

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

**INTRODUCTION TO**  
**THE HCUP NATIONWIDE AMBULATORY SURGERY SAMPLE (NASS)**  
**2018**

**These pages provide only an introduction to the 2018 NASS.**  
**For full documentation and notification of changes,**  
**visit the HCUP User Support (HCUP-US) website a**  
[www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov).

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## HCUP NATIONWIDE AMBULATORY SURGERY SAMPLE (NASS) SUMMARY OF DATA USE RESTRICTIONS

### \*\*\*\*\* REMINDER \*\*\*\*\*

**All users of the NASS must take the online HCUP Data Use Agreement (DUA) training course, and read and sign a Data Use Agreement.<sup>a</sup>**

Authorized users of HCUP data agree to the following restrictions:<sup>b</sup>

- 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. Will cite restrictions on data sharing in the Data Use Agreement and direct them to AHRQ HCUP ([www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov)) for more information on accessing HCUP data if a journal or publication requests access to data or analytic files.
- 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 ( $\leq 10$ ).
- 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.<sup>c</sup>

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.

<sup>a</sup> 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](http://www.hcup-us.ahrq.gov).

<sup>b</sup> 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.

<sup>c</sup> 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](http://www.hcup-us.ahrq.gov/db/publishing.jsp).

## HCUP CONTACT INFORMATION

**All Healthcare Cost and Utilization Project (HCUP) data users, including data purchasers and collaborators, must complete the online HCUP Data Use Agreement (DUA) Training Course and read and sign the HCUP DUA. Proof of training completion and signed DUAs 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](http://www.hcup-us.ahrq.gov/tech_assist/dua.jsp).

The HCUP Nationwide DUA is available on the Agency for Healthcare Research and Quality-sponsored HCUP User Support (HCUP-US) website at [www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov).

### HCUP Central Distributor

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

The HCUP Central Distributor also can help with questions concerning HCUP database purchases, current orders, training certificate codes, or invoices, if the specific questions are not covered in the [Purchasing Frequently Asked Questions \(FAQs\)](#) on the [Online HCUP Central Distributor](#) website.

Purchasing FAQs: [www.distributor.hcup-us.ahrq.gov/Purchasing-Frequently-Asked-Questions.aspx](http://www.distributor.hcup-us.ahrq.gov/Purchasing-Frequently-Asked-Questions.aspx)

Phone: (866) 556-HCUP (4287) (toll free in the United States)

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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](http://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 FAQs](#) or contact HCUP User Support:

HCUP FAQs: [www.hcup-us.ahrq.gov/tech\\_assist/faq.jsp](http://www.hcup-us.ahrq.gov/tech_assist/faq.jsp)

Phone: (866) 290-HCUP (4287) (toll free)

Email: [hcp@ahrq.gov](mailto:hcp@ahrq.gov)

### WHAT'S NEW IN THE 2018 NASS?

- Beginning with the 2018 NASS, the Diagnosis and Procedure Groups file is available and includes data elements derived from the Clinical Classifications Software Refined (CCSR) for Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) diagnoses.
- The 2018 NASS applied updated versions of the HCUP Surgery Flag Software for Services and Procedures and the CCS for Services and Procedures Tool. Combined, these updates contributed to changes in the CPT procedures and CCS procedure groups defined as in-scope for the NASS sample. See [Section 4.7](#) for more information regarding the impact of these changes.

## WHAT IS THE NASS?

- The Nationwide Ambulatory Surgery Sample (NASS) is a calendar-year, encounter-level database constructed from the Healthcare Cost and Utilization Project (HCUP) State Ambulatory Surgery and Services Databases (SASD).
- The NASS is the largest all-payer ambulatory surgery database that has been constructed in the United States, yielding national estimates of major ambulatory surgery encounters performed in hospital-owned facilities. The NASS contains clinical and resource-use information that is included in a typical hospital-owned facility record, including patient characteristics, clinical diagnostic and surgical procedure codes, disposition of patients, total charges, expected source of payment, and facility characteristics.
- Major ambulatory surgeries are identified through Healthcare Common Procedure Coding System (HCPCS) Level I codes, also known as Current Procedural Terminology (CPT®) codes. In what follows, HCPCS Level I codes will be called *CPT codes* for brevity. These major ambulatory surgeries are selected major therapeutic procedures that require the use of an operating room, penetrate or break the skin, and involve regional anesthesia, general anesthesia, or sedation to control pain. Procedures intended primarily for diagnostic purposes were excluded. In addition, other selection criteria were applied to major ambulatory surgeries included in the NASS and are described below.
- A total of 32 HCUP Partner organizations contributed to the 2018 NASS: California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, and Wisconsin. These States are geographically dispersed and account for 82 percent of the total U.S. resident population, an estimated 63 percent sample of the universe of hospital-owned facilities, and an estimated 72 percent sample of the universe of ambulatory surgery encounters.
- Unweighted, the NASS contains approximately 7.7 million major ambulatory surgery encounters in 2018, corresponding to approximately 10.1 million major ambulatory surgeries (some encounters have more than one major ambulatory surgery). Weighted, it estimates approximately 10.7 million major ambulatory surgery encounters and 14.1 million major ambulatory surgeries in the United States.
- The NASS is a publicly available database that can be purchased through the HCUP Central Distributor. Currently, the NASS is available for data years 2016–2018.
- Users must complete the HCUP Data Use Agreement Training Course before receiving the data.

## UNDERSTANDING THE NASS

- This document, *Introduction to the HCUP Nationwide Ambulatory Surgery Sample (NASS) 2018*, summarizes the content of the NASS and describes the development of the NASS sample and weights.
- Important considerations for data analysis are highlighted, and references to further resources are provided.
- In-depth documentation for the NASS is available on the HCUP User Support (HCUP-US) website ([www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov)). Please refer to detailed documentation before using the data.
- Prior to data year 2019, the NASS sample was limited to SASD encounters that involved surgeries defined as “narrow” by the HCUP Surgery Flag Software for Services and Procedures. Subsequent analyses revealed additional encounters involving “narrow” or major surgeries that were started in the emergency department and appeared in the State Emergency Department Databases (SEDD) but not in the SASD. As a result, these surgeries are undercounted in the 2016–2018 NASS. The procedures most impacted by this issue include appendectomy and removal of ectopic pregnancy (each undercounted by more than 50%) and cholecystectomy (undercounted by approximately 10%). In subsequent data years, these emergent in-scope surgeries are captured in the NASS.



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**HCUP Nationwide Ambulatory Surgery Sample (NASS)**

**ABSTRACT**

The Nationwide Ambulatory Surgery Sample (NASS) is part of the Healthcare Cost and Utilization Project (HCUP), which is sponsored by the Agency for Healthcare Research and Quality (AHRQ).

The NASS was created to enable analyses of selected ambulatory surgery utilization patterns and to support public health professionals, administrators, policymakers, and clinicians in their decision making regarding this critical source of care. The NASS contains clinical and resource-use information that is included in a typical hospital-owned facility record abstract, including patient characteristics, clinical diagnostic and surgical procedure codes, disposition of patients, total charges, expected source of payment, and facility characteristics. Therefore, it enables government entities, industry professionals, and researchers to develop research concepts with data-driven applications.

The NASS is the largest all-payer ambulatory surgery database that has been constructed in the United States, yielding national estimates of major ambulatory surgery encounters performed in hospital-owned facilities. It contains information from 7.7 million ambulatory surgery encounters at 2,699 hospital-owned facilities that approximate an estimated 62 percent stratified sample of U.S. hospital-owned facilities performing ambulatory surgeries. Weights are provided to calculate national estimates totaling 10.7 million ambulatory surgery encounters in 2018.

The NASS is drawn from statewide data organizations that provide HCUP with data from ambulatory surgery encounters. Thirty-two HCUP Partner organizations participated in the 2018 NASS. See [Appendix A, Table A.1](#) for a list of HCUP Partner organizations that contributed to the 2018 NASS.

By stratifying on important facility characteristics, the NASS is designed to be representative of U.S. hospital-owned facilities that perform ambulatory surgeries. Stratification is based on the following characteristics:

- Geographic region (Northeast, Midwest, South, and West)
- Hospital bed size (small, medium, and large dependent on region, location, and teaching status)
- Urban-rural location of the hospital (metropolitan and nonmetropolitan)
- Hospital teaching status
- Hospital ownership or control (public, for profit, and not for profit)

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

For more information on the NASS, visit the AHRQ-sponsored HCUP User Support (HCUP-US) website at [www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp](http://www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp).

## INTRODUCTION TO THE NATIONWIDE AMBULATORY SURGERY SAMPLE (NASS)

### 1 OVERVIEW OF NASS DATA

The Healthcare Cost and Utilization Project (HCUP) Nationwide Ambulatory Surgery Sample (NASS) was created to enable analysis of selected ambulatory surgery utilization patterns and to support public health professionals, administrators, policymakers, and clinicians in their decision making regarding this critical source of care. The NASS has many research, policy, and other data-driven applications because it contains clinical and nonclinical information about major ambulatory surgeries and diagnoses as well as geographic, facility, and patient characteristics.

#### 1.1 NASS Data Sources, Hospitals, and Encounters

The NASS is sampled from the HCUP [State Ambulatory Surgery and Services Databases \(SASD\)](#), which include various types of outpatient services, such as observation stays, lithotripsy, radiation therapy, imaging, chemotherapy, and labor and delivery. The specific types of ambulatory surgeries and outpatient services included in each SASD vary by State and data year. All SASD include data on ambulatory surgery encounters from hospital-owned facilities. Some States include data from nonhospital-owned facilities, although these are not included in the NASS.<sup>1</sup> The SASD do *not* include ambulatory surgery encounters that were subsequently admitted to the same hospital for inpatient care. As such, the NASS does not contain any encounters admitted from the ambulatory setting to the inpatient setting. Information on patients admitted to the hospital following ambulatory surgery is included in the HCUP State Inpatient Databases (SID).

The number of States, hospital-owned facilities, and ambulatory surgery encounters in the NASS varies by year (Table 1).

**Table 1. Number of States, Hospital-Owned Facilities, and Encounters in the NASS by Year**

Data Year	States in the NASS	Number of Hospital-Owned Facilities	Number of AS Encounters, Unweighted	Number of AS Encounters, Weighted for National Estimates
2018	CA, CO, CT, DC, FL, GA, IA, IL, IN, KS, KY, MD, ME, MI, MN, MO, NC, ND, NE, NJ, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, VT, WI (HI and UT data were not available)	2,699	7,693,084	10,696,131
2017	CA, CO, CT, DC, FL, GA, IA, IL, IN, KS, KY, MD, ME, MI, MN, MO, NC, ND, NE, NJ, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VT, WI (HI data were not available)	2,737	7,647,636	10,570,649
2016	CA, CO, CT, DC, FL, GA, HI, IA, IL,	2,751	7,608,879	10,623,113

<sup>1</sup> The following States have at least one freestanding facility in the HCUP SASD: California, Florida, Illinois, Kentucky, Michigan, Missouri, North Carolina, Nevada, New York, Oklahoma, Oregon, Pennsylvania, South Carolina, Utah, and Wisconsin.

	IN, KS, KY, MD, ME, MI, MN, MO, NC, ND, NE, NJ, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VT, WI			
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Abbreviations: AS, Ambulatory Surgery; NASS, Nationwide Ambulatory Surgery Sample; SASD, State Ambulatory Surgery and Services Databases.

The 2018 NASS sample comprises data from 32 HCUP Partner organizations (31 States and the District of Columbia). [Appendix A, Figure A.1](#) represents the geographic distribution of the HCUP Partner organizations that contributed to the 2018 NASS. The HCUP NASS States with the District of Columbia account for 82 percent of the U.S. population in 2018, an estimated 62 percent of hospital-owned facilities performing ambulatory surgeries, and an estimated 72 percent of ambulatory surgery encounters. Details on the percentage of population, encounters, and facilities by region are provided in [Appendix A, Table A.4](#) and [Appendix A, Table A.5](#).

