient Sample" to the "***National*** Inpatient Sample." The redesign incorporates three major types of changes:

- Revisions to the sample design—the NIS is now a sample of discharge records from all HCUP-participating hospitals, rather than a sample of hospitals from which all discharges were retained.

[1] Kaiser Family Foundation Medicare Advantage www.kff.org/medicare/fact-sheet/medicare-advantage/ (Accessed 8/27/2017).

- Revisions to how hospitals and discharges are defined—the NIS now uses the definitions of hospitals and discharges supplied by the statewide data organizations that contribute to HCUP, rather than the definitions used by the American Hospital Association (AHA) Annual Survey.
- Revisions to enhance confidentiality—the NIS now eliminates State and hospital identifiers and other data elements that are not uniformly available across States. Also, ages over 89 are aggregated into a single category of 90 years or older in the HCUP nationwide databases starting in data year 2012.

The new sampling strategy produces more precise estimates than the previous NIS design by reducing sampling error. For many estimates, confidence intervals under the new design are about half the length of confidence intervals under the previous design.

Key features of the most recent NIS (2018) include:

- The NIS is drawn from all States participating in HCUP, covering more than 97 percent of the U.S. population.
- The NIS approximates a 20-percent ***stratified sample of discharges*** from U.S. community hospitals, excluding rehabilitation and long-term acute care hospitals.
- The self-weighting design of the new NIS reduces the margin of error for estimates and delivers more stable and precise estimates than previous versions of the NIS.
- The NIS protects patient confidentiality because State and hospital identifiers are no longer provided.
- The new NIS retains a large sample size, which enables analyses of rare conditions, uncommon treatments, and special patient populations.

Changes to the NIS may impact some types of analyses. For example, the elimination of hospital identifiers means that hospital linkages can no longer be done with the NIS, and the sampling of discharges means that analyses relying on a census of discharges from sampled hospitals (e.g. hospital volume analysis) can no longer be performed. Because inpatient data are available for many individual States through the HCUP Central Distributor, State inpatient data can be used for those analyses that require a census of discharges from individual hospitals, local market areas, and States.

A summary of design changes is provided in Table 1 in Appendix I, *The National Inpatient Sample (NIS) Design Changes*. For a detailed description of the NIS redesign, please see the *2012 NIS Redesign Report* available on the HCUP-US website.

The NIS is available yearly, beginning with 1988, allowing analysis of trends over time. Analyses of time trends using the HCUP NIS are recommended from 1993 forward because earlier samples were drawn from only 8 to 11 States, covering less than 50 percent of the hospital discharge population. For trends analysis using NIS data 2011 and earlier, revised weights should be used to make estimates comparable to the new 2012 design. Users should refer to 1993-2011 NIS Trend Weights Files and the report, Using the HCUP National Inpatient Sample to Estimate Trends, available on the HCUP-US website, for details.

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. 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). In addition, 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.

Appendix III provides a summary of data elements and when they are effective. The data elements included in the NIS can vary across data years.

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

For more information on the NIS, please visit the AHRQ-sponsored HCUP-US website at www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp.

INTRODUCTION TO THE HCUP NATIONAL INPATIENT SAMPLE (NIS)

Overview of NIS Data

The National Inpatient Sample (NIS) contains all-payer data on hospital inpatient stays from States participating in the Healthcare Cost and Utilization Project (HCUP). Each year of the NIS includes over 7 million inpatient stays.

The NIS contains clinical and resource use information included in a typical discharge abstract. The NIS is a database of hospital inpatient stays derived from billing data submitted by hospitals to statewide data organizations across the U.S.

NIS 2012 Redesign

The 2012 National Inpatient Sample (NIS) was redesigned to improve national estimates. To highlight the design change, beginning with 2012 data, AHRQ renamed the NIS from the "***Nationwide*** Inpatient Sample" to the "***National*** Inpatient Sample." The redesign incorporates three major types of changes.

- First, the sample design was revised to create a sample of discharge records from all HCUP-participating hospitals, rather than all discharge records from a sample of hospitals.
- Second, the definition of discharges and hospitals was changed in several ways. The discharge universe was revised to exclude long-term acute care hospitals. In addition, the count of discharges in the universe is now based on the observed number of HCUP State Inpatient Database (SID) discharges, when available, rather than on American Hospital Association (AHA) admissions plus births. Finally, the definition of hospital entities is now based on State-supplied hospital identifiers rather than on AHA identification numbers.
- Third, confidentiality is enhanced by eliminating State identifiers and data elements that are not uniformly available across States, such as AHA hospital identifiers, secondary payer, and data elements with State-specific coding. Also, ages over 89 are aggregated into a single category of 90 years or older in the HCUP nationwide databases starting in data year 2012.

Impact of New Design on Estimates

The new NIS is now stratified by nine Census Divisions rather than four Census Regions, which will allow more refined analyses of geographic variation in U.S. hospitalizations. The new sampling strategy produces more precise estimates than the previous NIS design by reducing sampling error. For national-level estimates, the 2012 NIS systematic design reduces the margin of error by 42 to 48 percent over the previous NIS design for the outcomes studied (total discharges, average length-of-stay, average charges, and mortality rates); thus, ***the new NIS design generates estimates that are about twice as precise as those from the old design***. The margin of error is commonly used by the popular press to describe the reliability of sample statistics. Technically, it is the half-width of a confidence interval around a sample statistic, such as a rate or a mean. The systematic design also consistently reduced the margin of error for estimates at the DRG level.

Because of the changes implemented in the 2012 redesign, users should expect one-time disruptions to historical trends for counts, rates, and means estimated from the NIS, beginning with data year 2012. For 2012 it is expected to see overall trends in discharge counts to decline by about 4.3 percent, overall trends in average length-of-stay to decline by about 1.5 percent, overall trends in total charges to decline by about 0.5 percent, and overall trends in hospital mortality to decline by about 2.0 percent. New weights for prior years of the NIS to make prior year estimates comparable to the new design implemented in 2012 are available for download under 1993-2011 NIS Trend Weights Files from the NIS Database Documentation page on the HCUP-US website.

A summary of design changes is provided in Table 1 in Appendix I, The National Inpatient Sample (NIS) Design Changes. For a detailed description of the NIS redesign and the effects on sample estimates, please see the *2012 NIS Redesign Report* available on the HCUP-US website.

The NIS sampling and weighting strategy was also revised in 1998. A detailed report describing this revision, Changes in NIS Sampling and Weighting Strategy for 1998, is available on the HCUP-US website at www.hcup-us.ahrq.gov.

Types of Hospitals Included in the NIS

The NIS is a sample of discharges from U.S. community hospitals, defined as "all non-Federal, short-term, general, and other specialty hospitals, excluding hospital units of institutions."[2] Included among community hospitals are specialty hospitals such as obstetrics-gynecology, ear-nose-throat, orthopedic, and pediatric institutions. Also included are public hospitals and academic medical centers.

Starting in 2005, the AHA included long term acute care facilities with average lengths-of-stay less than 30 days in the definition of community hospitals, and such facilities were included in the NIS sampling frame. However, because long-term acute care hospital data was not uniformly available from all States participating in HCUP, and their average length of stay (ALOS) was over 25 days (unlike other community hospitals with an ALOS of about 4.5 days), long-term acute care hospitals were excluded in the 2012 NIS redesign. Exclusion of long-term acute care hospitals mainly affects statistics related to the elderly – estimates of discharge

[2] See the AHA "community hospital designation" at http://www.ahadataviewer.com/glossary.

counts, ALOS, charges, and mortality are reduced for the older age groups because of the demographics of patients in long-term acute care hospitals.

Sample Design for the NIS

This universe of U.S. community hospitals is divided into strata using five hospital characteristics: ownership/control, bed size, teaching status, urban/rural location, and the nine U.S. census divisions (the four census regions were used prior to the 2012 NIS).

- Prior to 2012, the NIS was a stratified probability ***sample of hospitals*** in the frame, with sampling probabilities proportional to the number of U.S. community hospitals in each stratum. The frame included all hospitals in the SID, and thus was limited by the availability of inpatient data from the data sources currently participating in HCUP.
- Starting with the 2012 NIS, a systematic sampling design was used to construct the database. Rather than first drawing a sample of hospitals and then keeping all discharges from that sample, in the 2012 NIS redesign a ***sample of discharges*** was drawn from ***all hospitals*** in the hospital frame.

The systematic sample starting in 2012 is a self-weighted sample design similar to simple random sampling, but it is more efficient. It ensures that the sample is representative of the population on the following critical factors:

- hospital (de-identified hospital number)
- census division of hospital
- hospital ownership
- urban-rural location of hospital
- hospital teaching status
- number of beds in the hospital
- diagnosis-related group (DRG) for the hospital stay
- admission month of the hospital stay

Weighted Estimates

To facilitate the production of national estimates, discharge weights are provided, along with information necessary to calculate the variance of estimates. More information on using the discharge weights for generating national estimates and studying trends is provided under How to Use the NIS for Data Analysis. Also, refer to the *Checklist for Working with the NIS* (www.hcup-us.ahrq.gov/db/nation/nis/nischecklist.jsp) to verify adherence to data use, methodology, and reporting requirements.

Detailed information on the design of the NIS prior to 2006 is available in the year-specific reports on *Design of the Nationwide Inpatient Sample* found on the NIS Related Reports page on the HCUP-US website. Detailed information on the design of the NIS from 2006-2012 is available in the *NIS Introduction* for each year on the NIS Database Documentation – Archive page on the HCUP-US website.

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-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.

NIS Data Sources, Hospitals, and Inpatient Stays

The NIS is sampled from the State Inpatient Databases (SID), which include all inpatient data currently contributed to HCUP. The 2018 NIS sampling frame includes data from 48 statewide data organizations (47 States plus the District of Columbia), covering more than 97 percent of the U.S. population (Appendix I, Figure 1) and including nearly 96 percent of discharges from U.S. community hospitals (Appendix I, Table 4). A list of the 48 HCUP Partner organizations participating in the NIS and a summary of NIS States, hospitals, and discharges by year are provided in Appendix 1 (Table 2 and Table 3). The NIS includes weights for calculating national estimates.

Partner Restrictions

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

File Structure of the NIS

Each release of the NIS includes:

- Data in fixed-width ASCII format
- Over 7 million inpatient records per year
- Discharge-level weights to calculate national estimates for discharges
- NIS Documentation and tools – including file specifications, programs for loading the ASCII data into SAS® and SPSS®, and value labels. Beginning with 2004, code is also provided for loading the NIS ASCII files into Stata®.

