

**MAINTAIN AND EXPAND
THE HEALTHCARE COST AND UTILIZATION PROJECT (HCUP)
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H·CUP

HEALTHCARE COST AND UTILIZATION PROJECT

Celebrating 20 Years of Powerful Data

**DRAFT REPORT – FEASIBILITY TO PRODUCE A PILOT
NATIONWIDE AMBULATORY SURGERY DATABASE
DELIVERABLE #1633.3B**

**THIS IS A REFERENCE DOCUMENT FOR AHRQ HCUP
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1. EXECUTIVE SUMMARY

The purpose of this report is to describe the characteristics of the current HCUP ambulatory surgery (AS) datasets and outline the challenges associated with developing a nationwide AS database. Specifically, we address the question of whether a nationwide AS database is feasible given the currently available HCUP AS data sources and reference datasets.

AS data is unique among HCUP databases in that there is considerable variability from state to state in terms of the nature and completeness of data collected, and also how “ambulatory surgery” is defined at a fundamental level. There is a corresponding lack of uniformity at the national level, which further complicated the development and definition of the sampling frame and universe.

Despite these complicating factors, a sampling scheme generally similar to the NIS and NEDS appears to be a feasible method for developing a nationwide AS database, especially once source data have been subsetted to identify those AS visits most likely to be: (a) reported consistently from state to state, and (b) of interest to health service researchers examining AS.

2. INTRODUCTION

2.1 Background and Motivation

Ambulatory surgeries have become more common over the past several decades. As new surgical techniques emerge and, as surgeries once done on an inpatient basis become possible on an ambulatory basis, understanding nationwide ambulatory surgery utilization will become increasingly important. However, there is currently no all-payer, nationwide ambulatory surgery database publicly available to researchers that captures both hospital-based and freestanding ambulatory surgery care from which to derive regional and national estimates of ambulatory surgery. Currently, analyses are limited to state-level or combined state studies. The creation of a Nationwide Ambulatory Surgery Database (NASD) would address this gap.

Key ambulatory surgery issues of interest to researchers include the following:

- The volume and types of surgeries conducted on an ambulatory basis
- The migration of surgeries from setting to setting as technologies advance including inpatient, hospital outpatient, freestanding ambulatory surgery centers and physician offices
- The (decreased) cost of surgeries that occur on an ambulatory basis and in different settings
- The quality and outcomes of ambulatory surgeries (including eight measures proposed by CMS on July 1, 2011 for reporting starting in 2012).

To aid in understanding and improving this vital component of healthcare, the Agency for Healthcare Research and Quality (AHRQ) and Thomson Reuters (TR) launched a study of the feasibility, practicability, and usefulness of constructing a Nationwide Ambulatory Surgery Database (NASD). Under the AHRQ Healthcare Cost and Utilization Project, there is a state-based database – the State Ambulatory Surgery Databases (SASD) – that could constitute the building block for a NASD. The SASD capture information on hospital outpatient services (other than emergency department) that include ambulatory surgeries. The SASD and other HCUP databases provide a unique resource to support health researchers, policy makers, and decision makers in epidemiology, environmental planning, policy analysis, health organization, public health, health planning, and disaster planning. The HCUP family of administrative, longitudinal databases is created by AHRQ through a Federal-State-Industry partnership.

2.2 Overview and Report Organization

This report evaluates the feasibility of developing a Nationwide Ambulatory Surgery Database (NASD) that can produce national and regional estimates of ambulatory surgery. It outlines an approach to creating a NASD but also highlights related issues, considerations, and limitations. The remainder of this report is divided into seven sections:

- Section 3. HCUP Data Available for a NASD
- Section 4. AHA Data Available to Compare to HCUP
- Section 5. NASD Database Design
- Section 6. Weighting and Stratification
- Section 7. Final sample design
- Section 8. Limitations of a Pilot
- Section 9. Conclusion and Recommendations

Note that, throughout this report, the term ambulatory surgery is used. However, depending on the definition, diagnostic and other procedures may also be incorporated.

3. HCUP DATA AVAILABLE FOR A NASD

A pilot NASD would be constructed using some or all data included in the HCUP SASD databases. First, we describe these data. Later we discuss which data we recommend to be included in the pilot NASD. (See Section 5. NASD Database Design.)

3.1 Previous AS Feasibility Study

A feasibility study, conducted in 2002, evaluated the creation of a nationwide sample of ambulatory surgery stays from the 13 State Ambulatory Surgery Databases for 1999.¹ The study determined that the limited geographical representativeness of the 1999 SASD, combined with the lack of sufficient data on freestanding ambulatory surgery centers in some states, did not warrant the creation of a nationwide sample of ambulatory surgery stays at that time.

However, since the completion of that evaluation, more than twice as many states now contribute SASD to the project.