The NASS is limited to encounters with at least one in-scope major ambulatory surgery on the record, performed at hospital-owned facilities. *In-scope major ambulatory surgeries* are defined as selected therapeutic Current Procedural Terminology (CPT)-coded procedures that require the use of an operating room, penetrate or break the skin, and involve regional anesthesia, general anesthesia, or sedation to control pain. These surgeries are flagged as *narrow* in the HCUP Surgery Flag Software.<sup>2</sup> They also belong to a subset of Clinical Classifications Software (CCS)<sup>3</sup> procedure groups with a relatively high major ambulatory surgery volume, a substantial share of major ambulatory surgeries performed in hospital-owned facilities, and evidence of reliable reporting from SASD hospitals. Detailed major ambulatory surgery selection criteria are outlined in [Section 3.2](#). A complete list of 2018 in-scope CCS procedure groups is included in [Appendix B](#). The 2018 sample includes 2,699 hospitals, 7,693,084 in-scope major ambulatory surgery encounters (unweighted), and 10,696,131 in-scope major ambulatory surgery encounters (weighted for national estimates).

Prior to data year 2019, the NASS sample was limited to SASD encounters that involved surgeries defined as “narrow” by the HCUP Surgery Flag Software for Services and Procedures. Subsequent analyses revealed additional encounters involving “narrow” or major surgeries that were started in the emergency department and appeared in the State Emergency Department Databases (SEDD) but not in the SASD. As a result, these surgeries are undercounted in the 2016–2018 NASS. The procedures most impacted by this issue include appendectomy and removal of ectopic pregnancy (each undercounted by more than 50%) and cholecystectomy

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<sup>2</sup> Agency for Healthcare Research and Quality. Surgery Flag Software for Services and Procedures. Healthcare Cost and Utilization Project (HCUP). Last modified October 15, 2020. [www.hcup-us.ahrq.gov/toolssoftware/surgeryflags\\_svcproc/surgeryflagssvc\\_proc.jsp](http://www.hcup-us.ahrq.gov/toolssoftware/surgeryflags_svcproc/surgeryflagssvc_proc.jsp). Accessed October 19, 2020. The terms *narrow* and *broad* are specific to the Surgery Flag Software. The 2018 NASS applied v2019.2, which included narrow surgeries identified in the following ranges of CPT codes: surgical (10004-69990), emerging technology (0100T-0588T), and cardiac-related medical (92920-93986). For more information, reference the Surgery Flag Software for Services and Procedures User Guide, available at: [https://www.hcup-us.ahrq.gov/toolssoftware/surgeryflags\\_svcproc/surgeryflagssvc\\_proc.jsp#user](https://www.hcup-us.ahrq.gov/toolssoftware/surgeryflags_svcproc/surgeryflagssvc_proc.jsp#user).

<sup>3</sup> The Clinical Classifications Software for Services and Procedures (CCS-Services and Procedures) is HCUP software that provides a method for classifying CPT codes and Healthcare Common Procedure Coding System (HCPCS) codes into clinically meaningful procedure categories. More than 9,000 CPT/HCPCS codes and 6,000 HCPCS codes are collapsed into 244 clinically meaningful categories that may be more useful for presenting descriptive statistics than are individual CPT or HCPCS codes. For more information, visit [www.hcup-us.ahrq.gov/toolssoftware/ccs\\_svcproc/ccssvcproc.jsp](http://www.hcup-us.ahrq.gov/toolssoftware/ccs_svcproc/ccssvcproc.jsp).

(undercounted by approximately 10%). In subsequent data years, these emergent in-scope surgeries are captured in the NASS.

Although encounters are limited to those with at least one in-scope major ambulatory surgery on the record, the NASS Supplemental File provides information on other surgical and nonsurgical procedures performed during these encounters (see [Section 1.3](#)).

## 1.2 Data Restrictions

Some HCUP Partner organizations that contributed data to the NASS imposed restrictions on the release of certain data elements. In addition, because of confidentiality laws, some data sources were prohibited from providing HCUP with encounter records that indicated specific medical conditions, such as HIV/AIDS or behavioral health conditions. Detailed information on these restrictions is available in [Appendix C](#).

## 1.3 File Structure of the NASS

The NASS is delivered as a set of related files. A hospital file lists hospitals in the NASS along with hospital attributes (e.g., teaching status, bed size category) as well as the encounter weight and sample stratum information. An encounter file links to the hospital table and contains information on the major ambulatory surgery encounter (e.g., patient age, expected source of payment, diagnoses), including information about in-scope major ambulatory surgeries. A related supplemental file contains entries for out-of-scope procedures with a key linking to the encounter file. Finally, a diagnosis and procedure group file contains information about diagnosis groupings with a key linking to the encounter file. (Note that this file is not available in the 2016 or 2017 NASS.)

**Hospital File:** This hospital-level file contains one observation for each hospital included in the NASS, along with encounter weight and stratum data elements. For 2018, the NASS Hospital File has 2,699 hospital-specific records. A list of data elements in the Hospital File is provided in [Appendix D, Table D.1](#).

**Encounter File:** This encounter-level file contains 100 percent of ambulatory surgery encounters containing a major ambulatory surgery from the sample of hospitals in participating States and the District of Columbia. For 2018, the NASS Encounter File has about 7.8 million ambulatory surgery encounter records (unweighted). Refer to [Appendix D, Table D.2](#) for a list of data elements in the NASS Encounter File.

**Supplemental File:** This encounter-level file contains information on procedures that were performed during encounters recorded in the Encounter File but not considered to be in-scope major ambulatory surgeries in the NASS. The Supplemental File contains about 5.4 million records for 2018. Procedures included on the Supplemental File are limited to Healthcare Common Procedure Coding System (HCPCS) Level I (CPT) procedure codes. HCPCS Level II codes were excluded from the Supplemental File. Refer to [Appendix D, Table D.3](#) for a list of data elements in the NASS Supplemental File.

**Diagnosis and Procedure Groups File:** Available beginning with the 2018 NASS, this encounter-level file contains information about ICD-10-CM diagnosis groups for all diagnoses associated with encounters recorded in the Encounter File, derived from the Clinical

Classifications Software Refined (CCSR) for ICD-10-CM Tool.<sup>4</sup> Refer to [Appendix D, Table D.4](#) for a list of data elements in the NASS Diagnosis and Procedure Groups File.

## 1.4 NASS Data Elements

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

Ensure usability without extensive editing by analysts

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

Structure the information for efficient storage, manipulation, and analysis

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

After analyzing the availability of information from the HCUP Partner organizations, a set of common fields to be available in the NASS was created. The NASS contains more than 100 clinical and nonclinical variables, such as the following:

- Patient demographics (e.g., sex, age, urban-rural designation of residence, national quartile of the median household annual income for the patient's ZIP Code)
- HCPCS Level I, also known as Current Procedure Terminology (CPT) procedure codes
- International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis codes
- Total charges and expected payment source (e.g., Medicare, Medicaid, private insurance, self-pay)
- Hospital characteristics (e.g., ownership, teaching status, region of the United States)

For comprehensive information about the NASS data elements, please refer to the NASS documentation on the HCUP-US website ([www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp](http://www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp)).

## 2 GETTING STARTED

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

The NASS product is downloaded in a single zipped file, which contains several data-related files and accompanying documentation. The three data-related files include the following compressed files:

- 1) Hospital File (NASS\_2018\_Hospital.zip)
- 2) Encounter File (NASS\_2018\_Encounter.zip)

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<sup>4</sup> Agency for Healthcare Research and Quality. Clinical Classifications Software Refined (CCSR) for ICD-10-CM Diagnoses. Last modified October 15, 2020. [https://www.hcup-us.ahrq.gov/toolssoftware/ccsr/ccs\\_refined.jsp](https://www.hcup-us.ahrq.gov/toolssoftware/ccsr/ccs_refined.jsp). Accessed October 19, 2020.

- 3) Supplemental File (NASS\_2018\_Supplemental.zip)
- 4) Diagnosis and Procedure Groups File (NASS\_2018\_DX\_PR\_GRPS.zip)

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

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

The total size of the CSV version of the NASS is 11.2 GB. The NASS files loaded into SAS are about 5.1 GB. In SAS, the largest use of space typically occurs during the sort procedure (PROC SORT), which requires workspace that is about three times the size of the file. Thus, the NASS files would require approximately 15 GB of available workspace to perform a sort procedure. Most SAS data steps will require twice the storage space of the file so that the input and output files can coexist.

With a file of this size, space easily could become a problem in a multistep program. It is not unusual to have several versions of a file marking different steps while preparing it for analysis, and there may be more versions for the actual analyses. Therefore, users should plan carefully because the amount of space required could escalate rapidly.

## 2.1 Decompressing the NASS Files

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

- 1) Create a directory for the NASS on your hard drive.
- 2) Unzip the compressed NASS product file into the new directory using a third-party zip utility. This will place three 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 an incorrect password and/or file or folder errors. The solution is to use a third-party zip utility.

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

- ZIP Reader (Windows) (free download offered by the PKWARE corporation)
  - SecureZIP for Mac or Windows (free evaluation and licensed/fee software offered by the PKWARE corporation)
  - WinZip (Windows) (evaluation and fee versions offered by the WinZip corporation)
  - Stuffit Expander (Mac) (free evaluation and licensed/fee software offered by Smith Micro corporation)
- 3) Unzip each of the compressed, encrypted data-related files using the same password and third-party zip utility method. This will place the data-related CSV files in the same directory by default.



## 2.2 Downloading and Running the Load Programs

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

- 1) Go to the NASS Database Documentation page on HCUP-US at [www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp](http://www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.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 (“NASS”) from the drop-down lists on this page.
- 5) Select and save the load programs you need. **The load programs are specific to the data year and data-related file.** Save the load programs into the same directory as the NASS CSV files on your computer.
- 6) Edit and run the load programs as appropriate for your computing environment to create the analysis files. For example, modify the directory paths to point to the location of your input and output files.

## 2.3 NASS Documentation

Comprehensive documentation for the NASS files is available on the HCUP-US website ([www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp](http://www.hcup-us.ahrq.gov/db/nation/nass/nassdbdocumentation.jsp)). Users of the NASS can access complete file documentation, including variable notes, file layouts, summary statistics, and related technical reports. Similarly, data users can download SAS, SPSS, and Stata load programs. These important resources help the user understand the structure and content of the NASS and aid in using the database. [Appendix A, Table A.2](#) details the comprehensive NASS documentation available on HCUP-US.

## 2.4 HCUP Online Tutorials

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

- The [Load and Check HCUP Data](#) tutorial provides instructions on how to unzip (decompress) HCUP data, save it on your computer, and load the data into a standard statistical software package. This tutorial also describes how to verify that the data have loaded correctly.
- The [HCUP Sample Design](#) tutorial is designed to help users learn how to account for sample design in their work with the HCUP nationwide databases. The tutorial will be updated in the future to directly address the NASS sampling design.
- The [Producing National HCUP Estimates](#) tutorial is designed to help users understand how three of the nationwide databases—the National (Nationwide) (NIS), the Nationwide Emergency Department Sample (NEDS), and the Kids’ Inpatient Database (KID)—can be used to produce national and regional estimates. A tutorial specific to the NASS database will be added in the future.
- The [Calculating Standard Errors](#) tutorial shows how to accurately determine the precision of the estimates produced from the HCUP nationwide databases. Users will learn two methods for calculating standard errors for estimates produced from the HCUP nationwide databases.

Other tutorials about the design or use of the HCUP databases are also available, and new tutorials are added periodically. The Online Tutorial Series is located on the HCUP-US website at [www.hcup-us.ahrq.gov/tech\\_assist/tutorials.jsp](http://www.hcup-us.ahrq.gov/tech_assist/tutorials.jsp).