The NIS Database is distributed as fixed-width ASCII-formatted data files delivered via secure

[3] ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification; ICD-10-CM/PCS: International Classification of Diseases, Tenth Revision, Clinical Modification/Procedure Coding System

digital download from the Online HCUP Central Distributor. The files are compressed and encrypted with SecureZIP® from PKWARE. **Users will need the password provided by the HCUP Central Distributor**.

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

- **Inpatient Core File:** This inpatient discharge-level file contains a sample of hospital discharge records from participating States. The unit of observation is an *inpatient stay record*.
  - This file is available in all years of the NIS.

- **Diagnosis and Procedure Groups File:** This discharge-level file contains data elements derived from AHRQ software tools based on the diagnostic and procedure information in the HCUP databases. The unit of observation is an *inpatient stay record*.
  - This discharge-level file is available from 2005 to 2015; and is available again beginning with 2018 data, when data elements derived from the Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses are added. This file is not available from 2016-2017 because the ICD-10-CM/PCS versions of the AHRQ tools were still under development.
  - Linkage between the Inpatient Core File and the Diagnosis and Procedure Groups File
    - Prior to the 2012 NIS, the HCUP unique record identifier (KEY) provided the linkage between the Core File and the Diagnosis and Procedure Groups File.
    - Beginning with the 2012 NIS, the unique NIS record number (KEY_NIS) provides the linkage between the Core File and the Diagnosis and Procedure Groups File.

- **Disease Severity Measures File:** This discharge-level file contains information from two different sets of disease severity measures. Information from the Severity File is to be used in conjunction with the Inpatient Core File. The unit of observation is an *inpatient stay record*.
  - This file is available beginning with the 2002 NIS.
  - Linkage between the Inpatient Core File and the Disease Severity Measures File
    - Prior to the 2012 NIS, the HCUP unique record identifier (KEY) provided the linkage between the Core File and the Disease Severity Measures File.
    - Beginning with the 2012 NIS, the unique NIS record number (KEY_NIS) provides the linkage between the Core File and the Disease Severity Measures File.

- **Hospital File:** This hospital-level file contains one observation for each hospital included in the NIS and contains weights and variance estimation data elements, as well as linkage data elements. The unit of observation is the *hospital*.
  - This file is available in all years of the NIS.
  - Linkage between the Inpatient Core File and the Hospital File
    - Prior to the 2012 NIS, the HCUP hospital identifier (HOSPID) provided the linkage between the NIS Inpatient Core File and the Hospital File.

- Beginning with the 2012 NIS, the NIS hospital number (HOSP_NIS) provides the linkage between the NIS Inpatient Core File and the Hospital File. The HOSP_NIS values are reassigned each year, so they cannot be used to link hospitals across years.

On the HCUP-US website, NIS users can access complete file documentation, including data element notes, file layouts, summary statistics, and related technical reports. Similarly, users can also download SAS, SPSS, and Stata load programs from this website. Available online documentation and supporting files are detailed in Appendix I, Table 5.

File structures can differ for a given year from the general structure described above. See below for specifics.

File Structure of the NIS Beginning with 2016 Data

Beginning with data year 2016, the NIS is a calendar year file that includes diagnoses and procedures coded using only ICD-10-CM/PCS. The file structure is similar to the file structure of the NIS prior to 2015.

File Structure of the 2015 NIS

For the 2015 data, because of the transition to ICD-10-CM/PCS on October 1, 2015, data elements related to diagnoses and procedures are included in files that are split into two files. Nine months of the 2015 data with ICD-9-CM codes (discharges from January 1, 2015 - September 30, 2015) are in one set of files labeled Q1-Q3. Three months of 2015 data with ICD-10-CM/PCS codes (discharges from October 1, 2015 - December 31, 2015) are in a separate set of files labeled Q4. More information about the changes to the HCUP databases for ICD-10-CM/PCS and use of data across the two coding systems may be found on the HCUP-US website under ICD-10-CM/PCS Resources.

File Structure of the NIS Prior to 2015

The NIS databases prior to 2015 are annual, calendar year files based on discharge date that include ICD-9-CM coding only. The Inpatient Core File and the Hospital File are available all data years. The Disease Severity File is available starting in data year 2002, and the Diagnosis and Procedure Groups File is available starting in data year 2005.

NIS Data Elements

All releases of the NIS contain two types of data: inpatient stay records and hospital information with weights to calculate national estimates. Appendix III identifies the data elements in each NIS file:

- Table 1 for the Inpatient Core File (record = inpatient stay)
- Table 2 for the Hospital File (record = hospital)
- Table 3 for the Disease Severity Measures File (record = inpatient stay)
- Table 4 for the Diagnosis and Procedure Groups File (record = inpatient stay).

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

Beginning with quarter 4 of 2015, data elements derived from the AHRQ software tools based on ICD-10-CM/PCS diagnosis and/or procedure codes are *not available on the NIS* except for the Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses, which is available beginning in data year 2018. Users interested in applying additional AHRQ software tools to the NIS that include ICD-10-CM/PCS-coded data may do so by downloading the respective tool(s) from the HCUP Tools & Software section of the HCUP User Support (HCUP-US) website at https://www.hcup-us.ahrq.gov/tools_software.jsp. 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.

Getting Started

System Requirements for Using the NIS

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

- A hard drive with at least 15 gigabytes of space available
- A third-party zip utility such as ZIP Reader, SecureZIP®, WinZip®, or Stuffit Expander®
- SAS®, SPSS®, Stata® or similar analysis software.

Decompressing the NIS Files

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

1) Create a directory for the NIS on your hard drive.
2) Unzip the compressed NIS product file into the new directory using a third-party zip utility. This will create 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 ASCII 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 User Support website (HCUP-US). The SAS and SPSS programs are available beginning with 1998. The Stata programs begin with 2004. To download and run the load programs, follow these steps:

1) Go to the NIS Database Documentation page on HCUP-US at www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.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 ("NIS") from the drop-down lists on this page. Or you may select "NIS 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.** For example, the load program for the 2018 NIS Core File is found under the link "SAS NIS 2018 Core File" in the list generated by selecting "2018" and "NIS." Save the load programs into the same directory as the NIS ASCII 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.

NIS Documentation

Year-specific NIS documentation files on the HCUP-US website (www.hcup-us.ahrq.gov) provide important resources for the user. Refer to these resources to understand the structure and content of the NIS and to aid in using the database.

- To locate the NIS documentation on HCUP-US, choose "HCUP Databases" from the home page (www.hcup-us.ahrq.gov). The first section under Nationwide HCUP Databases is specific to the NIS.

Table 5 in Appendix I details both the NIS related reports and the comprehensive NIS database 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 which provide 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 Sampling Design tutorial is designed to help users learn how to account for sample design in their work with HCUP national (nationwide) databases.

- The Producing National HCUP Estimates tutorial is designed to help users understand how the three national (nationwide) databases – the NIS, Nationwide Emergency Department Sample (NEDS), and Kids' Inpatient Database (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 national (nationwide) databases.

- The HCUP Multi-year Analysis tutorial presents solutions that may be necessary when conducting analyses that span multiple years of HCUP data.

- 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.

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

HOW TO USE THE NIS FOR DATA ANALYSIS

This section provides a brief synopsis of special considerations when using the NIS. Before reporting findings using the NIS, you should refer to the *Checklist for Working with the NIS* (www.hcup-us.ahrq.gov/db/nation/nis/nischecklist.jsp) to verify adherence to data use, methodology, and reporting requirements.

Data Use Agreement

If anyone other than the original purchaser uses the NIS data, be sure to have them read and sign a Data Use Agreement, after viewing the online Data Use Agreement Training Tool available on the HCUP-US website(www.hcup-us.ahrq.gov). A copy of the signed Data Use Agreements must be sent to the HCUP Central Distributor. See page 2 for the mailing address.

Choosing Data Elements for Analysis

- For all data elements you plan to use in your analysis, first perform descriptive statistics and examine the range of values, including the number of missing cases. Summary statistics for the entire NIS are provided on the Summary Statistics page of the HCUP-US website. Performing descriptive statistics by hospital can be helpful in detecting hospital-specific data anomalies.

- Not all data elements in the NIS are provided by each hospital. These data elements are provided on the NIS because they can be valuable for research purposes, but they should

be used cautiously. For example, RACE is missing for some hospitals; thus, national estimates using RACE should be interpreted and reported with caveats.

- Differences exist across the State data sources in the collection of information that could not be accounted for during HCUP processing to make the data uniform. For example, the most reliable way to identify ED admissions in the HCUP databases is to use the data element HCUP_ED, which considers all possible evidence of ED services. Unfortunately, this information is not always complete.

- 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.

- Although the NIS contains up to 40 diagnoses (30 prior to the 2017 NIS; 25 prior to the 2014 NIS; 15 prior to the 2009 NIS) and 25 procedures (15 prior to the 2017 NIS), the number of diagnoses and procedures varies across hospitals. Some hospitals provide as many as 50 diagnoses and procedures or more, while others provide as few as 9 diagnoses and 6 procedures. Because very few cases have more than 40 diagnoses or more than 25 procedures, the diagnosis and procedure vectors were truncated when necessary to save space in the NIS data files. See the notes on diagnoses and procedures on the HCUP-US website.

- 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 2017 data, separate external cause code data elements are discontinued (formerly HCUP I10_ECAUSEn data elements). External cause codes are now at the end of the ICD-10-C diagnosis array (I10_DXn).

Diagnosis-Related Groups

- The Diagnosis-Related Group (DRG) appropriate for the date of discharge is assigned by the Medicare DRG Grouper algorithm during HCUP processing and stored in the HCUP data element DRG. The software for DRG assignment changes on the fiscal year, so the NIS includes DRGs assigned with one version of the software from January to September and another version for discharges in October to December. The version of the DRG software is indicated in the HCUP data element DRGVER.

- Coding for DRGs has changed over time:
    - Effective October 2007 (Version 25 of the DRGs), CMS revised the DRG scheme into Medicare-Severity DRGs (MS-DRGs). This expanded the number of DRGs from 540 to over 700. First, DRGs were consolidated into 335 base MS-DRGs. Of these, 106 were split into two subgroups, and 152 were split into three subgroups, to arrive at 745 total MS-DRGs. The subgroups were based on the presence of complications or comorbidities (CCs) or major CCs (MCCs).

- Effective October 2015 (Version 33 of the DRGs), the MS-DRG algorithm uses ICD-10-CM/PCS codes. Differences in the underlying coding schemes can cause differences in the DRG assignment. An analysis of trends by DRG under ICD-9-CM and ICD-10-CM/PCS is available on the ICD-10-CM/PCS Resources page of the HCUP-US website.