3.2 Current HCUP AS data

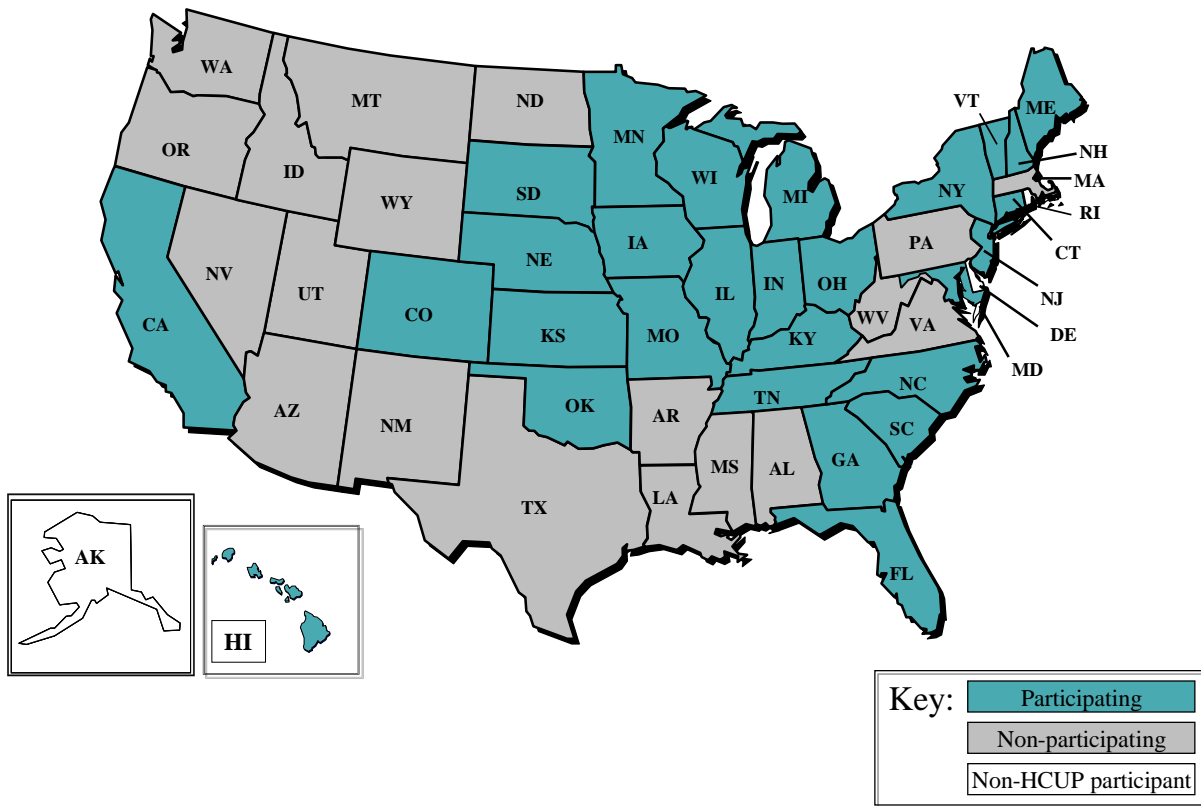
3.2.1 States providing AS data

For the 2009 data year, 29 states contributed data to the intramural State Ambulatory Surgery Databases (SASD): California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Utah, Vermont, and Wisconsin. It should be noted that, although Utah provides SASD data, the data were not received in time to be included in the analyses contained in this report, except as indicated.

Figure 1 shows the 29 states that contributed ambulatory surgery data to HCUP in 2009.

¹ [insert footnote for previous AS Feasibility study.]

Figure 1: States Contributing SASD Data in 2009



3.3 Identification of HCUP Ambulatory Surgery Records

HCUP ambulatory surgery records are submitted by state Partners along with other records. HCUP includes both ambulatory surgery and non-ambulatory surgery records in SASD. The current HCUP definition of ambulatory surgery appears to be overly broad and may include additional services and procedures. Partners submit both hospital-based and non-hospital based AS records.

3.3.1 Records Included in SASD

It is important to understand the origin of the SASD files and their contents, which go well beyond containing only ambulatory surgery data. In general, records included in the SASD are derived from the UB04/CMS1450 forms for hospital-based ambulatory surgery centers and the CMS 1500 form for freestanding ambulatory surgery centers.

Many states submit files that include a range of outpatient services, including, but not limited to ambulatory surgery. Emergency department data are often combined with ambulatory surgery data. Records in the 2009 SASD are defined in the same way as data in the 2004-2008 SASD, which differs substantially from previous years. In an attempt to create uniformly defined outpatient databases, AHRQ approved, starting with the 2004 data, screening the outpatient data provided by the HCUP Partners and assigning records to the SASD or State Emergency

Department Databases (SEDD) based on information coded on the record. Records identified as having emergency department services² were placed in the SEDD.

All other records were placed in the SASD. Therefore, SASD files can contain both records for ambulatory surgeries, as well as records for other outpatient services.

In addition, to ensure that all ambulatory surgery records were included in the SASD, records satisfying the criteria for an ambulatory surgery were included in the SASD files without regard to their origin in an ambulatory surgery or emergency department file. Those records that satisfied both ambulatory surgery and emergency department criteria were included in the SASD files, as well as the SEDD files.