## 3 METHODS

### 3.1 Creation of the NASS

Creation of the NASS requires the following steps:

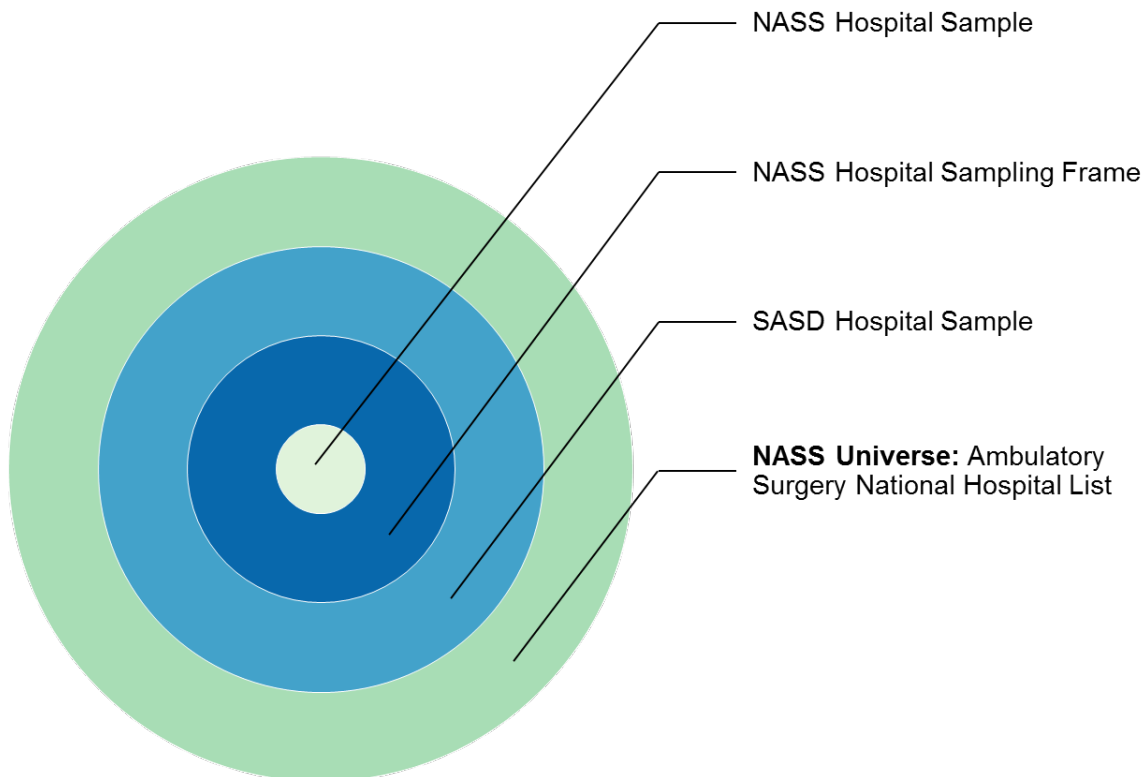
- *Identify in-scope major ambulatory surgeries.* The HCUP Surgery Flag Software (see [Section 3.2](#)) is used to identify **major ambulatory surgeries** as those with a taxonomy category of *narrow*. These are major therapeutic procedures that require the use of an operating room, penetrate or break the skin, and involve regional anesthesia, general anesthesia, or sedation to control pain. Empirical selection criteria then are used to define qualifying CCS for Services and Procedures<sup>5</sup> for procedure groups or **in-scope major ambulatory surgeries**. Selection criteria for a given CCS procedure group include the share of major ambulatory surgeries performed in hospital-owned facilities, the absolute volume of ambulatory surgeries in the SASD, and evidence that SASD hospitals are reliably reporting major ambulatory surgeries in the CCS group.
- *Build the NASS hospital sampling frame.* The NASS sampling frame is limited to SASD community nonrehabilitation hospitals with general acute care or children's service types also performing in-scope major ambulatory surgeries. Additional restrictions imposed for the NASS sampling frame were that the hospital have no gross irregularities in quarterly reporting volume, submit data to the SASD in all four quarters of 2018, and not have an unusually low volume of encounters containing an in-scope major ambulatory surgery.
- *Build encounter predictive models.* NASS sampling frame hospitals are used to create models for volumes of encounters containing in-scope major ambulatory surgeries. The predictive model can be applied to hospitals outside the NASS sampling frame.
- *Construct the universe of hospitals and ambulatory surgery encounters.* A national list of all hospitals performing ambulatory surgeries is created using SASD, American Hospital Association (AHA), and Centers for Medicare & Medicaid Services (CMS) data sources. The encounter predictive model is applied to hospitals outside the NASS sampling frame and then combined with observed data from sampling frame hospitals to create national encounter volume estimates.
- *Develop NASS sample strata.* Strata are created using hospital characteristics. When needed, strata are collapsed to achieve reasonable hospital sample/universe ratios.
- *Compute sample weights.* Hospitals are sampled from the NASS sampling frame. For 2018, 100 percent of hospitals were sampled from the frame. On the basis of the set of NASS sample hospitals and universe totals, sample weights are computed that project the NASS encounters and major ambulatory surgeries to the universe.
- *Create the NASS database.* All of the previous steps culminate in a NASS database, which is a set of three related tables: Hospitals, Encounters, and Supplemental.

The relationship between the NASS universe, the SASD sample, and the NASS sampling frame is portrayed in Figure 1. The predictive model for hospital major ambulatory surgery encounter volume is developed using the NASS sampling frame hospitals and then is applied to all other hospitals not in the sampling frame to generate the encounter universe. In 2018, the NASS sample and sampling frame were identical because 100 percent of hospitals were sampled.

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<sup>5</sup> Agency for Healthcare Research and Quality. Clinical Classifications Software (CCS) for Services and Procedures. Healthcare Cost and Utilization Project (HCUP). Last modified October 14, 2020. [www.hcup-us.ahrq.gov/toolssoftware/ccs\\_svcsproc/ccssvcproc.jsp](http://www.hcup-us.ahrq.gov/toolssoftware/ccs_svcsproc/ccssvcproc.jsp). Accessed October 19, 2020.

**Figure 1. NASS Hospital Universe, SASD Sample, and NASS Sampling Frame**



Abbreviations: NASS, Nationwide Ambulatory Surgery Sample; SASD, State Ambulatory Surgery and Services Databases.

The following sections describe several of the NASS development steps in greater detail.

## **3.2 Selection of Major Ambulatory Surgeries**

### **3.2.1 Definition of Major Ambulatory Surgery**

HCUP Surgery Flag Software<sup>6</sup> was used to identify surgical procedures of interest for the NASS. The Surgery Flag Software processes CPT procedure codes and classifies them as *narrow*, *broad*, or *neither*. The NASS will focus on surgeries in the narrow class, or **major ambulatory surgeries**. The narrowly defined flag (narrow flag) is the most targeted and restrictive surgical identifier, consisting of major therapeutic procedures. A narrow procedure (1) requires the use of an operating room, (2) penetrates or breaks the skin, and (3) involves regional anesthesia, general anesthesia, or sedation to control pain. Some common narrow procedures are cataract surgery and cholecystectomy. Other examples include appendectomy, gastric bypass, hysterectomy, hernia repair, and spinal fusion. The following three procedures, which are primarily performed for a diagnostic purpose, are assigned a narrow surgery flag

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<sup>6</sup> Agency for Healthcare Research and Quality. Surgery Flag Software for Services and Procedures. Healthcare Cost and Utilization Project (HCUP). Last modified October 15, 2020. [www.hcup-us.ahrq.gov/toolsoftware/surgeryflags\\_svcproc/surgeryflagssvc\\_proc.jsp](http://www.hcup-us.ahrq.gov/toolsoftware/surgeryflags_svcproc/surgeryflagssvc_proc.jsp). Accessed October 19, 2020. The terms *narrow* and *broad* are specific to the Surgery Flag Software. The 2018 NASS applied v2019.2, which included narrow surgeries identified in the following ranges of CPT codes: surgical (10004-69990), emerging technology (0100T-0588T), and cardiac-related medical (92920-93986).

based on the degree of their invasiveness: biopsies if the procedure is within an internal organ (e.g., brain, deep cervical node, stomach), thoracotomy with or without biopsy, and exploratory laparotomy with or without biopsy.

### **3.2.2 Selection of In-Scope Major Ambulatory Surgeries**

Several selection criteria were used to define **in-scope major ambulatory surgeries** for the NASS. Prior to application of selection criteria, all major ambulatory surgeries identified by HCUP Surgery Flag Software were grouped in categories defined by CCS for Services and Procedures.<sup>7</sup> Then, the following criteria were applied at the CCS procedure group level.

1. *Hospital share.* A substantial share of major ambulatory surgeries occurs in hospital-owned facilities.
2. *Volume.* A relatively high major ambulatory surgery volume is observed in the SASD.
3. *Reporting quality.* Hospitals are reliably submitting major ambulatory surgery data.

For the 2018 NASS, we first set hospital-owned facility market share criteria: at least 25 percent of major ambulatory surgeries for the CCS procedure category. Then, we created a threshold for average annual multistate SASD major ambulatory surgery volumes based on observed data for 2018 (we chose a threshold of 4,000 surgeries annually).<sup>8</sup> Finally, we excluded four CCS procedure groups because SASD hospital data showed evidence of unreliable reporting or underreporting of dental services, skin grafts, wound debridement, and percutaneous transluminal coronary angioplasty (PTCA).<sup>9</sup> The final set of included, or *in-scope*, CCS procedure groups for the 2018 NASS is provided in [Appendix B](#). [Appendix B](#) also includes a running list of changes to the in-scope procedure groups over time.

Figure 2 illustrates the relationship between ambulatory surgeries, major ambulatory surgeries, and in-scope major ambulatory surgeries.

Note that although encounters are limited to those with at least one in-scope major ambulatory surgery on the record, the NASS Supplemental File provides information on other (or *out-of-scope*) procedures performed during these encounters.

**In the remainder of this document, we use the term *major ambulatory surgery* as synonymous with *in-scope major ambulatory surgery* for brevity.**

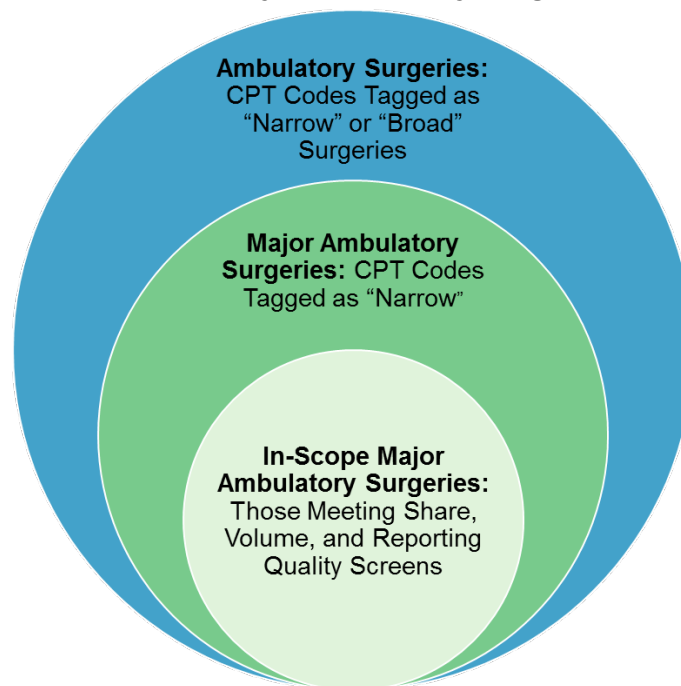
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<sup>7</sup> Agency for Healthcare Research and Quality. Clinical Classifications Software (CCS) for Services and Procedures. Healthcare Cost and Utilization Project (HCUP). Last modified October 14, 2020. [www.hcup-us.ahrq.gov/toolsoftware/ccs\\_svcsproc/ccssvcproc.jsp](http://www.hcup-us.ahrq.gov/toolsoftware/ccs_svcsproc/ccssvcproc.jsp). Accessed October 19, 2020.

<sup>8</sup> For the 2016 NASS, the volume threshold was applied to observed data for 2013 through 2016. For the 2017 NASS, the threshold was applied to observed data for 2015 through 2017.