Missing Values

- Missing data values can compromise the quality of estimates. If the outcome for discharges with missing values is different from the outcome for discharges with valid values, then sample estimates for that outcome will be biased and inaccurately represent the discharge population. For example, race is missing on over 3 percent of discharges in the 2018 NIS because some hospitals and HCUP Partners do not supply it. (The percentage of missing race values was higher in previous years.) Therefore, race-specific estimates may be biased. This is especially true for estimates of discharge totals by race.

- There are several techniques available to help assess and overcome this missing data bias.[4] 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. For details, see the report, *Missing Data Methods for the NIS and the SID*, available on the HCUP-US website.

Hospital-Level Data Elements

- Beginning with the 2012 NIS, specific hospital identifiers (e.g. the AHA identifier) are no longer available. This means that you will not be able to link the NIS to outside data sources that require hospital-specific identifiers. However, there are hospital-level data elements for all hospitals in the NIS that allow you to study certain hospital characteristics including ownership/control, teaching status, rural/urban location, bed size, and the nine census divisions (as well as the four regions).

Longitudinal Hospital Analyses

- Beginning with the 2012 data, the NIS includes a sample of discharges from all HCUP hospitals. However, the NIS hospital number (HOSP_NIS) values are reassigned each year, so they cannot be used to link hospitals across years. Thus, the redesigned NIS cannot support longitudinal analyses of specific hospitals. Even prior to 2012, there was no guarantee that individual hospitals would be sampled across data years (since a new 20 percent sample of hospitals was selected each year), thus longitudinal data analysis on the same set of hospitals was limited across years.

Hospital Volume Estimates

- Prior to the 2012 NIS, the NIS was a sample of hospitals with 100 percent of discharges from the sampled hospitals included. Therefore, hospital volumes (i.e. totals of patients for a hospital) could be calculated for each sampled hospital. However, beginning with the 2012 NIS, it is no longer possible to estimate hospital volumes. Although the redesigned

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[4] See, for example, van Buuren, S. (2012). *Flexible Imputation of Missing Data.* CRC Press, Boca Raton, FL.

NIS is a sample of discharges from all HCUP hospitals, approximating a 20 percent sample of the target universe of hospital discharges, individual hospital sampling rates vary considerably depending on which stratum the hospitals are in and how well hospitals are represented in the sampling frame.

- If a stratum is under-represented in the sampling frame, it will be oversampled to achieve the target sample size. Because information on the rate at which discharges were sampled from each hospital is not provided, users cannot reliably estimate individual hospital volumes using the NIS for 2012 or later. However, users could estimate percentages of discharges (e.g. percentage of Medicare discharges) for a hospital equal to the percentage of discharges observed in the sample for the hospital.

Calculating National Estimates

- **To produce national estimates, you MUST use discharge weights.** Use the discharge weight (DISCWT[5]) to project discharges in the NIS Core Files to the discharges from all U.S. community hospitals, excluding rehabilitation and long-term acute care (LTAC) hospitals. (For trends analysis using NIS data 2011 and earlier, see the next section of this report regarding trend weights.)

- Because the NIS is a stratified sample, proper statistical techniques must be used to calculate standard errors and confidence intervals. For detailed instructions, refer to the special report Calculating National Inpatient Sample Variances for Data Years 2012 and Later on the HCUP-US website.

- When creating national estimates, it is recommended to check your estimates against other data sources, if available.

- To ensure that you are using the weights appropriately and calculating estimates and variances accurately, check your estimates against 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 level. HCUPnet offers easy access to national statistics and trends and selected State statistics about hospital stays. HCUPnet generates statistics using the NIS, KID, NRD, NEDS, SID, SASD, and SEDD for those States that have agreed to participate. In addition, HCUPnet provides Quick Statistics – ready-to-use tables on commonly requested information.

[5] Prior to 1998, the discharge weight was named DISCWT_U. For 2000 only, use DISCWT to create national estimates for all analyses except those that involve total charges; and use DISCWTCHARGE to create national estimates of total charges.

Studying Trends

- For analysis of diagnoses and procedures, beginning with 2015 data, the introduction of ICD-10-CM/PCS means that trends that rely on diagnosis and procedures may be interrupted. Analyses that do not rely on diagnosis and procedure coding should not be affected. 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). In addition, 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 NIS is available yearly, beginning with 1988, allowing analysis of trends over time. Analyses of time trends using the HCUP NIS are recommended from 1993 forward because earlier samples were drawn from only 8 to 11 States, covering less than 50 percent of the hospital discharge population.

- When studying trends over time using the NIS, be aware that the sampling frame for the NIS changes almost annually (i.e., more States have been added over time). Estimates from earlier years of the NIS may be subject to more sampling bias than later years of the NIS.

- For the 1998 redesign, rehabilitation hospitals—although classified as community hospitals by the AHA—were excluded from the NIS universe because (1) the State data did not always include discharges from those hospitals, and (2) patient characteristics and outcomes differ from short-term acute care hospitals. Likewise, for the 2012 redesign, long term acute care (LTAC) hospitals were excluded from the NIS universe for the same reasons.

- Because of the changes implemented in the 2012 redesign, users should expect one-time disruptions to historical trends for counts, rates, and means estimated from the NIS, beginning with data year 2012. For 2012, it is expected to see overall trends in discharge counts to decline by about 4.3 percent, overall trends in average length-of-stay to decline by about 1.5 percent, overall trends in total charges to decline by about 0.5 percent, and overall trends in hospital mortality to decline by about 2.0 percent. For a detailed description of the effects of the design changes on sample estimates, please see the *2012 NIS Redesign Report* available on the HCUP-US website.

- For trends analysis using NIS data 2011 and earlier, revised weights should be used to make estimates comparable to the new design beginning with 2012 data. These new discharge trend weights replace the earlier NIS Trend Weights that were developed for the 1988-1997 NIS following the 1998 NIS redesign. The new trend weights are available for download as ASCII files, along with SAS®, SPSS®, and Stata® load programs, under 1993-2011 NIS Trend Weights Files from the NIS Database Documentation page on the HCUP-US website. The report *Using the HCUP National Inpatient Sample to Estimate Trends*, available on the HCUP-US website under Methods Series, includes recommendations for trends analysis.

Studying Readmissions

- The NIS contains discharge-level records, not patient-level records. This means that individual patients who are hospitalized multiple times in one year may be present in the NIS multiple times. There is no uniform patient identifier available that allows a patient-level analysis with the NIS. This will be especially important to remember for certain conditions for which patients may be hospitalized multiple times in a single year. Researchers wishing to examine readmissions should use either the Nationwide Readmissions Database (NRD), or the State Inpatient Databases (SID) and accompanying Revisit Files which allow identification of readmissions for individual patients. See the Databases documentation on the HCUP-US website for more information.

Variance Calculations

- It may be important for researchers to calculate a measure of precision for some estimates based on the NIS sample data. Variance estimates must consider both the sampling design and the form of the statistic. A stratified systematic sample of discharges was drawn from a sorted list of discharges comprising *all* discharges in the sampling frame. **To accurately calculate variances from the NIS, you must use appropriate statistical software and techniques.** For details, see the special report, *Calculating National Inpatient Sample (NIS) Variances for Data Years 2012 and Later*, available on the HCUP-US website.

- If discharges inside the sampling frame are similar to discharges outside the frame, the sample of discharges can be treated as if they were randomly selected from the entire universe of discharges within each stratum. Although the NIS is no longer a cluster sample, discharges are still clustered by hospitals. Therefore, hospitals (HOSP_NIS) should be treated as clusters when calculating statistics. Standard formulas for a stratified, single-stage cluster sample without replacement should still be used to calculate statistics and their variances in most applications.

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

- These variance calculations are based on finite-sample theory, which is an appropriate method for obtaining cross-sectional, national estimates of outcomes. According to finite-sample theory, the intent of the estimation process is to obtain estimates that are precise representations of the national population at a specific point in time. In the context of the NIS, any estimates that attempt to accurately describe characteristics and interrelationships among hospitals and discharges during a specific year should be governed by finite-sample theory. Examples of this 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 from 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 national population in a given year is only a snapshot in time of the possible interrelationships among hospital 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 fixed at that point in time, and because the estimate is for a fixed characteristic as it existed when sampled. This contrasts with the superpopulation model, which adopts a stochastic viewpoint rather than a deterministic viewpoint. That is, the national discharge population in a particular year is viewed as a random sample that resulted from a specific set of random events drawn from an underlying superpopulation of similar random events that might have occurred. For example, the outcome of a particular hospitalization might differ depending admission timing, hospital staffing during the stay, and so on. 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 Variance Calculations

- The discharge weights are useful for producing discharge-level statistics for analyses that use the *discharge* as the unit of analysis. The discharge weights may be used to estimate national population statistics.

- In most cases, computer programs are readily available to perform these calculations. Several statistical programming packages allow weighted analyses.[6] For example, nearly all SAS procedures incorporate weights. In addition, several statistical analysis programs have been developed to specifically calculate statistics and their standard errors from survey data. Version eight 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 and Stata to calculate NIS variances are presented in the special report *Calculating National Inpatient Sample (NIS) Variances for Data Years 2012 and Later*, available on the HCUP-US website. 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 NIS database includes a Hospital File with data elements required by these programs to calculate finite population statistics. The file includes hospital identifiers (Primary Sampling Units or PSUs), stratification data elements, and stratum-specific totals for the numbers of discharges 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 analyses, it may be feasible to set aside a part of the data for validation purposes. Standard errors and confidence intervals can then be calculated from the validation data.

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

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

SAMPLING PROCEDURE

The NIS Hospital Universe

Each year, the AHA's Health Forum administers the AHA Annual Survey of Hospitals. The purpose of the survey is to collect utilization, financial, service, and personnel information on each of the nation's hospitals. The survey's overall response rate averages approximately 85 percent each year, which is high for a voluntary survey given its length and the size of the universe (about 6,000 hospitals). For hospitals that do not respond, the AHA imputes items based on prior-year information, so that data are available for all hospitals in the universe.

The hospital universe is defined by all hospitals that were open during any part of the calendar year and were designated as community hospitals in the AHA Annual Survey. For purposes of the NIS, the definition of a *community hospital* is that used by the AHA: "all nonfederal short-term general and other specialty hospitals, excluding hospital units of institutions." Consequently, Veterans Affairs hospitals and other Federal hospitals are excluded. Beginning with the 1998 redesign, rehabilitation hospitals are excluded. Beginning with the 2012 redesign, long-term acute care hospitals are also excluded.