<sup>9</sup> Percutaneous transluminal coronary angioplasty (PTCA) was included in earlier years of the NASS (2016 and 2017).

**Figure 2. Ambulatory Surgeries, Major Ambulatory Surgeries, and In-Scope Major Ambulatory Surgeries**



Abbreviation: CPT, Current Procedural Terminology.

### 3.3 Sampling Design of the NASS

The NASS is a stratified cluster sample of major ambulatory surgery encounters ([see Section 3.2](#)) occurring in hospital-owned facilities. The main objective of a stratified sample is to ensure that it is representative of the target universe with respect to factors in the stratification scheme. In this section, we summarize the NASS setting and universe definition, the process for constructing the sampling frame, the sample strata, the sampling plan, and the calculation of sample weights.

#### 3.3.1 Ambulatory Surgery Setting and Universe Definition

Ambulatory surgeries are performed in hospital-owned facilities, nonhospital-owned ambulatory surgery centers (ASCs), or office settings. In this context, *office* means a place of service that is neither a hospital-owned facility nor an ASC. The office setting may include professional facilities with procedure rooms or surgical suites.

HCUP Partners provide information on ambulatory surgeries in hospital-owned facilities. About half of the Partners also provide ambulatory surgery data from facilities that are not hospital owned. The designation of a facility as *hospital owned* is specific to its financial relationship with a hospital that provides inpatient care and is not related to its physical location. Hospital-owned ambulatory surgery and other outpatient care facilities may be contained within the hospital, physically attached to the hospital, or located in a different geographic area. The designation as *hospital owned* means that HCUP can verify that the hospital is billing for this service.

The NASS is restricted to major ambulatory surgeries performed in the hospital-owned facilities, either in the hospital itself or in physically separate hospital-owned facilities. There are two reasons for this restriction. First, the SASD have more than twice as many hospital-owned

facilities as facilities that are not hospital owned. Second, although the HCUP hospital sampling frame is well understood, much less is known about the HCUP sample of surgery facilities that are not hospital owned compared with all freestanding ASCs.

In addition to restricting attention to the hospital-owned facilities, facility selection criteria for the NASS are (1) community nonrehabilitation hospital type and (2) a service type of either general acute care or children's. This restriction is imposed because of a lack of uniformity across States regarding inclusion of other types of hospitals, such as psychiatric, long-term acute care, and specialty hospitals. This means that specialty hospitals (e.g., heart, orthopedic, women's) are not included in the current NASS design.

A key challenge for the NASS design is creation of national major ambulatory surgery encounter volume estimates (*encounter universe*), tabulated in strata used in the sampling design. National estimates do not exist for several reasons, but the most important is the definition of *ambulatory surgery* itself. Organizations collecting survey information from hospitals, such as the AHA, rely on verbal descriptions of ambulatory surgery.<sup>10</sup> These descriptions leave room for interpretation and result in significant variation in which encounters hospitals report as ambulatory surgeries. In contrast, hospitals generally report total inpatient admissions, births, and emergency department visits with reasonable accuracy.

The NASS uses a CPT code- and data-based definition of **major ambulatory surgeries** (see [Section 3.2](#)). Self-reported hospital ambulatory surgery volumes from the AHA may or may not be consistent with the HCUP definition of *major ambulatory surgeries*, and it is challenging to ascertain that consistency. Consequently, rather than using an external reference source for major ambulatory surgery volumes, the NASS universe of major ambulatory surgery encounters was constructed by combining observed encounter volumes for hospitals in the NASS sampling frame and estimated encounter volumes for all other hospitals performing major ambulatory surgeries. Estimated encounter volumes were generated using a predictive model, described in [Section 3.4.1](#).

### **3.3.2 Generating the Ambulatory Surgery National Hospital List**

A crucial step in developing the NASS was generating a list of hospitals performing major ambulatory surgery outside the NASS sampling frame and hospital-specific predictor variables to compute estimated encounters using a predictive model (see [Section 3.4.1](#)).

Hospitals were included in the national list if they were a community nonrehabilitation facility, with a service type of either general acute care or children's. Hospitals reporting no outpatient surgeries in the AHA Annual Survey were then excluded from the national list.

Model predictor variables were obtained from the AHA Annual Survey (for HCUP SASD hospitals and hospitals reporting outpatient surgeries in the AHA Annual Survey) or the CMS POS file (for all other hospitals). See Table 2 for a description of the predictor variables obtained from AHA and CMS sources.

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<sup>10</sup> The AHA Annual Survey definition for *outpatient surgery* is as follows: Scheduled surgical services provided to patients who do not remain in the hospital overnight. The surgery may be performed in operating suites also used for inpatient surgery, specially designated surgical suites for outpatient surgery, or procedure rooms within an outpatient care facility. (American Hospital Association. TrendWatch Chartbook 2018 – Glossary. [www.aha.org/guidesreports/2018-06-01-trendwatch-chartbook-2018-glossary](http://www.aha.org/guidesreports/2018-06-01-trendwatch-chartbook-2018-glossary). Accessed June 30, 2020.)

### 3.4 NASS Sampling Frame

Selection of SASD hospitals for the NASS sampling frame was limited to community nonrehabilitation hospitals with general acute care or children’s service types also performing some in-scope major ambulatory surgeries.<sup>11</sup>

Additional restrictions imposed for the NASS sampling frame were that the hospital (1) have no gross irregularities in quarterly reporting volume, (2) submit data to the SASD in all four quarters of 2018, and (3) not have an unusually low volume of encounters containing an in-scope major ambulatory surgery.

A comparison between the NASS hospital universe and the final NASS sample is provided in [Appendix A, Table A.3](#).

#### 3.4.1 NASS Encounter Predictive Model

Creation of the major ambulatory surgery encounter universe requires a method for estimating the volume of encounters containing major ambulatory surgeries for hospitals outside the NASS sampling frame. This estimation was accomplished by building a predictive model for encounters using data for the 2,699 hospitals in the NASS sampling frame.

The hospital-specific number of encounters containing at least one in-scope major ambulatory surgery was the outcome variable in the model. A model predicting the number of major ambulatory surgery encounters per hospital was developed using the NASS sampling frame hospitals. Predictor variables used in the model are reported in Table 2.

**Table 2. Independent Variables Included in Encounter Predictive Model**

Category	Independent Variable
Ownership	Voluntary, not for profit
	Proprietary, for profit
	Local or State government
Location and teaching status	Rural location
	Urban nonteaching
	Urban teaching
Census region	Midwest
	Northeast
	South
	West
Hospital size (number of beds)	001–049
	050–099
	100–199
	200–299
	300–399
	400–499

<sup>11</sup> The HCUP SASD contain a number of hospital-owned facilities performing major ambulatory surgeries that are not inpatient hospitals. In the NASS, these facilities are assigned the identifier of the hospital owner. Stratification, sampling, weighting, and reporting are performed using the hospital owner identifier and hospital characteristics.



Category	Independent Variable
	500+
AHA Annual Survey: self-reported outpatient surgery volume	Log scale

Abbreviation: AHA, American Hospital Association.

### 3.4.2 NASS Sampling Strata

Sampling strata were selected using results from the encounter predictive model (which quantify the importance of stratification factors in encounter volume variation) and a study of the current NIS and NEDS stratification schemes. Table 3 contains values for the NASS stratification variables: census region, bed size category,<sup>12</sup> location and teaching status, and ownership.<sup>13</sup> There are 108 possible strata (i.e., unique combinations of region, bed size, location/teaching status, and ownership categories).

**Table 3. NASS Stratification Variables**

Stratum	Code	Label
Census region	1	North
	2	Midwest
	3	South
	4	West
Bed size category	1	Small (depends on region, location, and teaching status)
	2	Medium (depends on region, location, and teaching status)
	3	Large (depends on region, location, and teaching status)
Location and teaching status	1	Rural
	2	Urban nonteaching
	3	Urban teaching
Ownership	1	Local and State government
	2	Voluntary, not for profit
	3	Proprietary, for profit

Abbreviation: NASS, Nationwide Ambulatory Surgery Sample.

A goal was established to have at least 10 hospitals assigned to each stratum with as many strata as possible having a sampling fraction greater than .20.<sup>14</sup>

Assignment of hospitals to the initial stratification scheme of 108 levels results in a number of strata with fewer than 10 sampling frame hospitals small sampling fractions. In those cases, ownership category was collapsed, first by combining local and State government with voluntary

<sup>12</sup> Bed size categories were originally established for the development of the Nationwide (National) Inpatient Sample (NIS). 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). For more information, reference the *Introduction to the NIS*, available at <https://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp>.

<sup>13</sup> Hospital service type was not used as a stratum because of its weaker predictive power in the predictive models and the small number of children's hospitals in the sample.

<sup>14</sup> *The sampling fraction* is defined as (number units in sample)/(number units in universe). The overall sampling fraction for the 2018 universe of hospitals and sampling frame is  $(2,699/4,357) = 0.62$ .

hospitals.<sup>15</sup> If the goal still was not achieved, all the ownership types were combined. Other stratum combinations were constructed *manually*, using the following conventions:

- Require that the region dimension persist.
- Examine the strata with deficient ratios or sample sizes. On the basis of the data, elect to collapse the location and teaching or bed size dimensions using the following rules:
  - Collapse location and teaching into two categories (urban and rural nonteaching vs. teaching) or collapse the entire location and teaching dimension if required.
  - Collapse the entire bed size dimension if required.

We used judgment when manually collapsing the strata to ensure that no single stratum had a large percentage of total encounter or hospital volume. This led to relaxing the number of sampling frame hospitals or sampling fraction criteria for some strata. After manual adjustments, the NASS had 57 strata for 2018. In the end, all strata had at least 10 hospitals and sampling fractions greater than .20.

### 3.5 Sample Weights

To obtain nationwide estimates, encounter weights were developed combining the NASS universe of hospitals and encounters with the NASS sample hospitals and encounters.

Computation of sample weights is straightforward. Given a universe of encounter volumes in stratum  $s$ , the sample weight is computed as the ratio of NASS universe to sample encounter volumes so that the sample volume is inflated to agree with the universe volume within the stratum.

#### 3.5.1 Frame Sampling Rate

For the 2018 NASS, all hospitals in the sampling frame were selected for inclusion in the NASS, resulting in an approximate 62 percent sample of universe hospitals.

#### 3.5.2 Encounter Weights

Encounter weights were calculated by stratum. Within stratum  $s$  for hospital  $i$ , the universe weight for each encounter in the NASS sample was calculated as follows:

$$W_{is}(\text{universe}) = [N_s(\text{universe}) \div N_s(\text{sample})] * (4 \div Q_i),$$

where  $W_{is}(\text{universe})$  is the encounter weight,  $N_s(\text{universe})$  represents the number of ambulatory surgery encounters in the universe within stratum  $s$ ,  $N_s(\text{sample})$  is the number of ambulatory surgery encounters from sample hospitals selected for the NASS, and  $Q_i$  represents the number of quarters of ambulatory surgery encounters contributed by hospital  $i$  to the NASS (for the 2018NASS,  $Q_i = 4$  for all hospitals). Thus, each encounter's weight is equal to the number of universe ambulatory surgery encounters it represents in stratum  $s$  during that year.

$W_{is}(\text{universe})$  is named DISCWT in the NASS encounter table ([see Appendix D, Table D.2](#)). The 2018 NASS sampling frame required that all hospitals qualifying for the frame submit data in all four quarters of 2018.

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<sup>15</sup> The ownership category was chosen for collapsing because it had lower explanatory power in the predictive models than did bed size or location and teaching status. Census region was considered as an essential stratum to include in the design.



## 4 HOW TO USE THE NASS FOR DATA ANALYSIS

This section provides a synopsis of special considerations for using the NASS.

### 4.1 Calculating National Estimates

**To produce national estimates, weights MUST be used.**

The major ambulatory surgery encounter weight (DISCWT) in the NASS Encounter Table should be used for producing nationwide, encounter-level statistics where the ambulatory surgery encounter is the unit of analysis.