Long-term acute care hospitals are classified as community hospitals by the AHA if they have an average length-of-stay (ALOS) less than 30 days. However, long-term acute care hospital data was not uniformly available from all States participating in HCUP, and ALOS data from these facilities was over 25 days (unlike other community hospitals with an ALOS of about 4.5 days). Thus, long term acute care facilities were eliminated starting with the 2012 NIS.

Prior to the 2012 NIS, NIS sample weights were calculated by dividing the number of universe discharges by the number of sampled discharges within each hospital stratum. The number of universe discharges had been estimated using data from the AHA annual hospital survey. The total number of discharges in the universe was estimated by the sum of births and admissions contained in the AHA annual survey for all hospitals in the universe.

Given that HCUP Partners supply more than 95 percent of discharges nationwide, beginning with the 2012 NIS, the universe count of discharges within each stratum is estimated using the actual count of discharges contained in HCUP data. The AHA counts are used only for hospitals in the universe that do not appear in HCUP data coming from the statewide data organizations.

This option was not considered for the previous 1998 redesign because HCUP data included a much smaller percentage of discharges in the United States, and the differences between HCUP counts and AHA counts would tend to adversely affect trends as the mix of HCUP Partners changed from year to year. In 2011, for hospitals in both the AHA and the SID, in 43 of 46 States, the AHA survey data estimated State discharge totals that were between 1 percent

and 17 percent higher than the observed SID discharge totals. Overall, the AHA survey estimated about a 4 percent higher count of discharges than the observed SID count.

In the 2012 redesign, a logical corollary of switching from AHA discharge estimates to SID discharge counts was to distinguish unique hospitals using the SID hospital identifiers rather than the AHA hospital identifiers. For most hospitals, the SID hospital identifiers are in one-to-one correspondence with the AHA hospital identifiers. However, about 10 percent of the AHA identifiers correspond to two or more hospitals in the SID that have common ownership within a hospital system. For these "combined" AHA identifiers, the number of estimated discharges and the number of hospital beds in the AHA data reflect the sum of estimated discharges and the sum of beds, respectively, from the constituent hospitals. As a result, these combined hospitals could have been allocated to the wrong bed size stratum in the sample design. Also, the between-hospital variance was combined with the within-hospital variance for these combined hospitals. Therefore, use of the SID hospital identifiers in the 2012 NIS disaggregates the previously combined hospitals in many States, which is likely to improve the classification of hospitals and improve variance estimates.

For more information on how hospitals in the data set were mapped to hospitals as defined by the AHA, refer to the special report, *HCUP Hospital Identifiers*.[7] For a list of all data sources, refer to Table 2 in Appendix I.

Stratification Data Elements

Given the increase in the number of contributing HCUP Partner organizations, AHRQ evaluated and revised the sampling and weighting strategy for the 1998 NIS and subsequent data years to best represent the U.S. This included changes to the definitions of the strata data elements, the exclusion of rehabilitation hospitals from the NIS hospital universe, and a change to the calculation of hospital universe discharges for the weights. A full description of this process is available in the special report on *Changes in NIS Sampling and Weighting Strategy for 1998*, available on the HCUP-US website. (A description of the sampling procedures and definitions of strata data elements used from 1988 through 1997 can be found in the special report: *Design of the HCUP Nationwide Inpatient Sample, 1997*. This report is also available on the HCUP-US website.)

Again, for the 2012 NIS and subsequent data years, AHRQ evaluated and revised the sampling strategy to best represent the U.S. See Table 1 in Appendix I, The National Inpatient Sample (NIS) Design Changes, for a summary of design changes. For a detailed description of the NIS redesign, please see the *2012 NIS Redesign Report* available on the HCUP-US website.

Prior to 2012, the NIS sampling strata were defined based on five hospital characteristics contained in the AHA hospital files. Beginning with the 2012 NIS, the only hospital-level stratification factor that changes is census *division* rather than census *region;*[8] and the stratification data elements were defined as follows:

Census Division – New England, Middle Atlantic, East North Central, West North Central, South Atlantic, South Central, Mountain, and Pacific. This is an important stratification data element because practice patterns have been shown to vary substantially by region. For example,

[7] As of August 2019, this report had not been updated for the new NIS design; however, the methods described are still valid.
[8] However, researchers can still make estimates for census regions by aggregating census divisions.

lengths of stay tend to be longer in East Coast hospitals than in West Coast hospitals. The NIS States by census division are shown in Figure 2 of Appendix I.

1. *Control – government non-Federal (public), private not-for-profit (voluntary), and private investor-owned (proprietary)*. Depending on their control, hospitals tend to have different missions and different responses to government regulations and policies. Hospitals are stratified as public, voluntary, and proprietary. When necessary, strata are combined so that a minimum of two hospitals are included in each stratum.

2. *Location – urban or rural.* Government payment policies for hospital services often differ according to this designation. Also, rural hospitals are generally smaller and offer fewer services than urban hospitals. Hospitals with a CBSA type of *Metropolitan* are categorized as urban, while hospitals with a CBSA type of *Micropolitan* or *Rural* are designated as rural.

3. *Teaching Status – teaching or non-teaching.* The missions of teaching hospitals differ from non-teaching hospitals. In addition, financial considerations differ between these two hospital groups. Currently, the Medicare Diagnosis Related Group (DRG) payments are uniformly higher to teaching hospitals. A hospital is considered to be a teaching hospital if it met any one of the following three criteria: (See Appendix IV for details.)

    - Residency training approval by the Accreditation Council for Graduate Medical Education (ACGME)
    - Membership in the Council of Teaching Hospitals (COTH)
    - A ratio of full-time equivalent interns and residents to beds of .25 or higher

4. *Bed Size – small, medium, and large.* Bed size categories were based on the number of hospital beds and were specific to the hospital's region, location, and teaching status, as shown in Table 6 in Appendix I. The bed size cutoff points were chosen so that approximately one-third of the hospitals in each region, location, and teaching status combination would fall within each bed size category (small, medium, or large). Different cutoff points were used for rural, urban non-teaching, and urban teaching hospitals because hospitals in those categories tend to be small, medium, and large, respectively. For example, a medium-sized teaching hospital would be considered a rather large rural hospital. Further, the size distribution is different among regions for each of the urban/teaching categories. For example, teaching hospitals tend to be smaller in the West than they are in the South. Using differing cutoff points in this manner avoids strata containing small numbers of hospitals.

No distinction was made by teaching status among rural hospitals, because rural teaching hospitals were rare. For example, in 2018, rural teaching hospitals comprised less than 4 percent of the total hospital universe. Bed size categories were defined within location and teaching status because they would otherwise have been redundant. Rural hospitals tend to be small; urban non-teaching hospitals tend to be medium-sized; and urban teaching hospitals tend to be large. Yet it was important to recognize gradations of size within these types of hospitals. For example, in serving rural discharges, the role of "large" rural hospitals (particularly rural referral centers) often differs from the role of "small" rural hospitals.

To further ensure geographic representativeness of the sample, implicit stratification data elements included de-identified hospital number, Diagnosis Related Group (DRG), and admission month. The discharges were sorted according to these data elements prior to systematic random sampling.

Design Considerations

Prior to 2012, the NIS was a stratified probability sample of hospitals in the frame, with sampling probabilities proportional to the number of U.S. community hospitals in each stratum: sampling probabilities were calculated to select 20 percent of the universe of U.S. community, non-rehabilitation hospitals contained in each stratum. This sample size was determined by AHRQ based on their experience with similar research databases. The overall design objective was to select a sample of hospitals that accurately represented the target universe, which included hospitals outside the frame (i.e., having zero probability of selection). Moreover, this sample was to be geographically dispersed, yet drawn only from data supplied by HCUP Partners.

Starting with the 2012 NIS, a systematic sampling design is used to construct the database. Rather than first drawing a sample of hospitals and then keeping all discharges from that sample, in the 2012 NIS redesign a sample of discharges was drawn from *all* hospitals in the hospital frame. Both designs selected approximately 20 percent of the target universe of discharges from United States community hospitals, excluding rehabilitation and long-term acute care hospitals.

The new systematic sample is a self-weighted sample design similar to simple random sampling, but it is more efficient. It ensures that the sample is representative of the population on the following critical factors: hospital factors (de-identified hospital number, census division, ownership, urban-rural location, teaching status, number of beds) and patient factors (diagnosis-related group, admission month). Within each stratum all discharges are sorted in the following order on patient-level "control" variables: encrypted hospital ID, DRG, admission month, and a random number.

It should be possible, for example, to estimate DRG-specific average lengths of stay across all U.S. hospitals using weighted average lengths of stay, based on averages or regression coefficients calculated from the NIS. Ideally, relationships among outcomes and their correlates estimated from the NIS should accurately represent all U.S. hospitals. It is advisable to verify your estimates against other data sources, especially for specific patient populations (e.g., organ transplant recipients).

The *2012 NIS Redesign Report* assessed the accuracy of NIS estimates and considered alternative stratified sampling allocation schemes. However, the systematic sampling design was preferred for several reasons:

- It significantly reduced the margin of error for estimates and delivered improved accuracy more consistently across DRGs compared with the other alternatives.
- It is easy for analysts to use because of its self-weighting design.
- It is straightforward to estimate accurate confidence intervals using standard statistical software.
- There is little researcher demand for 100 percent of discharges from a sample of hospitals, and researchers who require complete discharge data from every hospital can use the SID data.
- Its implementation on an annual basis will be efficient and can be accomplished using readily available software and accepted methods.

Overview of the Sampling Procedure

The strata for the 2012 and later NIS systematic sampling design are the same as those for the previous NIS sample design except that the four census regions are replaced by the nine census divisions—New England, Middle Atlantic, East North Central, West North Central, South Atlantic, South Central, Mountain, and Pacific. Within each stratum, dischargers are sorted by re-identified hospital number. Then, within each hospital, discharges are sorted by their DRG and their admission month. This sorting ensures that the NIS sample will be representative on these factors.

Next, within each stratum, a number of discharges proportionate to the number of discharges in the universe are selected systematically from the sorted list. For example, if the sampling frame was equal to the universe and 20 percent of the universe was required, then every fifth discharge would be selected from the sorted list of discharges, beginning with a randomly selected start at discharge number 1, 2, 3, 4, or 5 on the list.

To ensure a self-weighted sample that has 20 percent of the universe within each stratum represented, sampling rates would vary for each stratum, depending on the proportion of the population of discharges covered by the discharges in the sampling frame. Thus, the sampling rate would not always be 20 percent for each stratum. For strata that were missing more discharges, the sampling rate would be higher to ensure that the number of sampled discharges would equal 20 percent of the universe.