Because the NASS is a stratified cluster sample, proper statistical techniques must be used to calculate standard errors and confidence intervals. For detailed instructions, refer to the HCUP Methods Series report #2003-02, [Calculating Nationwide Inpatient Sample \(NIS\) Variances for Data Years 2011 and Earlier](#), on the HCUP-US website ([www.hcup-us.ahrq.gov/](http://www.hcup-us.ahrq.gov/)). The HCUP NIS prior to 2012 used a stratified sampling design similar to the NASS, so techniques appropriate for the NIS prior to 2012 also are appropriate for the NASS.

### 4.2 Choosing Data Elements for Analysis

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

### 4.3 ICD-10-CM Diagnosis Codes and CPT Procedure Codes

Each unique analysis should consider limitations related to ICD-10-CM and CPT procedure codes.

- CPT procedure codes, which are copyrighted by the American Medical Association, can change each year in January. It is essential to check all procedure codes used for analysis to ensure that the codes are in effect during the time period(s) studied.
- ICD-10-CM diagnosis 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-10-CM codes change every October as new codes are introduced and some codes are retired. It is critical to check all ICD-10-CM codes used for analysis to ensure that the codes are in effect during the time period studied.
- The NASS contains fields for up to 15 diagnoses, up to 30 in-scope HCPCS Level I or CPT-coded procedures, and up to 30 out-of-scope HCPCS Level I or CPT-coded procedures, although the number of code fields populated varies by State because of reporting differences. Some States provide more than the maximum code fields retained on the NASS. To reduce the file size of the NASS, the number of codes retained was limited. For 2018, approximately 5 percent of all ambulatory surgery records report more fields than the maximum allowed on the NASS.

### 4.4 Missing Values

Missing data values can compromise the quality of estimates. For example, if the outcome for ambulatory surgery encounters with missing values is different from the outcome for ambulatory surgery encounters with valid values, then sample estimates for that outcome will be biased and

inaccurately represent the ambulatory surgery utilization patterns. Several techniques are available to help overcome this bias. One strategy is to use imputation to replace missing values with acceptable values. Another strategy is to use sample weight adjustments to compensate for missing values. Descriptions of such data preparation and adjustment are outside the scope of this report; however, it is recommended that researchers evaluate and adjust for missing data, if necessary.

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

#### 4.5 Variance Calculations

It may be important for researchers to calculate a measure of precision for some estimates based on the NASS sample data. Variance estimates must account for both the sampling design and the form of the statistic. The NASS sampling design consists of a stratified, single-stage cluster sample. A stratified random sample of hospitals (clusters) providing major ambulatory surgeries was drawn, and then all encounters with in-scope major ambulatory surgeries were included from each selected hospital. **To accurately calculate variances from the NASS, appropriate statistical software and techniques must be used.** For detailed instructions, refer to the HCUP Methods Series report #2003-02, [Calculating Nationwide Inpatient Sample \(NIS\) Variances for Data Years 2011 and Earlier](#), on the HCUP-US website ([www.hcup-us.ahrq.gov/](http://www.hcup-us.ahrq.gov/)). The HCUP NIS prior to 2012 used a stratified sample design similar to the NASS, so techniques appropriate for the NIS prior to 2012 also are appropriate for the NASS.

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

A multitude of statistics can be estimated from the NASS data. Several computer programs that calculate statistics and their variances from sample survey data are listed in [Section 4.6](#). 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 certain statistics.

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

Alternatively, in the study of hypothetical population outcomes not limited to a specific point in time, the concept of a *superpopulation* may be useful. Analysts may be less interested in specific characteristics of the finite population (and time period) from which the *sample* was

drawn than they are in hypothetical characteristics of a conceptual superpopulation from which any particular finite *population* in a given year might have been drawn. According to this superpopulation model, the nationwide population in a given year is only a snapshot in time of the possible interrelationships among hospital, market, discharge, encounter, or visit characteristics. In a given year, all possible interactions between such characteristics may not have been observed, but analysts may wish to predict or simulate interrelationships that may occur in the future.

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

#### **4.6 Computer Software for Weighted and Variance Calculations**

Computer programs are readily available to perform weighted variance calculations. Several statistical programming packages allow weighted analyses.<sup>16</sup> For example, nearly all SAS procedures incorporate weights. In addition, several statistical analysis programs have been developed to specifically calculate statistics and their standard errors from survey data. Version 8 or later of SAS contains procedures (PROC SURVEYMEANS and PROC SURVEYREG) for calculating statistics on the basis of specific sampling designs. Stata and SUDAAN<sup>®</sup> are two other common statistical software packages that perform calculations for numerous statistics arising from the stratified, single-stage cluster sampling design. Examples of the use of SAS, SUDAAN, and Stata to calculate NIS variances are presented in the special report [Calculating Nationwide Inpatient Sample \(NIS\) Variances for Data Years 2011 and Earlier](#) on the HCUP-US website ([www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov)). For a helpful review of programs to calculate statistics from survey data, visit the following website: [www.hcp.med.harvard.edu/statistics/survey-soft/](http://www.hcp.med.harvard.edu/statistics/survey-soft/).

The NASS includes a Hospital File with variables required by these programs to calculate finite-population statistics. The file includes synthetic hospital identifiers (Primary Sampling Units, or PSUs), stratification variables, and stratum-specific totals for the numbers of ambulatory surgery encounters 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. Depending on the analysis problem, a large number of observations may be available, and it may be feasible to set aside a part of the data for validation purposes. Standard errors and confidence intervals then can be calculated from the validation data.

If the analytic file is too small to set aside a large validation sample, cross-validation techniques may be used. For example, tenfold cross-validation would split the data into 10 subsets of equal size. The estimation would take place in 10 iterations. In each iteration, the outcome of interest is predicted for one-tenth of the observations by an estimate based on a model that is fit

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<sup>16</sup> Carlson BL, Johnson AE, Cohen SB. An evaluation of the use of personal computers for variance estimation with complex survey data. *J Off Statistics*. 1993;9(4):795-814.

to the other nine-tenths of the observations. Unbiased estimates of error variance then are obtained by comparing the actual values to the predicted values obtained in this manner.

#### 4.7 Limitations of the NASS

The NASS contains about 7.7 million ambulatory surgery encounter records and many clinical and nonclinical data elements. Many research studies can be conducted with the data, but some limitations should be considered:

For 2018, about 11 percent of all ambulatory surgery encounters (unweighted) are missing information about total charges. Estimates of the sum of charges should use the product of the number of cases multiplied by the average charge to account for records with missing information.

The NASS contains *encounter*-level records, not *patient*-level records. This means that individual patients who visit a hospital facility for ambulatory surgery multiple times in 1 year may be present in the NASS multiple times. No uniform patient identifier is available that would allow a patient-level analysis to identify individuals with more than one ambulatory surgery encounter or to track outcomes or additional follow-up care received after an encounter. In contrast, some HCUP State databases may be used for this type of analysis.

The database includes only HCPCS Level I or CPT codes. HCPCS Level II codes are excluded.

The procedures considered in scope for the NASS sample can change from year to year (see [Appendix B](#)). Additionally, the 2018 NASS applied updated versions of the HCUP Surgery Flag Software for Services and Procedures and the CCS for Services and Procedures Tool. Combined, these updates contributed to changes in the CPT procedures and CCS procedure groups defined as in-scope for the NASS sample. See [Appendix E](#) for a summary of CCS procedure category totals in the 2016–2018 NASS and contributing reasons for large changes over time. For the subset of CCS categories affected by NASS design changes, trend analyses based on CCS category are not recommended.

Prior to data year 2019, the NASS sample was limited to SASD encounters that involved surgeries defined as “narrow” by the HCUP Surgery Flag Software for Services and Procedures. Subsequent analyses revealed additional encounters involving “narrow” or major surgeries that were started in the emergency department and appeared in the State Emergency Department Databases (SEDD) but not in the SASD. As a result, these surgeries are undercounted in the 2016–2018 NASS. The procedures most impacted by this issue include appendectomy and removal of ectopic pregnancy (each undercounted by more than 50%) and cholecystectomy (undercounted by approximately 10%). In subsequent data years, these emergent in-scope surgeries are captured in the NASS.

## **5 USER FEEDBACK AND QUESTIONS**

The NASS is a new HCUP database, with 2016–2018 as the first publicly available data years. To optimize the usefulness of the data and related documentation, HCUP would like to hear from data users regarding any suggestions, comments, or issues. Please contact HCUP User Support at [hcup@ahrq.gov](mailto:hcup@ahrq.gov) or (866) 290-HCUP (4287).

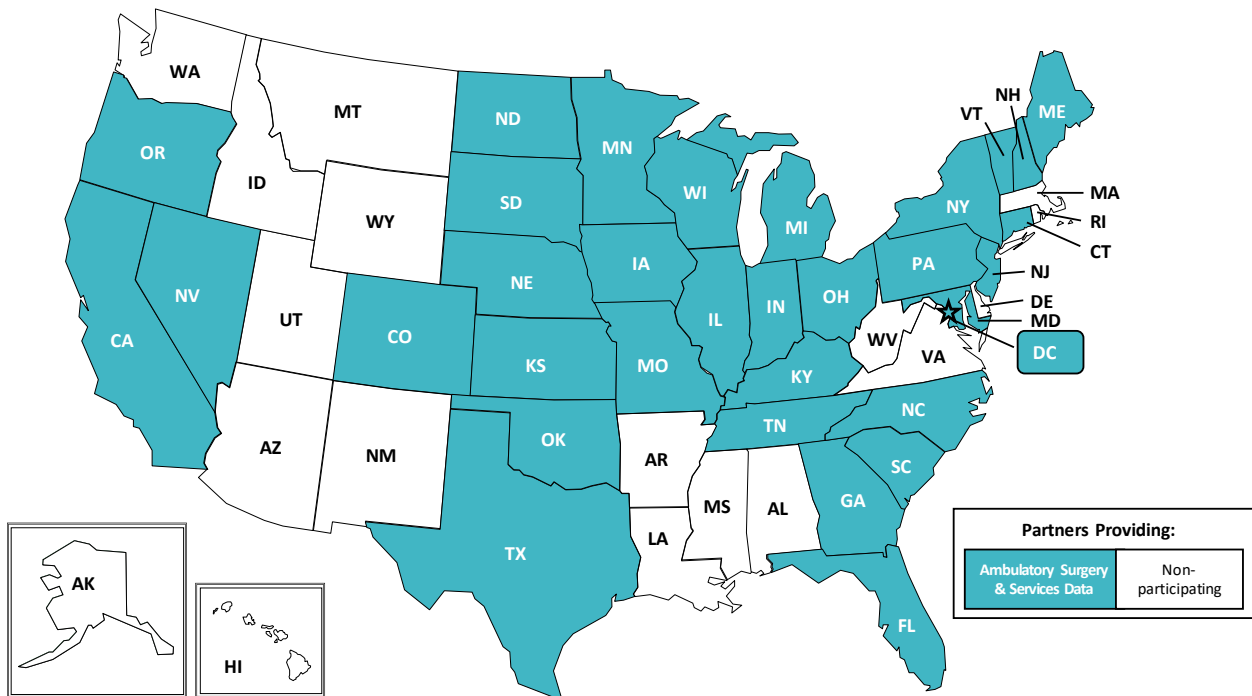
# **Appendix A: NASS Introductory Information**

**Table A.1. HCUP Partner Organizations Participating in the 2018 NASS**

<b>State</b>	<b>Data Organization</b>
California	California Office of Statewide Health Planning & Development
Colorado	Colorado Hospital Association
Connecticut	Connecticut Hospital Association
District of Columbia	District of Columbia Hospital Association
Florida	Florida Agency for Health Care Administration
Georgia	Georgia Hospital Association
Iowa	Iowa Hospital Association
Illinois	Illinois Department of Public Health
Indiana	Indiana Hospital Association
Kansas	Kansas Hospital Association
Kentucky	Kentucky Cabinet for Health and Family Services
Maryland	Maryland Health Services Cost Review Commission
Maine	Maine Health Data Organization
Michigan	Michigan Health & Hospital Association
Minnesota	Minnesota Hospital Association
Missouri	Missouri Hospital Industry Data Institute
North Carolina	North Carolina Department of Health and Human Services
North Dakota	North Dakota (data provided by the Minnesota Hospital Association)
Nebraska	Nebraska Hospital Association
New Jersey	New Jersey Department of Health
Nevada	Nevada Department of Health and Human Services
New York	New York State Department of Health
Ohio	Ohio Hospital Association
Oklahoma	Oklahoma State Department of Health
Oregon	Oregon Association of Hospitals and Health Systems Oregon Office of Health Analytics
Pennsylvania	Pennsylvania Health Care Cost Containment Council
South Carolina	South Carolina Revenue and Fiscal Affairs Office
South Dakota	South Dakota Association of Healthcare Organizations
Tennessee	Tennessee Hospital Association
Texas	Texas Department of State Health Services
Vermont	Vermont Association of Hospitals and Health Systems
Wisconsin	Wisconsin Department of Health Services

Abbreviation: HCUP, Healthcare Cost and Utilization Project; NASS, Nationwide Ambulatory Surgery Sample.

**Figure A.1. HCUP States and the District of Columbia Included in the 2018 NASS**



Abbreviation: HCUP, Healthcare Cost and Utilization Project; NASS, Nationwide Ambulatory Surgery Sample.



**Table A.2. NASS-Related Reports and Database Documentation Available on the HCUP-US Website**

<p><b>Description of NASS Database</b></p> <ul style="list-style-type: none"> <li>• <a href="#">NASS Overview</a> <ul style="list-style-type: none"> <li>○ <a href="#">HCUP Partners in the NASS</a></li> </ul> </li> <li>• <a href="#">Introduction to the NASS, 2018</a> (<i>this document</i>) and <a href="#">prior years</a></li> <li>• <a href="#">NASS Related Reports</a></li> </ul> <p><b>Restrictions on the Use</b></p> <ul style="list-style-type: none"> <li>• <a href="#">HCUP Data Use Agreement Training</a></li> <li>• <a href="#">Data Use Agreement for the HCUP Nationwide Databases</a></li> <li>• <a href="#">Requirements for Publishing with HCUP data</a></li> </ul> <p><b>File Specifications and Load Programs</b></p> <ul style="list-style-type: none"> <li>• <a href="#">NASS File Specifications</a>—details on data file names, number of records, record length, and record layout</li> <li>• <a href="#">Nationwide SAS Load Programs</a></li> <li>• <a href="#">Nationwide SPSS Load Programs</a></li> <li>• <a href="#">Nationwide Stata Load Programs</a></li> </ul> <p><b>Data Elements</b></p> <ul style="list-style-type: none"> <li>• <a href="#">NASS Description of Data Elements</a>—details uniform coding and State-specific idiosyncrasies</li> <li>• <a href="#">Summary Statistics</a>—lists means and frequencies on nearly all data elements</li> </ul> <p><b>Additional Resources for NASS Data Elements</b></p> <ul style="list-style-type: none"> <li>• <a href="#">HCUP Quality Control Procedures</a>—describes procedures used to assess data quality</li> <li>• <a href="#">HCUP Coding Practices</a>—describes how HCUP data elements are coded</li> <li>• <a href="#">HCUP Hospital Identifiers</a>—explains data elements that characterize individual hospitals</li> </ul>	<p><b>HCUP Tools: Labels and Formats</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses</a></li> <li>• <a href="#">Clinical Classifications Software for Services and Procedures</a></li> <li>• Format Programs—to create value labels             <ul style="list-style-type: none"> <li>○ <a href="#">HCUP Formats</a></li> <li>○ <a href="#">HCUP Diagnoses and Procedure Groups Formats, including CCSR Categories</a></li> <li>○ <a href="#">ICD-10-CM Formats</a></li> </ul> </li> </ul> <p><b>Obtaining HCUP Data</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Purchase HCUP Data from the HCUP Central Distributor</a></li> </ul>
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Abbreviation: CCSR, Clinical Classification Software Refined; HCUP, Healthcare Cost and Utilization Project; ICD-10-CM/PCS, International Classification of Diseases, Tenth Revision, Clinical Modification/Procedure Coding System; NASS, Nationwide Ambulatory Surgery Sample; US, User Support.

**Table A.3. NASS Target Universe, Sampling Frame, and Final Sample Characteristics, 2018**

Sample	Description	Number of Hospitals Providing Outpatient Surgery	Number of In-Scope Major Ambulatory Surgery Encounters
2018 target universe	Community, nonrehabilitation, general and children's U.S. hospitals providing outpatient surgery services	4,357 <sup>a</sup>	10,696,131 <sup>b</sup>
2018NASS	Sample of target universe drawn from the sampling frame	2,699	7,693,084

Abbreviation: NASS, Nationwide Ambulatory Surgery Sample.

<sup>a</sup> Estimated. See section 3.3.2.

<sup>b</sup> Estimated. See section 3.4.1.

**Table A.4. Percentage of Population in NASS Sample, by Census Region, 2018**

<b>Census Region</b>	<b>2018 Population States in NASS Sampling Frame</b>	<b>2018 Population States Not in NASS Sampling Frame</b>	<b>Total 2018 Population</b>	<b>States in NASS Sampling Frame: Percent of Total Population</b>
Midwest	61,300,057	7,008,687	68,308,744	89.7
Northeast	46,795,157	9,315,922	56,111,079	83.4
South	97,915,056	26,838,892	124,753,948	78.5
West	60,013,305	17,980,358	77,993,663	76.9
Total	266,023,575	61,143,859	327,167,434	81.3

Abbreviation: NASS, Nationwide Ambulatory Surgery Sample.

Source: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2019 (NST-EST2019-01), Population Division, U.S. Census Bureau, [www.census.gov/data/datasets/time-series/demo/popest/2010s-state-total.html](http://www.census.gov/data/datasets/time-series/demo/popest/2010s-state-total.html). Release Date: December 2019. Accessed October 20, 2020.

**Table A.5. Percentage of Encounters and Facilities in NASS Sample, by Census Region, 2018**

Census Region	Encounters			Facilities		
	No. of Ambulatory Surgery Encounters (Unweighted)	No. of Ambulatory Surgery Encounters (Weighted) <sup>a</sup>	Unweighted Encounters: Weighted Encounters, %	No. of NASS Sample Hospitals	No. of Hospitals Performing Ambulatory Surgery <sup>b</sup>	NASS Sample Hospitals: Hospitals Performing Ambulatory Surgery, %
Midwest	2,583,617	2,813,566	91.8	1,024	1,326	77.2
Northeast	1,447,090	1,855,420	78.0	398	550	72.4
South	2,527,924	3,983,863	63.5	868	1,602	54.2
West	1,200,286	2,132,302	56.3	409	879	46.5
Total	7,758,917	10,785,152	71.9	2,699	4,357	61.9

Abbreviations: NASS, Nationwide Ambulatory Surgery Sample.

<sup>a</sup> Estimated. See section 3.3.2.

<sup>b</sup> Estimated. See section 3.4.1.

# **Appendix B: 2018 NASS In-Scope Major Ambulatory Surgeries**

**Table B.1. NASS In-Scope Clinical Classifications Software (CCS) for Services and Procedure Categories**

<b>CCS for Services and Procedures Category</b>	<b>Description</b>	<b>Data Years in Scope for the NASS Sample</b>
003	Laminectomy, excision intervertebral disc	2016–2018
006	Decompression peripheral nerve	2016–2018
009	Other OR therapeutic nervous system procedures	2016–2018
010	Thyroidectomy, partial or complete	2016–2018
012	Other therapeutic endocrine procedures	2016–2018
013	Corneal transplant	2016–2018
014	Glaucoma procedures	2018
015	Lens and cataract procedures	2016–2018
016	Repair of retinal tear, detachment	2016–2018
019	Other therapeutic procedures on eyelids, conjunctiva, cornea	2018
020	Other intraocular therapeutic procedures	2018
021	Other extraocular muscle and orbit therapeutic procedures	2016–2018
022	Tympanoplasty	2016–2018
023	Myringotomy	2016–2018
024	Mastoidectomy	2016–2018
026	Other therapeutic ear procedures	2016–2018
028	Plastic procedures on nose	2016–2018
030	Tonsillectomy and/or adenoidectomy	2016–2018
033	Other OR therapeutic procedures on nose, mouth and pharynx	2016–2018
042	Other OR therapeutic procedures on respiratory system	2016–2018
045	Percutaneous transluminal coronary angioplasty (PTCA) <sup>a</sup>	2016, 2017
048	Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator	2016–2018
049	Other OR heart procedures	2016–2018
053	Varicose vein stripping, lower limb	2016–2018
057	Creation, revision and removal of arteriovenous fistula or vessel-to-vessel cannula for dialysis	2016–2018
061	Other OR procedures on vessels other than head and neck	2016–2018
063	Other non-OR therapeutic cardiovascular procedures <sup>a</sup>	2016, 2017
067	Other therapeutic procedures, hemic and lymphatic system	2016–2018
078	Colorectal resection	2016–2018
080	Appendectomy	2016–2018
081	Hemorrhoid procedures	2018
084	Cholecystectomy and common duct exploration	2016–2018
085	Inguinal and femoral hernia repair	2016–2018
086	Other hernia repair	2016–2018
087	Laparoscopy	2016–2018
094	Other OR upper GI therapeutic procedures	2016–2018
095	Other non-OR lower GI therapeutic procedures <sup>a</sup>	2016, 2017
096	Other OR lower GI therapeutic procedures	2016–2018
099	Other OR gastrointestinal therapeutic procedures	2016–2018

<b>CCS for Services and Procedures Category</b>	<b>Description</b>	<b>Data Years in Scope for the NASS Sample</b>
100	Endoscopy and endoscopic biopsy of the urinary tract	2016, 2017
101	Transurethral excision, drainage, or removal urinary obstruction	2018
104	Nephrectomy, partial or complete	2018
106	Genitourinary incontinence procedures	2016–2018
109	Procedures on the urethra	2016–2018
112	Other OR therapeutic procedures of urinary tract	2016–2018
113	Transurethral resection of prostate (TURP)	2016–2018
114	Open prostatectomy	2016–2018
117	Other non-OR therapeutic procedures, male genital <sup>a</sup>	2016, 2017
118	Other OR therapeutic procedures, male genital	2016–2018
119	Oophorectomy, unilateral and bilateral	2016–2018
120	Other operations on ovary	2016, 2017
121	Ligation of fallopian tubes	2016–2018
122	Removal of ectopic pregnancy	2016–2018
124	Hysterectomy, abdominal and vaginal	2016–2018
125	Other excision of cervix and uterus	2016–2018
129	Repair of cystocele and rectocele, obliteration of vaginal vault	2016–2018
130	Other diagnostic procedures, female organs	2018
132	Other OR therapeutic procedures, female organs	2016–2018
141	Other therapeutic obstetrical procedures	2016, 2017
142	Partial excision bone	2016–2018
143	Bunionectomy or repair of toe deformities	2016–2018
144	Treatment, facial fracture or dislocation	2016–2018
145	Treatment, fracture or dislocation of radius and ulna	2016–2018
146	Treatment, fracture or dislocation of hip and femur	2017, 2018
147	Treatment, fracture or dislocation of lower extremity (other than hip or femur)	2016–2018
148	Other fracture and dislocation procedure	2016–2018
149	Arthroscopy	2016–2018
150	Division of joint capsule, ligament or cartilage	2016–2018
151	Excision of semilunar cartilage of knee	2016–2018
152	Arthroplasty knee	2016–2018
153	Hip replacement, total and partial	2016–2018
154	Arthroplasty other than hip or knee	2016–2018
157	Amputation of lower extremity	2016–2018
158	Spinal fusion	2016–2018
160	Other therapeutic procedures on muscles and tendons	2016–2018
161	Other OR therapeutic procedures on bone	2016–2018
162	Other OR therapeutic procedures on joints	2016–2018
164	Other OR therapeutic procedures on musculoskeletal system	2016–2018
166	Lumpectomy, quadrantectomy of breast	2016–2018
167	Mastectomy	2016–2018

CCS for Services and Procedures Category	Description	Data Years in Scope for the NASS Sample
171	Suture of skin and subcutaneous tissue	2016, 2017
174	Other non-OR therapeutic procedures on skin and breast <sup>a</sup>	2016, 2017
175	Other OR therapeutic procedures on skin and breast	2016–2018
225	Conversion of cardiac rhythm	2016–2018
244	Gastric bypass and volume reduction	2016–2018

Abbreviations: GI, gastrointestinal; NASS, Nationwide Ambulatory Surgery Sample; OR, operating room.