WEIGHTS

To obtain nationwide estimates, discharge weights were developed to extrapolate NIS sample discharges to the discharge universe. NIS discharge weights are calculated by dividing the number of universe discharges by the number of sampled discharges within each NIS stratum. Historically, the number of universe discharges had been estimated using data from the AHA annual hospital survey. The total number of discharges in the universe was estimated by the sum of births and admissions contained in the AHA annual survey for all hospitals in the universe.

Given that HCUP Partners supply more than 95 percent of discharges nationwide, beginning with the 2012 NIS, the universe count of discharges was estimated within each stratum using the actual count of discharges contained in HCUP data. The only exceptions are for strata with HCUP hospitals that, according to the AHA files, were open for the entire year but contributed less than a full year of data to HCUP. For those hospitals, the number of observed discharges was *adjusted* by a factor of 12 ÷ M, where M is the number of months for which the hospital contributed discharges to HCUP. For example, when a hospital contributed only six months of discharge data to HCUP, the *adjusted* number of discharges is double the observed number.

For non-HCUP hospitals in the universe, adjusted AHA discharge estimates were calculated by multiplying the AHA admissions plus births volume by the overall ratio of HCUP discharges to AHA volumes for HCUP hospitals in the census division.

The discharge weights are constant for all discharges within a stratum, where the stratum is defined by hospital characteristics: census division, rural/urban location, bed size, teaching status, and ownership. The previous design provided discharge weights that reflected the

universe of discharges in each of the *four census regions*. The 2012 NIS design provides discharge weights that reflect the universe of discharges in each of the nine *census divisions*.

Each discharge weight is essentially equal to the number of target universe discharges that each sampled discharge represents in its stratum. Discharge weights to the universe were calculated as follows: Within stratum *s*, each NIS sample discharge's universe weight was calculated as:

$DW_s(\text{universe}) = DN_s(\text{universe}) \div DN_s(\text{sample})$

where DW_s(universe) was the discharge weight; DN_s(universe) represented the number of discharges from community hospitals in the universe within stratum *s*; and DN_s(sample) was the number of discharges selected for the NIS. Thus, each discharge's weight (DISCWT) is equal to the number of universe discharges it represents in stratum *s* during that year.[9] Because 20 percent of the universe discharges in each stratum were sampled, the discharge weights are near five.

Prior to the 2012 NIS redesign, the NIS included weights to project NIS hospitals to the number of hospital in the target universe. However, with the 2012 NIS redesign the hospital weights are discontinued because the NIS is now a sample of discharges from all available HCUP SID community hospitals, excluding rehabilitation and long-term acute care hospitals.

[9] Although discharge characteristics (DRG and admission month) are implicit stratifiers for sampling, they do not play a role in weighting.

APPENDIX I: TABLES AND FIGURES

Table 1: National Inpatient Sample (NIS) Design Changes Beginning in 2012

Feature	Previous Design (1998-2011)	New 2012 and Later Design
Universe	Included long-term acute care hospitals	Removed long-term acute care hospitals
	Discharge estimates based on AHA admissions plus births	Discharge estimates based on SID discharges when available (for about 90 percent of all hospitals); otherwise, based on adjusted AHA counts
	Hospitals defined based on AHA IDs	Hospitals defined based on State-supplied hospital identifiers for HCUP States
Sample design	Sample hospitals and then retain all discharges from each sampled hospital	Systematic sample of discharges from all frame hospitals
	Stratified by: • hospital census *region,*[a] • ownership, • urban/rural location, • teaching status, and • number of beds (bed size categories)	Stratified by • hospital census *division,*[b] • ownership, • urban/rural location, • teaching status, and • number of beds (bed size categories)
	Sorted by three-digit hospital ZIP Code within strata before sampling	Sorted by hospital and by DRG and admission month within strata before sampling
	Sample without self-weighting requires weights for all estimates	Self-weighting sample requires weights for estimating totals, but not for means and rates
Data elements	Includes State and hospital identifiers and data elements with State-specific coding	• Drops State identifiers and data elements that were not available uniformly across the States, such as hospital identifiers, secondary payer, and data elements with State-specific coding • Drop hospital weights • Retain certain high value State-specific data elements (See Appendix B) • Ages (AGE) over 89 are aggregated into a single category of 90 years or older in the HCUP nationwide databases starting in data year 2012.

Abbreviations: AHA, American Hospital Association; DRG, diagnosis-related group; ID, identification numbers; SID, State Inpatient Databases.

[a] Census region: Northeast, Midwest, South, West.

[b] Census division: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, Pacific.

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Table 2: States Participating in the 2018 NIS

State	Data Organization
AK	Alaska Department of Health and Social Services
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
DE	Delaware Division of Public Health
FL	Florida Agency for Health Care Administration
GA	Georgia Hospital Association
HI	(Hawaii) Laulima Data Alliance
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
LA	Louisiana Department of Health
MA	Massachusetts Center for Health Information and Analysis
MD	Maryland Health Services Cost Review Commission
ME	Maine Health Data Organization
MI	Michigan Health & Hospital Association
MN	Minnesota Hospital Association
MO	Missouri Hospital Industry Data Institute
MS	Mississippi Department of Health
MT	Montana Hospital Association

State	Data Organization
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
NM	New Mexico Department of Health
NV	Nevada Department of Health & Human Services
NY	New York State Department of Health
OH	Ohio Hospital Association
OK	Oklahoma State Department of Health
OR	Oregon Association of Hospitals and Health Systems
PA	Pennsylvania Health Care Cost Containment Council
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
TX	Texas Department of State Health Services
UT	Utah Department of Health
VT	Vermont Association of Hospitals and Health Systems
VA	Virginia Health Information
WA	Washington State Department of Health
WI	Wisconsin Department of Health Services
WV	West Virginia Health Care Authority
WY	Wyoming Hospital Association

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Table 3: Summary of NIS States, Hospitals, and Inpatient Stays, 1988-2018

Year	Data Sources	Number of States	Number of Hospitals	Number of Discharges in the NIS, Unweighted	Number of Discharges in the NIS, Weighted	Number of Discharges in the NIS, Weighted with Trend Weight
1988	CA CO FL IA IL MA NJ WA	8	759	5,265,756	35,171,448	
1989	AZ CA CO FL IA IL MA NJ PA WA WI	11	882	6,110,064	35,104,645	
1990	AZ CA CO FL IA IL MA NJ PA WA WI	11	871	6,268,515	35,215,397	
1991	AZ CA CO FL IA IL MA NJ PA WA WI	11	859	6,156,188	35,036,492	
1992	AZ CA CO FL IA IL MA NJ PA WA WI	11	856	6,195,744	35,011,385	
1993	AZ CA CO CT FL IA IL KS MA MD NJ NY OR PA SC WA WI	17	913	6,538,976	34,715,985	33,736,753
1994	AZ CA CO CT FL IA IL KS MA MD NJ NY OR PA SC WA WI	17	904	6,385,011	34,622,203	33,149,768
1995	AZ CA CO CT FL IA IL KS MA MD MO NJ NY OR PA SC TN WA WI	19	938	6,714,935	34,791,998	33,647,121
1996	AZ CA CO CT FL IA IL KS MA MD MO NJ NY OR PA SC TN WA WI	19	906	6,542,069	34,874,386	33,386,097
1997	AZ CA CO CT FL GA HI IA IL KS MA MD MO NJ NY OR PA SC TN UT WA WI	22	1,012	7,148,420	35,408,207	33,232,257
1998	AZ CA CO CT FL GA HI IA IL KS MA MD MO NJ NY OR PA SC TN UT WA WI	22	984	6,827,350	34,874,001	33,923,632
1999	AZ CA CO CT FL GA HI IA IL KS MA MD ME MO NJ NY OR PA SC TN UT VA WA WI	24	984	7,198,929	35,467,673	34,440,994
2000	AZ CA CO CT FL GA HI IA IL KS KY MA MD ME MO NC NJ NY OR PA SC TN TX UT VA WA WI WV	28	994	7,450,992	36,417,565	35,300,425
2001	AZ CA CO CT FL GA HI IA IL KS KY MA MD ME MI MN MO NC NE NJ NY OR PA RI SC TN TX UT VA VT WA WI WV	33	986	7,452,727	37,187,641	36,093,550
2002	CA CO CT FL GA HI IA IL KS KY MA MD ME MI MN MO NC NE NJ NV NY OH OR PA RI SC SD TN TX UT VA VT WA WI WV	35	995	7,853,982	37,804,021	36,523,831
2003	AZ CA CO CT FL GA HI IA IL IN KS KY MA MD MI MN MO NC NE NH NJ NV NY OH OR PA RI SC SD TN TX UT VA VT WA WI WV	37	994	7,977,728	38,220,659	37,074,605
2004	AR AZ CA CO CT FL GA HI IA IL IN KS KY MA MD MI MN MO NC NE NH NJ NV NY OH OR RI SC SD TN TX UT VA VT WA WI WV	37	1,004	8,004,571	38,661,786	37,496,978

Year	Data Sources	Number of States	Number of Hospitals	Number of Discharges in the NIS, Unweighted	Number of Discharges in the NIS, Weighted	Number of Discharges in the NIS, Weighted with Trend Weight
2005	AR AZ CA CO CT FL GA HI IA IL IN KS KY MA MD MI MN MO NC NE NH NJ NV NY OH OK OR RI SC SD TN TX UT VT WA WI WV	37	1,054	7,995,048	39,163,834	37,843,039
2006	AR AZ CA CO CT FL GA HI IA IL IN KS KY MA MD MI MN MO NC NE NH NJ NV NY OH OK OR RI SC SD TN TX UT VA VT WA WI WV	38	1,045	8,074,825	39,450,216	38,076,556
2007	AR AZ CA CO CT FL GA HI IA IL IN KS KY MA MD ME MI MN MO NC NE NH NJ NV NY OH OK OR RI SC SD TN TX UT VA VT WA WI WV WY	40	1,044	8,043,415	39,541,948	38,155,908
2008	AR AZ CA CO CT FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO NC NE NH NJ NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	42	1,056	8,158,381	39,885,120	38,210,889
2009	AR AZ CA CO CT FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MT NC NE NH NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	44	1,050	7,810,762	39,434,956	37,734,584
2010	AK AR AZ CA CO CT FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MS MT NC NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	45	1,051	7,800,441	39,008,298	37,352,013
2011	AK AR AZ CA CO CT FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	46	1,049	8,023,590	38,590,733	36,962,415
2012	AK AR AZ CA CO CT FL GA HI IA IL IN KS KY LA MA MD MI MN MO MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	44	4,378	7,296,968	36,484,846	
2013	AR AZ CA CO CT DC FL GA HI IA IL IN KS KY LA MA MD MI MN MO MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	44	4,363	7,119,563	35,597,792	
2014	AR AZ CA CO CT DC FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	45	4,411	7,071,762	35,358,818	