<sup>a</sup> CCS categories 63, 95, 117, and 174 did not meet the criteria for inclusion in the 2018 NASS because all major surgeries were moved from these “non-OR therapeutic procedure” categories in the most recent update to the CCS for Services and Procedures Tool. For example, all major surgeries in CCS 95, *Other non-OR lower GI therapeutic procedures* were reassigned to CCS 96, *Other OR lower GI therapeutic procedures*. Therefore, these major surgeries are still included in the 2018 NASS, but with a different CCS category assignment than in previous NASS data years. CCS 45, *PTCA*, was removed from the 2018 NASS based on evidence of underreporting by NASS sample hospitals.

Notes: Updates to the HCUP Surgery Flag Software for Services and Procedures changed the designation of several surgeries from major (“narrow”) to not major (“broad” or “neither”), and vice versa. This affected the major surgery volume and hospital-owned facility outpatient market share for multiple CCS categories, resulting in additions to and deletions from the NASS in-scope CCS procedure groups in data year 2018. See [https://hcup-us.ahrq.gov/toolssoftware/ccs\\_svcsproc/ccssvcproc.jsp](https://hcup-us.ahrq.gov/toolssoftware/ccs_svcsproc/ccssvcproc.jsp) for more information on CCS for Services and Procedures.



# Appendix C: Data Restrictions

Table C.1 enumerates the types of restrictions applied to the 2018 Nationwide Ambulatory Surgery Sample. Restrictions include the following types:

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

**Table C.1. Data Restrictions**

<b>Confidentiality of Hospitals</b>
<p>Limitations on sampling to ensure hospital confidentiality:</p> <ul style="list-style-type: none"> <li>• Hospital identifiers are removed from NASS records.</li> <li>• State identifiers are removed from NASS records.</li> </ul>
<b>Confidentiality of Records</b>
<p>Limitations on selected data elements to ensure patient confidentiality:</p> <ul style="list-style-type: none"> <li>• Age (AGE) values greater than 90 are set to 90 for all NASS records.</li> <li>• At least one HCUP Partner required ages in years (AGE) to be set to the midpoints of age ranges.</li> <li>• At least one HCUP Partner requires that admission month (AMONTH) is set to missing on all records.</li> </ul>
<b>Limited Reporting of Diagnosis Codes for Medical Misadventures and Adverse Effects</b>
<p>At least one HCUP Partner removes diagnosis codes for medical misadventures and adverse effects from the data files supplied to HCUP.</p>
<b>Missing Information for Specific Populations of Patients</b>
<p>Human Immunodeficiency Virus (HIV)</p> <p>At least one HCUP Partner excludes records for HIV patients from the files provided to HCUP. Therefore, these records are not included in the NASS.</p> <p>Alternatively, at least one HCUP Partner includes records for HIV patients in the data provided to HCUP but removes the diagnosis codes identifying HIV.</p> <p>At least one HCUP Partner masks the type of abortion (e.g., spontaneous, legally induced) by setting all abortion-specific diagnosis and procedure codes to “unspecified” abortions.</p>

Abbreviations: HCUP, Healthcare Cost and Utilization Project; NASS, Nationwide Ambulatory Surgery Sample.

# **Appendix D: NASS Files and Data Elements**

**Table D.1. NASS Hospital File Data Elements, 2018**

Type of Data Element	HCUP Data Element	Coding Notes
Encounter counts	TOTAL_AS_ENCOUNTERS	SASD encounters with at least one narrow surgery for this hospital <sup>a</sup>
	N_DISC_U	Number of ambulatory surgery encounters for <u>all</u> hospitals in the stratum
	S_DISC_U	Number of ambulatory surgery encounters for <u>sampled</u> hospitals in the stratum
Encounter weight	DISCWT	Encounter weight used to calculate national estimates
Encounter year	YEAR	Encounter year
Hospital characteristics	HOSP_BEDSIZE_CAT	Hospital bed size category: (1) 00–99, (2) 100–299, (3) 300+
	HOSP_CONTROL	Control/ownership of hospital: (1) public, (2) voluntary, (3) proprietary
	HOSP_LOCATION	Location of hospital: (0) rural, (1) urban
	HOSP_LOCTEACH	Location/teaching status of hospital: (1) rural, (2) urban nonteaching, (3) urban teaching
	HOSP_REGION	Region of hospital: (1) Northeast, (2) Midwest, (3) South, (4) West
	HOSP_TEACH	Teaching status of hospital: (0) nonteaching, (1) teaching
	NASS_STRATUM	Stratum used to sample hospital-owned facilities, includes geographic region, bed size category, location/teaching status, and control/ownership
Hospital counts	N_HOSP_U	Number of hospitals in the stratum
	S_HOSP_U	Number of <u>sampled</u> hospitals in the stratum
NASS hospital identifier, synthetic	HOSP_NASS	Unique HCUP NASS hospital number, links to other NASS files, but not to other HCUP databases

Abbreviations: HCUP, Healthcare Cost and Utilization Project; NASS, Nationwide Ambulatory Surgery Sample.

<sup>a</sup> Surgeries flagged as “narrow” in the HCUP Surgery Flag Software are defined as invasive therapeutic surgical procedures that typically require the use of an operating room and regional anesthesia, general anesthesia, or sedation.

**Table D.2. NASS Encounter File Data Elements, 2018**

Type of Data Element	HCUP Data Element	Coding Notes
Admission timing	AMONTH	Admission month coded from (1) January to (12) December
	AWEEKEND	Admission on weekend: (0) admission on Monday–Friday, (1) admission on Saturday–Sunday
Age at admission	AGE	Age in years coded 0–90 years. Any ages greater than 90 years were set to 90.

Type of Data Element	HCUP Data Element	Coding Notes
CPT procedure information	CPT1-CPT30	In-scope CPT procedures on the record (maximum of 30)
	CPTCCS1-CPTCCS30	Clinical Classifications Software (CCS) category for in-scope CPT procedures
	NCPT_INSCOPE	Number of in-scope CPT procedures for this encounter
Diagnosis information	I10_DX1-I10DX15	ICD-10-CM diagnoses (maximum of 15)
	I10_NDX	Number of diagnoses for this encounter
Disposition of the patient	DISPUNIFORM	Disposition of patient, uniform coding: (1) routine; (2) transfer to short-term hospital; (5) other transfers, including skilled nursing facility, intermediate care, and another type of facility; (6) home healthcare; (7) against medical advice; (20) died in hospital; (99) discharged alive, destination unknown
Encounter timing	DQTR	Encounter quarter
	YEAR	Encounter year
Encounter weight	DISCWT	Encounter weight used to calculate national estimates
Identifiers, synthetic	HOSP_NASS	Unique HCUP NASS hospital number, links to other NASS files but not to other HCUP databases
	KEY_NASS	Unique HCUP NASS record number, links to NASS Supplemental and Diagnosis and Procedure Groups Files, but not to other HCUP databases
National quartile for median household income of 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–\$42,999, (2) \$43,000–\$53,999, (3) \$54,000–\$70,999, and (4) \$71,000 or more.
Payer information	PAY1	Expected primary payer, uniform: (1) Medicare, (2) Medicaid, (3) private including HMO, (4) self-pay, (5) no charge, (6) other
Sex of patient	FEMALE	Indicator of sex: (0) male, (1) female
Total charges	TOTCHG	Total charges for AS services, edited
Urban-rural location of patient's residence	PL_NCHS	Urban–rural designation for patient's county of residence: (1) large central metropolitan, (2) large fringe metropolitan, (3) medium metropolitan, (4) small metropolitan, (5) micropolitan, (6) not metropolitan or micropolitan

Abbreviations: AS, ambulatory surgery; CPT, Current Procedural Terminology; HCUP, Healthcare Cost and Utilization Project; HMO, health maintenance organization; ICD-10-CM, International Classification of Diseases, Tenth Revision, Clinical Modification; NASS, Nationwide Ambulatory Surgery Sample.

**Table D.3. NASS Supplemental File Data Elements, 2018**

Type of Data Element	HCUP Data Element	Coding Notes
CPT procedure information <sup>a</sup>	CPT1-CPT30	Out-of-scope CPT procedures on the record (maximum of 30)
	CPTCCS1-CPTCCS30	Clinical Classifications Software category for out-of-scope CPT procedures
	NCPT_NOTINSCOPE	Number of out-of-scope CPT procedures for this encounter
Encounter year	YEAR	Encounter year
Identifiers, synthetic	HOSP_NASS	Unique HCUP NASS hospital number, links to other NASS files but not to other HCUP databases
	KEY_NASS	Unique HCUP NASS record number, links to NASS Encounter and Diagnosis and Procedure Groups Files but not to other HCUP databases

Abbreviations: CPT, Current Procedural Terminology; HCUP, Healthcare Cost and Utilization Project; NASS, Nationwide Ambulatory Surgery Sample.

<sup>a</sup> Although some encounter records may have included Level II Healthcare Common Procedure Coding System (HCPCS) codes, this procedure information is limited to Level I HCPCS codes (i.e., CPT codes).

**Table D.4. NASS Diagnosis and Procedure Groups File Data Elements, 2018**

Type of Data Element	HCUP Data Element	Coding Notes
CCSR for ICD-10-CM diagnoses	DXCCSR_AAAnn	Indication that at least one ICD-10-CM diagnosis on the record is included in CCSR AAAnn
	DXCCSR_DEFAULT_DX1	Default CCSR for first-listed ICD-10-CM diagnosis
	DXCCSR_VERSION	Version of CCSR for ICD-10-CM diagnoses
Identifiers, synthetic	HOSP_NASS	Unique HCUP NASS hospital number, links to other NASS files but not to other HCUP databases
	KEY_NASS	Unique HCUP NASS record number, links to NASS Encounter and Supplemental Files but not to other HCUP databases

Abbreviations: CCSR, Clinical Classifications Software Refined; CPT, Current Procedural Terminology; HCUP, Healthcare Cost and Utilization Project; ICD-10-CM, International Classification of Diseases, Tenth Revision, Clinical Modification; NASS, Nationwide Ambulatory Surgery Sample.