Year	Data Sources	Number of States	Number of Hospitals	Number of Discharges in the NIS, Unweighted	Number of Discharges in the NIS, Weighted	Number of Discharges in the NIS, Weighted with Trend Weight
2015	AK AR AZ CA CO CT DC FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	47	4,573	7,153,989	35,769,942	
2016	AK AR AZ CA CO CT DC FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	47	4,575	7,135,090	35,675,421	
2017	AK AR AZ CA CO CT DC DE FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	48	4,584	7,159,694	35,798,453	
2018	AK AR AZ CA CO CT DC DE FL GA HI IA IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY	48	4,550	7,105,498	35,527,481	

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Table 4: Number of Hospitals and Discharges in 2018 Universe, Frame, and NIS, by Census Division

Number of Hospitals and Discharges in 2018 Universe, Frame, and NIS, by Census Division								
		Universe		Frame		NIS		
Census Region	Census Division	Hospitals	Discharges	Hospitals	Discharges	Hospitals	Discharges	Weighted Discharges
Northeast	New England	180	1,642,433	151	1,505,540	150	328,487	1,642,433
Northeast	Middle Atlantic	440	4,824,308	417	4,470,821	417	964,863	4,824,308
Northeast	***Subtotal***	***620***	***6,466,741***	***568***	***5,976,361***	***567***	***1,293,350***	***6,466,741***
Midwest	East North Central	755	5,402,299	742	5,371,151	741	1,080,458	5,402,299
Midwest	West North Central	671	2,506,338	628	2,481,206	628	501,269	2,506,338
Midwest	***Subtotal***	***1,426***	***7,908,637***	***1,370***	***7,852,357***	***1,369***	***1,581,727***	***7,908,637***
South	South Atlantic	716	7,353,957	709	7,340,171	709	1,470,790	7,353,957
South	East South Central	392	2,412,549	292	1,727,155	292	482,509	2,412,549
South	West South Central	794	4,262,187	753	4,173,813	753	852,437	4,262,187
South	***Subtotal***	***1,902***	***14,028,693***	***1,754***	***13,241,139***	***1,754***	***2,805,736***	***14,028,693***
West	Mountain	398	2,258,321	335	2,096,074	335	451,667	2,258,321
West	Pacific	533	4,865,089	526	4,834,277	525	973,018	4,865,089
West	***Subtotal***	***931***	***7,123,410***	***861***	***6,930,351***	***860***	***1,424,685***	***7,123,410***
Total	***Total***	***4,879***	***35,527,481***	***4,553***	***34,000,208***	***4,550***	***7,105,498***	***35,527,481***

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Table 5: NIS Related Reports and Database Documentation Available on HCUP-US

Description of the NIS Database
• NIS Overview
  ○ HCUP Partners in the NIS
• Introduction to the NIS, 2018 – *this document*
• NIS Related Reports
Links to HCUP-US page with various NIS related reports such as the following:
  ○ Design of the Nationwide Inpatient Sample for 1988 to 2005.
  ○ Changes in NIS Sampling and Weighting Strategy for 1998
  ○ Updated Calculating NIS Variance Reports
  ○ NIS Trends Report
  ○ Missing Data Methods Report
  ○ 2012 NIS Redesign Report
  ○ NIS Comparison Reports (available for years in which the NIS sample changed)
  ○ HCUP Data Quality Reports for 1988-2018
  ○ HCUP E-Code Evaluation Report
	ICD-10-CM/PCS Data Included in the NIS Starting With 2015
	• NIS Changes Beginning Data Year 2016
	• Caution: 2015 NIS includes ICD-9-CM and ICD-10-CM/PCS
	  ○ 2015 NIS Revised File Structure and New Data Elements
	• Additional ICD-10-CM/PCS Resources
	• Tutorial for Loading HCUP Software Tools for ICD-10-CM/PCS
	
	Information on the Redesign of the NIS in 2012
	• 2012 NIS Redesign Report
	• Trend Weights for the 1993-2011 NIS for Consistent Estimates with the Redesigned NIS
	
	Known Data Issues
	• Why the NIS should not be used to make State-level estimates
	• Information on corrections to the NIS data sets
	
	NIS Supplemental Files
	• Cost-to-Charge Ratio files
	• Hospital Market Structure (HMS) files
	• 1993-2011 NIS Supplemental Discharge-Level Files
	• NIS Ownership Files

Restrictions on the Use
• Data Use Agreement Training
• Data Use Agreement for the NIS
• Requirements for Publishing with HCUP data
 	
File Specifications and Load Programs
• NIS File Specifications
• Nationwide SAS Load Programs
• Nationwide SPSS Load Programs
• Nationwide Stata Load Programs
	HCUP Tools: Labels and Formats
	• Overview of Clinical Classifications Software (CCS), a categorization scheme that groups ICD-9-CM diagnosis and procedure codes into mutually exclusive categories
	• Format Programs
	  ○ Labels file for multiple versions of Diagnosis Related Groups (DRGs) and Major Diagnostic Categories (MDCs)
	  ○ NIS SAS format library program to create value labels
	  ○ HCUP Diagnosis and Procedure Groups Formats Program - formats to label DX_PR_Groups including CCS data elements
	  ○ NIS ICD-9-CM formats to label ICD-9-CM diagnoses and procedures

		○ NIS ICD-10-CM formats to label ICD-10-CM diagnoses and procedures ○ NIS Severity formats to label severity data elements

Data Elements
• NIS Description of Data Elements – details uniform coding and State-specific idiosyncrasies
• NIS Summary Statistics – lists means and frequencies on nearly all data elements
• Prior to Data Year 2012
  • Availability of AHA Hospital Identifiers
  • Why the NIS should not be used to make State-level estimates		

Additional Resources for Data Elements • NIS Severity Measures – provides detailed documentation on the different types of measures • 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		**Obtaining HCUP Data** • Purchase HCUP data from the HCUP Central Distributor

Table 6: Hospital Size Categories (in Number of Beds), by Region

Location and Teaching Status	Hospital Bed Size		
	Small	**Medium**	**Large**
NORTHEAST			
Rural	1-49	50-99	100+
Urban, non-teaching	1-124	125-199	200+
Urban, teaching	1-249	250-424	425+
MIDWEST			
Rural	1-29	30-49	50+
Urban, non-teaching	1-74	75-174	175+
Urban, teaching	1-249	250-374	375+
SOUTH			
Rural	1-39	40-74	75+
Urban, non-teaching	1-99	100-199	200+
Urban, teaching	1-249	250-449	450+
WEST			
Rural	1-24	25-44	45+
Urban, non-teaching	1-99	100-174	175+
Urban, teaching	1-199	200-324	325+

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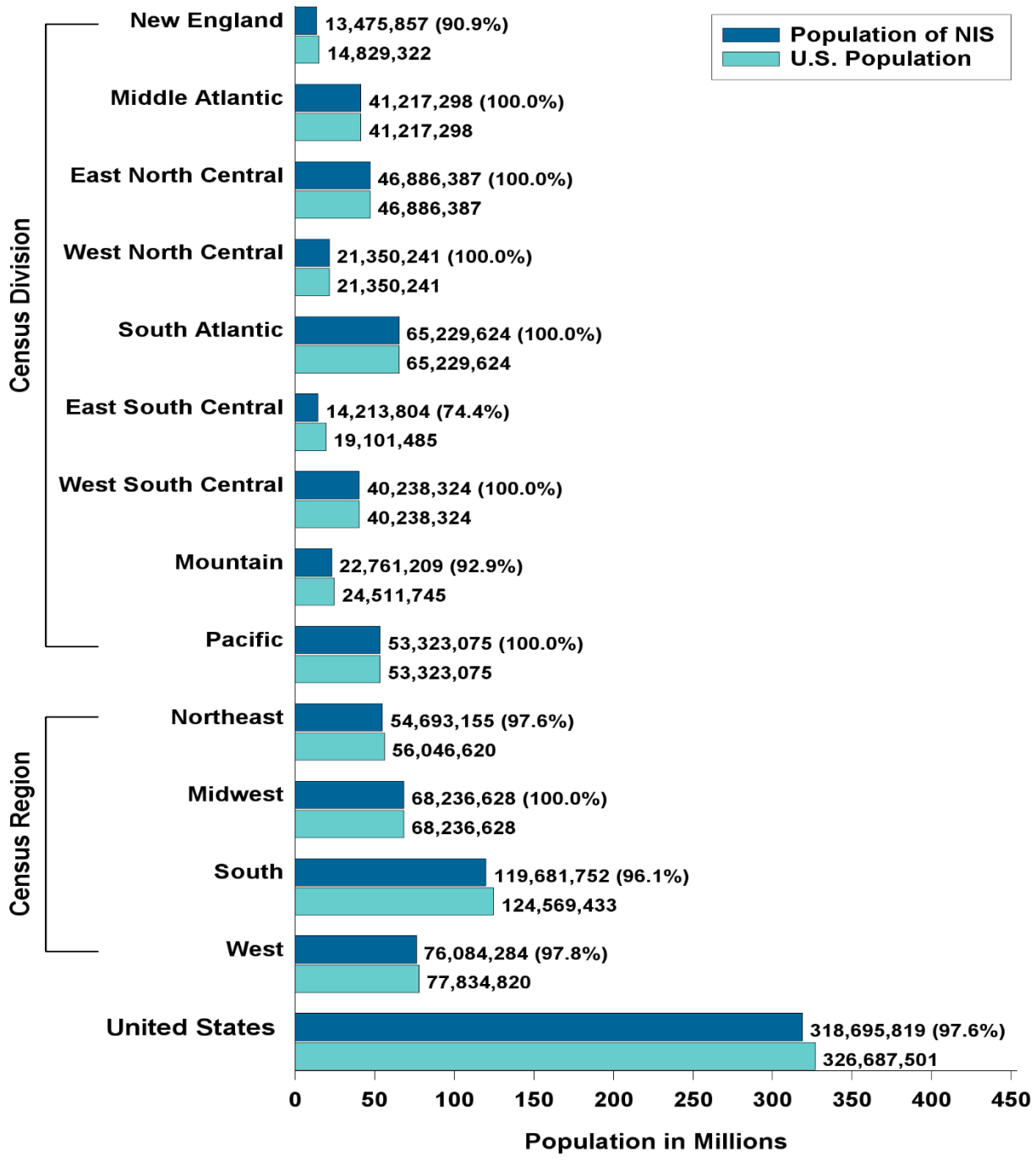
Figure 1: Percentage of U.S. Population Covered in the 2018 NIS by Census Division and Region, Calculated using the Estimated U.S. Population on July 1, 2018.



Source: Table 1. Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2019 (NST-EST2019-01). Source: U.S. Census Bureau, Population Division. Release Date: December 2019.

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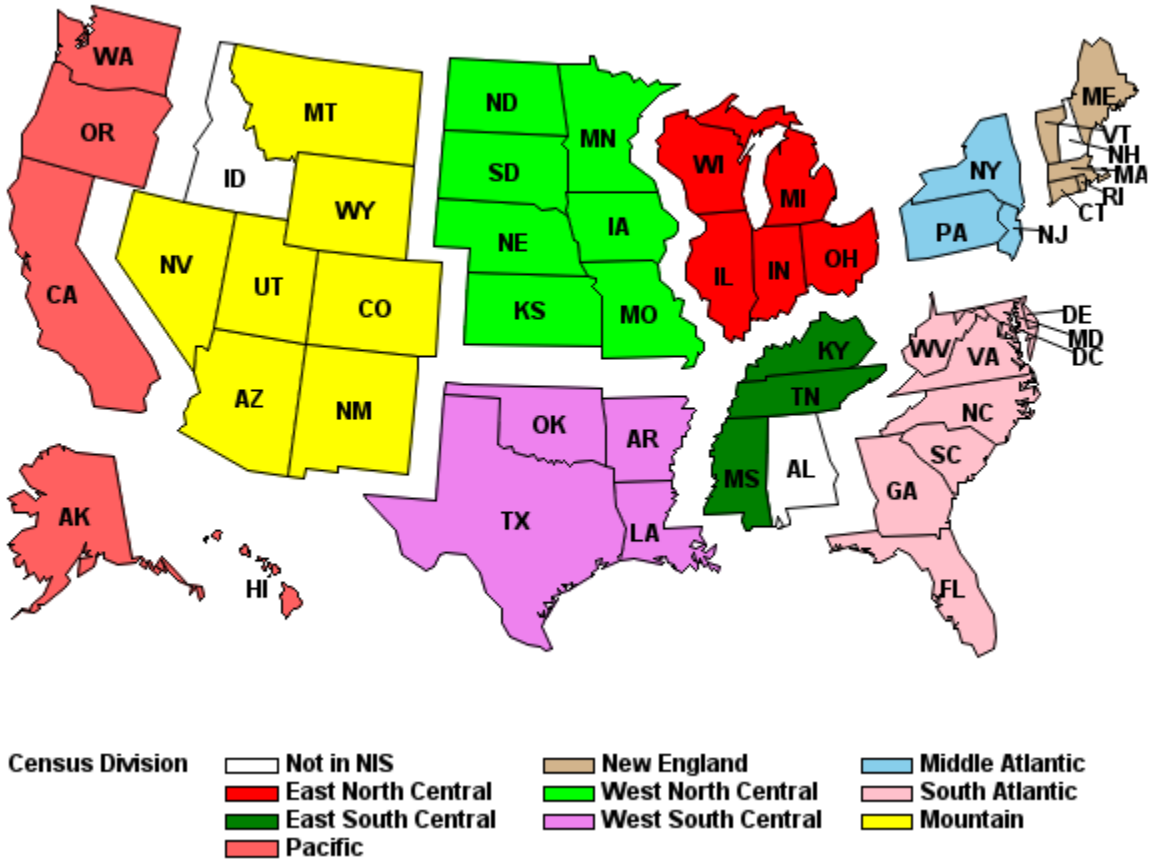
Figure 2: NIS States, by Census Division



All States, by U.S Census Bureau Region and Census Division

- Region 1 (Northeast)
  - Division 1 (New England) Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut
  - Division 2 (Mid-Atlantic) New York, Pennsylvania, New Jersey
- Region 2 (Midwest[a])
  - Division 3 (East North Central) Wisconsin, Michigan, Illinois, Indiana, Ohio
  - Division 4 (West North Central) Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa
- Region 3 (South)
  - Division 5 (South Atlantic) Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida
  - Division 6 (East South Central) Kentucky, Tennessee, Mississippi, *Alabama*
  - Division 7 (West South Central) Oklahoma, Texas, Arkansas, Louisiana
- Region 4 (West)
  - Division 8 (Mountain) *Idaho*, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico
  - Division 9 (Pacific) Alaska, Washington, Oregon, California, Hawaii

Notes: New Hampshire participates in HCUP but did not provide data in time for the 2010-2018 NIS.
Mississippi participates in HCUP but did not provide data in time for the 2012-2014 NIS.
Alaska participates in HCUP but did not provide data in time for the 2013-2014 NIS.
States and areas in italics do not participate in HCUP.
[a] Prior to June 1984, the Midwest Region was designated as the North Central Region.
Source: U.S. Census Bureau. Census Bureau Regions and Divisions with State FIPS Codes.
www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf. Accessed May 18, 2018.

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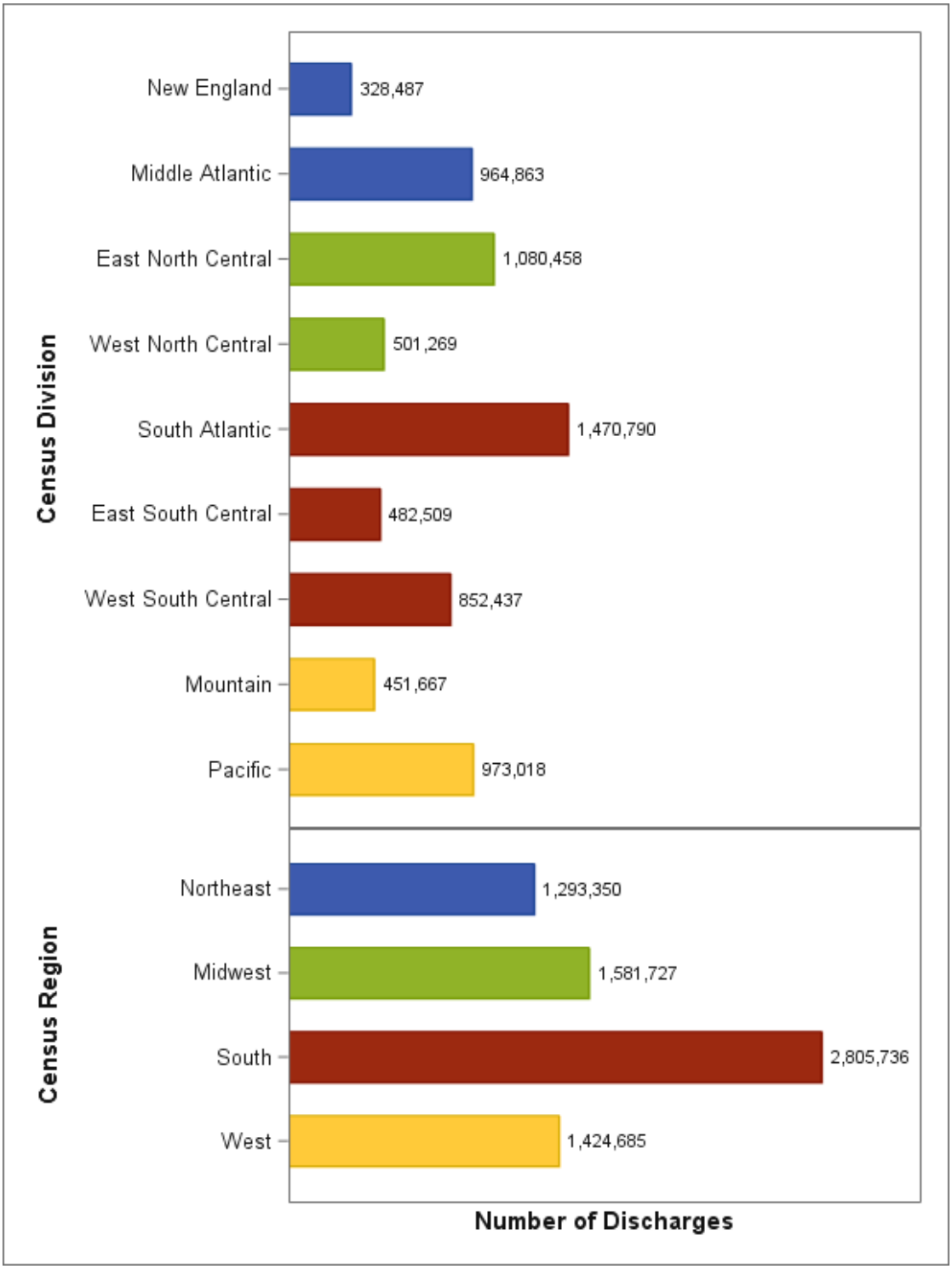
Figure 3: Number of Discharges (in Thousands, Unweighted) in 2018 NIS by Census Division and Census Region



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APPENDIX II: STATE-SPECIFIC RESTRICTIONS

The table below enumerates the types of restrictions applied to the National Inpatient Sample. Restrictions include the following types:

- Confidentiality of records
  - Restricted release of age in years
- Missing discharges.

Confidentiality of Records - Restricted Release of Age in Years
• Ages (AGE) over 89 are aggregated into a single category of 90 years or older in the HCUP nationwide databases starting in data year 2012. • At least one Partner required ages in years (AGE) to be set to the midpoints of age ranges.

Missing Discharges
• At least one Partner prohibits the release of discharge records for patients with HIV diagnoses. • At least one Partner prohibits the release of Alternate Level of Care (SNF / Swing Bed Skilled) discharges. • At least one Partner prohibits the release of abortion discharges. • At least one Partner prohibits the release of medical misadventure or adverse reaction cause codes.

APPENDIX III: DATA ELEMENTS

Beginning with quarter 4 of 2015, data elements derived from the AHRQ software tools based on ICD-10-CM/PCS diagnosis and/or procedure codes are *not available on the NIS* except for the Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses, which is available beginning in data year 2018. Users interested in applying additional AHRQ software tools to the NIS that include ICD-10-CM/PCS-coded data may do so by downloading the respective tool(s) from the HCUP Tools & Software section of the HCUP User Support (HCUP-US) website at https://www.hcup-us.ahrq.gov/tools_software.jsp. 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.