# **Appendix E: Procedure Totals by NASS Data Year**

**Table E.1. Number of Procedures by In-Scope Clinical Classifications Software (CCS) for Services and Procedure Category, 2016–2018**

CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
003	Laminectomy, excision intervertebral disc	249,110	255,565	253,928	2.6%	-0.6%	
006	Decompression peripheral nerve	410,874	411,047	405,317	0.0%	-1.4%	
009	Other OR therapeutic nervous system procedures	116,354	125,122	117,597	7.5%	-6.0%	
010	Thyroidectomy, partial or complete	113,076	112,028	106,839	-0.9%	-4.6%	
012	Other therapeutic endocrine procedures	55,089	55,997	58,398	1.6%	4.3%	
013	Corneal transplant	21,321	20,209	20,149	-5.2%	-0.3%	
014	Glaucoma procedures			54,542			Surgery Flag Software update: added as in scope for 2018; satisfied hospital outpatient market share threshold after reclassification of 2 CPT codes
015	Lens and cataract procedures	1,340,065	1,301,715	1,210,209	-2.9%	-7.0%	
016	Repair of retinal tear, detachment	105,692	104,225	103,715	-1.4%	-0.5%	
019	Other therapeutic procedures on eyelids, conjunctiva, cornea	--	--	167,666	--	--	Surgery Flag Software update: added as in scope for 2018; satisfied hospital outpatient market share threshold after reclassification of several CPT codes
020	Other intraocular therapeutic procedures	--	--	94,473	--	--	Surgery Flag Software update: added as in scope for 2018; satisfied hospital outpatient market share threshold after reclassification of 3 CPT codes
021	Other extraocular muscle and orbit therapeutic	76,054	77,517	68,077	1.9%	-12.2%	



CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
	procedures						
022	Tympanoplasty	31,151	31,296	51,690	0.5%	65.2%	Surgery Flag Software update: volume increase in 2018 after 2 CPT codes were reclassified from broad to narrow
023	Myringotomy	373,415	367,333	343,636	-1.6%	-6.5%	
024	Mastoidectomy	19,840	19,022	18,946	-4.1%	-0.4%	
026	Other therapeutic ear procedures	31,715	32,406	34,177	2.2%	5.5%	
028	Plastic procedures on nose	186,276	186,821	178,049	0.3%	-4.7%	
030	Tonsillectomy and/or adenoidectomy	485,276	478,189	428,990	-1.5%	-10.3%	
033	Other OR therapeutic procedures on nose, mouth and pharynx	269,320	243,337	496,217	-9.6%	103.9%	Surgery Flag Software and CCS for Services and Procedures updates: overall volume increase in 2018 after reclassification of several CPT codes and reassignment of 1 narrow CPT code to CCS 33 from CCS 32
042	Other OR therapeutic procedures on respiratory system	42,575	39,360	37,051	-7.6%	-5.9%	
045	Percutaneous transluminal coronary angioplasty	109,015	108,667	--	-0.3%	--	Evidence of underreporting in 2016 and 2017 SASD: removed from in scope list for 2018
048	Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator	338,356	329,131	306,324	-2.7%	-6.9%	
049	Other OR heart procedures	8,765	10,911	14,364	24.5%	31.7%	Surgery Flag Software and CCS for Services and Procedures updates: overall volume increase in 2018 after 4 CPT codes were reclassified from narrow to broad and 1 narrow CPT code was reassigned to CCS 49 from CCS 63
053	Varicose vein stripping, lower limb	38,944	36,780	8,967	-5.6%	-75.6%	Surgery Flag Software update: volume decrease in 2018 after 2 CPT codes were reclassified from

CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
							narrow to broad
057	Creation, revision and removal of arteriovenous fistula or vessel-to-vessel cannula for dialysis	163,593	162,783	165,243	-0.5%	1.5%	
061	Other OR procedures on vessels other than head and neck	253,849	247,212	288,649	-2.6%	16.8%	
063	Other non-OR therapeutic cardiovascular procedures	32,453	30,976	--	-4.6%	--	CCS for Services and Procedures update: not in scope for 2018 after all narrow procedures were reassigned from CCS 63 to other CCS categories
067	Other therapeutic procedures, hemic and lymphatic system	205,173	219,684	247,178	7.1%	12.5%	
078	Colorectal resection	13,085	13,331	13,766	1.9%	3.3%	
080	Appendectomy	191,770	198,305	190,789	3.4%	-3.8%	
081	Hemorrhoid procedures	--	--	54,125	--	--	Surgery Flag Software update: added as in scope for 2018; satisfied volume threshold after 6 CPT codes were reclassified to narrow
084	Cholecystectomy and common duct exploration	635,584	624,384	594,724	-1.8%	-4.8%	
085	Inguinal and femoral hernia repair	496,072	499,926	485,620	0.8%	-2.9%	
086	Other hernia repair	456,466	470,563	462,531	3.1%	-1.7%	
087	Laparoscopy	77,663	78,100	83,194	0.6%	6.5%	
094	Other OR upper GI therapeutic procedures	12,672	13,990	23,219	10.4%	66.0%	Surgery Flag Software and CCS for Services and Procedures updates: volume increase in 2018 after 1 CPT code was reclassified from broad to narrow and 1 narrow CPT code was reassigned to CCS 94 from CCS 95
095	Other non-OR lower GI therapeutic procedures	5,673	5,582	--	-1.6%	--	CCS for Services and Procedures update: not in scope for 2018 after all narrow procedures were reassigned from CCS 95 to CCS 96

CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
096	Other OR lower GI therapeutic procedures	64,404	62,193	71,900	-3.4%	15.6%	
099	Other OR gastrointestinal therapeutic procedures	33,129	34,358	19,891	3.7%	-42.1%	Surgery Flag Software update: volume decrease in 2018 after reclassification of 2 CPT codes were reclassified from narrow to broad
100	Endoscopy and endoscopic biopsy of the urinary tract	18,551	18,356	--	-1.1%	--	CCS for Services and Procedures update: not in scope for 2018 after all narrow procedures were moved from CCS 100
101	Transurethral excision, drainage, or removal urinary obstruction	--	--	159,567	--	--	Surgery Flag Software update: added as in scope for 2018; satisfied volume threshold after reclassification of 8 CPT codes
104	Nephrectomy, partial or complete	--	--	7,129	--	--	Volume increase: added as in scope for 2018; satisfied volume threshold
106	Genitourinary incontinence procedures	107,932	115,295	118,089	6.8%	2.4%	
109	Procedures on the urethra	26,176	26,441	20,095	1.0%	-24.0%	Surgery Flag Software update: volume decrease in 2018 after 5 CPT codes were reclassified from narrow to neither
112	Other OR therapeutic procedures of urinary tract	31,262	33,945	22,359	8.6%	-34.1%	Surgery Flag Software update and CCS for Services and Procedures update: volume decrease in 2018 after reclassification of 5 CPT codes and the reassignment of 1 narrow CPT code to CCS 112 from CCS 111
113	Transurethral resection of prostate (TURP)	81,061	85,895	88,685	6.0%	3.2%	
114	Open prostatectomy	7,321	8,132	28,604	11.1%	251.7%	Reimbursement change: increased volume in 2018 after CMS removed laparoscopic prostatectomy from the inpatient-only list <sup>a</sup>
117	Other non-OR therapeutic procedures, male genital	7,206	8,953	--	24.3%	--	CCS for Services and Procedures update: not in scope for 2018 after all narrow procedures were reassigned from CCS 117 to CCS 118
118	Other OR therapeutic procedures, male genital	243,482	246,117	204,268	1.1%	-17.0%	
119	Oophorectomy, unilateral and bilateral	153,195	166,184	177,789	8.5%	7.0%	

CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
120	Other operations on ovary	16,052	16,072	--	0.1%	--	Not in scope for 2018; did not satisfy outpatient hospital market share threshold
121	Ligation of fallopian tubes	106,323	95,869	82,181	-9.8%	-14.3%	
122	Removal of ectopic pregnancy	21,637	20,540	19,406	-5.1%	-5.5%	
124	Hysterectomy, abdominal and vaginal	368,304	394,383	403,980	7.1%	2.4%	
125	Other excision of cervix and uterus	19,435	20,642	53,798	6.2%	160.6%	Surgery Flag Software update: volume increase in 2018 after 1 CPT code was reclassified from broad to narrow
129	Repair of cystocele and rectocele, obliteration of vaginal vault	97,983	106,588	109,576	8.8%	2.8%	
130	Other diagnostic procedures, female organs	--	--	5,845	--	--	Surgery Flag Software update: added as in scope for 2018; satisfied volume threshold after 2 CPT codes were reclassified from neither to narrow
132	Other OR therapeutic procedures, female organs	234,603	244,687	243,104	4.3%	-0.6%	
141	Other therapeutic obstetrical procedures	18,034	18,965	--	5.2%	--	Surgery Flag Software update: not in scope for 2018; did not satisfy volume threshold after reclassification of 2 CPT codes
142	Partial excision bone	286,010	297,669	278,414	4.1%	-6.5%	
143	Bunionectomy or repair of toe deformities	275,055	267,755	255,623	-2.7%	-4.5%	
144	Treatment, facial fracture or dislocation	52,321	53,979	47,981	3.2%	-11.1%	
145	Treatment, fracture or dislocation of radius and ulna	127,190	130,390	132,169	2.5%	1.4%	
146	Treatment, fracture or dislocation of hip and	--	7,924	7,072	--	-10.7%	Volume increase: added as in scope in 2017; satisfied volume threshold

CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
	femur						
147	Treatment, fracture or dislocation of lower extremity (other than hip or femur)	185,209	196,585	203,855	6.1%	3.7%	
148	Other fracture and dislocation procedure	122,348	127,249	120,152	4.0%	-5.6%	
149	Arthroscopy	106,223	101,486	94,708	-4.5%	-6.7%	
150	Division of joint capsule, ligament or cartilage	71,499	65,945	61,009	-7.8%	-7.5%	
151	Excision of semilunar cartilage of knee	485,518	453,645	414,936	-6.6%	-8.5%	
152	Arthroplasty knee	46,695	52,471	204,648	12.4%	290.0%	Reimbursement change: increased volume in 2018 after CMS removed total knee arthroplasty from the inpatient-only list <sup>a</sup>
153	Hip replacement, total and partial	41,791	48,614	55,515	16.3%	14.2%	
154	Arthroplasty other than hip or knee	59,702	60,809	62,754	1.9%	3.2%	
157	Amputation of lower extremity	45,131	47,079	49,959	4.3%	6.1%	
158	Spinal fusion	55,145	80,104	86,651	45.3%	8.2%	Reimbursement change: increased volume in 2017 after CMS added several surgical spine codes to the list of approved ambulatory surgery center covered procedures <sup>b</sup>
160	Other therapeutic procedures on muscles and tendons	1,009,641	1,028,920	1,027,256	1.9%	-0.2%	
161	Other OR therapeutic procedures on bone	319,538	328,577	302,822	2.8%	-7.8%	
162	Other OR therapeutic procedures on joints	603,110	599,063	534,821	-0.7%	-10.7%	
164	Other OR therapeutic procedures on	46,975	48,306	47,807	2.8%	-1.0%	

CCS for Services and Procedures Category	Description	Total Procedures, N			Percentage Change		Potential Contributing Reasons for Change Over Time
		2016	2017	2018	2016–2017	2017–2018	
	musculoskeletal system						
166	Lumpectomy, quadrantectomy of breast	333,254	335,169	334,609	0.6%	-0.2%	
167	Mastectomy	81,982	88,380	95,682	7.8%	8.3%	
171	Suture of skin and subcutaneous tissue	8,241	8,756	--	6.2%	--	Surgery Flag Software update: not in scope for 2018 because outpatient hospital share fell below threshold after reclassification of 6 CPT codes
174	Other non-OR therapeutic procedures on skin and breast	19,769	20,851	--	5.5%	--	CCS for Services and Procedures update: not in scope for 2018 after all narrow procedures were reclassified from CCS 174 to CCS 175
175	Other OR therapeutic procedures on skin and breast	488,415	492,185	491,674	0.8%	-0.1%	
225	Conversion of cardiac rhythm	123,689	142,384	155,112	15.1%	8.9%	
244	Gastric bypass and volume reduction	27,961	26,255	26,253	-6.1%	0.0%	

Abbreviations: CMS, Centers for Medicare & Medicaid Services; CPT, Current Procedural Terminology; GI, gastrointestinal; NASS, Nationwide Ambulatory Surgery Sample; OR, operating room.

<sup>a</sup> See CMS Hospital Outpatient Prospective Payment- Notice of Final Rulemaking (NFRM) with Comment Period (CMS–1678–FC), available at: <https://www.govinfo.gov/content/pkg/FR-2017-11-13/pdf/2017-23932.pdf>.

<sup>b</sup> See CMS Hospital Outpatient Prospective Payment - Final Rule with Comment and Final CY2017 Payment Rates (CMS-1656-FC), available at: <https://www.govinfo.gov/content/pkg/FR-2016-11-14/pdf/2016-26515.pdf>.

Notes: Totals represent weighted estimates. Totals are missing if the CCS procedure category was not in scope for the NASS sample. Contributing reasons for changes over time are reported only for categories that were added to or removed from the NASS in-scope procedure list and for categories with year-to-year percentage change in volume greater than 20 percent.