Table 1: Data Elements in the 2018 NIS Inpatient Core Files

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

Type of Data Element	HCUP Name	Coding Notes
Admission information		
Admission day	AWEEKEND	Admission on weekend: (0) admission on Monday-Friday, (1) admission on Saturday-Sunday
Admission month	AMONTH	Admission month coded from (1) January to (12) December
Transferred into hospital	TRAN_IN	Transfer In Indicator: (0) not a transfer, (1) transferred in from a different acute care hospital [ATYPE NE 4 & (ASOURCE=2 or POO=4)], (2) transferred in from another type of health facility [ATYPE NE 4 & (ASOURCE=3 or POO=5, 6, D, E, F)]
Indicator of emergency department service	HCUP_ED	Indicator that discharge record includes evidence of emergency department (ED) services: (0) Record does not meet any HCUP Emergency Department criteria, (1) Emergency Department revenue code on record, (2) Positive Emergency Department charge (when revenue center codes are not available), (3) Emergency Department CPT procedure code on record, (4) Admission source of ED, (5) State-defined ED record; no ED charges available
Admission type	ELECTIVE	Indicates elective admission: (1) elective, (0) non-elective admission

Type of Data Element	HCUP Name	Coding Notes
Patient demographic and location information		
Age at admission	AGE	Age in years coded 0-124 years
	AGE_NEONATE	Neonatal age (first 28 days after birth) indicator: (0) non-neonatal age (1) neonatal age
Sex of patient	FEMALE	Indicates gender for NIS beginning in 1998: (0) male, (1) female
Race of patient	RACE	Race, uniform coding: (1) white, (2) black, (3) Hispanic, (4) Asian or Pacific Islander, (5) Native American, (6) other. (*For 2018, RACE contains missing values on over 3 percent of the records*.)
Location of patient's residence	PL_NCHS	Patient Location: NCHS Urban-Rural Code. This is a six-category urban-rural classification scheme for U.S. counties: (1) "Central" counties of metro areas of >=1 million population, (2) "Fringe" counties of metro areas of >=1 million population, (3) Counties in metro areas of 250,000-999,999 population, (4) Counties in metro areas of 50,000-249,999 population, (5) Micropolitan counties, (6) Not metropolitan or micropolitan counties
Median household income for patient's ZIP Code	ZIPINC_QRTL	Median household income quartiles for patient's ZIP Code. For 2018, the median income quartiles are defined as: (1) $1 - $45,999; (2) $46,000 - $58,999; (3) $59,000 - 78,999; and (4) $79,000 or more.
Payer information		
Primary expected payer	PAY1	Expected primary payer, uniform: (1) Medicare, (2) Medicaid, (3) private including HMO, (4) self-pay, (5) no charge, (6) other
Diagnosis and procedure information		
ICD-10-CM diagnoses	I10_DX1 – I10_DX40	ICD-10-CM diagnoses, principal and secondary, with external cause of morbidity codes at the end of the array
	I10_NDX	Number of ICD-10-CM diagnoses coded on the record

Type of Data Element	HCUP Name	Coding Notes
ICD-10-PCS procedures	I10_PR1 – I10_PR25	ICD-10-PCS procedures, principal and secondary
	I10_NPR	Number of ICD-10-PCS procedures coded on the record
	PRDAY1	Number of days from admission to principal procedure
	PRDAY2 – PRDAY25	Number of days from admission to secondary procedures
DRG information		
Diagnosis Related Group (DRG)	DRG	DRG in use on discharge date (based on ICD-10-CM/PCS codes)
	DRG_NoPOA	DRG in use on discharge date, calculated without Present On Admission (POA) indicators (based on ICD-10-CM/PCS codes)
	DRGVER	Grouper version in use on discharge date
Major Diagnostic Category (MDC)	MDC	MDC in use on discharge date (based on ICD-10-CM/PCS codes)
	MDC_NoPOA	MDC in use on discharge date, calculated without Present on Admission (POA) indicators (based on ICD-10-CM/PCS codes)
Resource use information		
Total charges	TOTCHG	Total charges, edited
Length of stay	LOS	Length of stay, edited
Discharge information		
Discharge quarter	DQTR	Coded: (1) First quarter, Jan - Mar, (2) Second quarter, Apr - Jun, (3) Third quarter, Jul - Sep, (4) Fourth quarter, Oct - Dec
Discharge year	YEAR	Calendar year
Disposition of patient (discharge status)	DIED	Indicates in-hospital death: (0) did not die during hospitalization, (1) died during hospitalization
	DISPUNIFORM	Disposition of patient, uniform coding used beginning in 1998: (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

Type of Data Element	HCUP Name	Coding Notes
	TRAN_OUT	Transfer Out Indicator: (0) not a transfer, (1) transferred out to a different acute care hospital, (2) transferred out to another type of health facility

Weights (to calculate national estimates)

Discharge weights	DISCWT	Discharge weight on Core File and Hospital File for NIS beginning in 1998.

Hospital information

Hospital identifiers (encrypted)	HOSP_NIS	NIS hospital number (links to Hospital File; does not link to previous years)
Hospital location	HOSP_DIVISION	Census Division of hospital (STRATA): (1) New England, (2) Middle Atlantic, (3) East North Central, (4) West North Central, (5) South Atlantic, (6) East South Central, (7) West South Central, (8) Mountain, (9) Pacific
Hospital stratifier	NIS_STRATUM	Stratum used to sample hospitals, based on geographic region, control, location/teaching status, and bed size. Stratum information is also contained in the Hospital File.

Linkage Data Element

Record identifier, synthetic	KEY_NIS	Unique record number for file beginning in 2012 links the Core File to other discharge-level NIS files.

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Table 2: Data Elements in the 2018 NIS Hospital Files

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

Type of Data Element	HCUP Name	Coding Notes
Discharge counts	N_DISC_U	Number of universe discharges in the stratum
	S_DISC_U	Number of sampled discharges in the sampling stratum (NIS_STRATUM or STRATUM)
	TOTAL_DISC	Total number of discharges from this hospital in the NIS
Discharge weights	DISCWT	Discharge weight used in the NIS beginning in 1998.
Discharge Year	YEAR	Discharge year
	N_HOSP_U	Number of universe hospitals in the stratum
	S_HOSP_U	Number of sampled hospitals in the stratum (NIS_STRATUM or STRATUM)
Hospital identifiers	HOSP_NIS	NIS hospital number (links to Hospital File; does not link to previous years)
Hospital characteristics	HOSP_BEDSIZE	Bed size of hospital (STRATA): (1) small, (2) medium, (3) large
	H_CONTRL	Control/ownership of hospital: (1) government, nonfederal, (2) private, non-profit, (3) private, investor-own
	HOSP_ LOCTEACH	Location/teaching status of hospital (STRATA): (1) rural, (2) urban non-teaching, (3) urban teaching
	HOSP_REGION	Region of hospital: (1) Northeast, (2) Midwest, (3) South, (4) West
	HOSP_DIVISION	Census Division of hospital (STRATA): (1) New England, (2) Middle Atlantic, (3) East North Central, (4) West North Central, (5) South Atlantic, (6) East South Central, (7) West South Central, (8) Mountain, (9) Pacific
	NIS_STRATUM	Stratum used to sample hospitals beginning in 1998; includes geographic region, control, location/teaching status, and bed size

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Table 3: Data Elements in the 2018 NIS Disease Severity Measures Files

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

Type of Data Element	HCUP Name	Coding Notes
All Patient Refined DRG (3M)	APRDRG	All Patient Refined DRG
	APRDRG_Risk_ Mortality	Risk of Mortality Subclass: (0) No class specified, (1) Minor likelihood of dying, (2) Moderate likelihood of dying, (3) Major likelihood of dying, (4) Extreme likelihood of dying
	APRDRG_ Severity	Severity of Illness Subclass: (0) No class specified, (1) Minor loss of function (includes cases with no comorbidity or complications), (2) Moderate loss of function, (3) Major loss of function, (4) Extreme loss of function
Linkage Data Elements	HOSP_NIS	NIS hospital number (links to Hospital File; does not link to previous years)
	KEY_NIS	Unique record number for file beginning in 2012

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Table 4: Data Elements in the 2018 NIS Diagnosis and Procedure Groups Files

The Diagnosis and Procedure Groups file is available from 2005 to 2015; and is available again beginning with 2018 data, when data elements derived from the Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses are added. This file is not available from 2016-2017 because the ICD-10-CM/PCS versions of the AHRQ tools were still under development.

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

Clinical Classifications Software Refined (CCSR) Category	DXCCSR_aaannn*	Indication that at least one ICD-10-CM diagnosis on the record is included in CCSR aaannn
	DXCCSR_DEFAULT_DX1	Default Clinical Classifications Software Refined (CCSR) for principal diagnosis
	DXCCSR_VERSION	Version of CCSR for ICD-10-CM diagnoses
Linkage Data Elements	HOSP_NIS	NIS hospital number (links to Hospital Weights file; does not link to previous years)
	KEY_NIS	Unique record number for file beginning in 2012

* Where aaa denotes the body system and nnn denotes the CCSR number within the body system.

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APPENDIX IV: TEACHING HOSPITAL INDICATOR ASSIGNMENT

The following data elements from the American Hospital Association Annual Survey Database (Health Forum, LLC © 2019) were used to assign the NIS Teaching Hospital Indicator:

AHA Data Element Name = Description [HCUP Data Element Name].

BDH	= Number of short-term hospital beds [B001H].
BDTOT	= Number of total facility beds [B001].
FTRES	= Number of full-time employees: interns & residents (medical & dental) [E125].
PTRES	= Number of part-time employees: interns & residents (medical & dental) [E225].
MAPP8	= Council of Teaching Hospitals (COTH) indicator [A101].
MAPP3	= Residency training approval by the Accreditation Council for Graduate Medical Education (ACGME) [A102].

Beginning with the 1998 NIS, the following SAS codes were used to assign the teaching hospital status indicator, HOSP_TEACH:

```
/*******************************************************/
/* FIRST ESTABLISH SHORT-TERM BEDS DEFINITION */
/*******************************************************/
IF BDH NE .  THEN BEDTEMP = BDH ;      /* SHORT TERM BEDS */
ELSE IF BDH =.  THEN BEDTEMP = BDTOT ; /* TOTAL BEDS PROXY */
/*******************************************************/
/* ESTABLISH IRB NEEDED FOR TEACHING STATUS */
/* BASED ON F-T P-T RESIDENT INTERN STATUS */
/*******************************************************/
IRB = (FTRES + .5*PTRES) / BEDTEMP ;
/*******************************************************/
/* CREATE TEACHING STATUS DATA ELEMENT */
/*******************************************************/
IF (MAPP8 EQ 1) OR (MAPP3 EQ 1) THEN HOSP_TEACH = 1 ;
ELSE IF (IRB GE 0.25) THEN HOSP_TEACH = 1 ;
ELSE HOSP_TEACH = 0 ;
```

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