Appendix C: States that provide combined SASD and SEDD files indicates which States provide combined SASD and SEDD files. In total, 15 of 29 States provide combined files. A nationwide database drawn from complete SASD files would include ED visits for these States.

Given the contents of the SASD files, AHRQ may want to consider renaming the files from SASD to a broader description that indicates they can contain a wide range of hospital outpatient services.

3.3.2 Definition of Ambulatory Surgery

Another important consideration is the definition of ambulatory surgery. The variable HCUP_AS is used to identify ambulatory surgery records.

Ambulatory surgery records (HCUP_AS>0) are defined based on meeting at least one of the following criteria:

- 1) ICD-9-CM ranges include codes 00.50-86.99 (excluded are procedure codes in the range 88.4-88.59),
- 2) CPT procedures codes indicating surgery (yearly updates can be downloaded from the Centers for Medicare & Medicaid Services (CMS) and, generally, include 10121-69930, G0105, G0121, and G0260),
- 3) Presence of at least one revenue center code in the following range 036x (operating room services), 037x (anesthesia), or 049x (ambulatory surgical care), or
- 4) Presence of a UB04 bill type of 83 indicating outpatient services.

All records in the SASD not meeting these criteria for ambulatory surgery are designated with HCUP_AS=0.

However, this definition of ambulatory surgery is broad and incorporates services that occur in conjunction with ambulatory surgeries (e.g., x-rays and blood draws) and that occur in the same care settings as ambulatory surgeries (e.g., tonsillectomy). These services may be ancillary to ambulatory surgeries and paid for as a bundle with ambulatory surgeries by some payers. Others may be unrelated to ambulatory surgery (e.g., vaccinations).

For the AS Evaluation Study, the AS definition was refined in two steps. The first step excluded specific CPT codes for minor procedures. The following is the revised definition, identifying the excluded CPT codes:

² Emergency department services met at least one of the following criteria: 1) emergency department revenue code of 450-459; 2) positive emergency department charge, when revenue center codes were not available; or 3) emergency department CPT code of 99281-99285.

1. ICD-9-CM ranges include codes 00.50-86.99 (excluded are procedure codes in the range 88.4-88.59),
2. CPT procedures codes 10021-69930, G0105, G0121, and G0260 (**exclude CPT codes: 20979, 29550, 29580, 29581, 36415, 36416, 36511, 36512, 36513, 36514, 36515, 36516, 38204, 38207, 38211, 38212, 38213, 38214, 38215, 50300, 50320, 50547, 55859, 62252**)
3. Presence of at least one revenue center code in the following range 036x (operating room services), 037x (anesthesia), or 049x (ambulatory surgical care), OR
4. Presence of a UB04 bill type of 83 indicating outpatient services.

In the second step, Clinical Classifications Software (CCS) for ICD-9-CM and CCS for Services and Procedures were applied. Then the following categories were eliminated based on AHRQ recommendations that they were not surgical in nature: 2, 4, 27, 34, 36, 43, 44, 50, 51, 52, 56, 58, 64, 66, 72, 73, 74, 75, 78, 79, 91, 104, 105, 107, 108, 126, 133, 134, 135, 136, 137, 138, 139, 140, 153, 156, 171, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 212, 213, 214, 215, 216, 217, 218, 219, 221, 222, 223, 224, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243.³

As noted in the AS Evaluation Study (Tables 8 and 9), the revised definition had a substantial impact on the number of ambulatory surgeries identified in hospital-based facilities. The CCS criteria excluded 28.9 percent of ICD-9-CM procedure codes that would have otherwise been identified as surgeries and 72.5 percent of CPT codes. For non-hospital based facilities, only 5.3 percent of ICD-9-CM procedure codes that would have otherwise been identified as surgeries and 9.0 percent of CPT codes were eliminated.

The analyses provided in this report are based on this revised ambulatory surgery definition. AHRQ is currently exploring further refinement of the definition of ambulatory surgery. Where appropriate, the implications of a further refined definition of ambulatory surgery on the creation of a NASD are highlighted.

3.3.3 Records contain multiple services

SASD data, like other HCUP data, are designed so that each record captures a visit. During a visit, a patient will likely have multiple services. Unlike inpatient records, AS records do not identify a principal service or procedure. The first listed procedure is not necessarily principal or primary.

To apply the HCUP_AS definition of ambulatory surgery, HCUP processing searches through all procedures listed on the AS record for any that match the criteria. If a single procedure matches, the entire record is labeled as HCUP_AS>0 and is thus considered an AS record. As a result, even once SASD records are filtered down to those that meet the AS definition, those records will contain both ambulatory surgeries plus other services that were provided during the same visits as ambulatory surgeries.

3.3.4 Non-hospital-based AS

³ See Appendix E: Excluded CCS Services and Procedure Codes

States may provide hospital-based data only or include data from non-hospital-affiliated free standing ambulatory surgery centers, physician practices or other non-hospital-based settings. For the annual SASD Comparison Report, both data from hospital-based facilities and non-hospital-based facilities have been assessed.

Facilities in the SASD were categorized as hospital-based or non-hospital based. Facilities classified as hospital-based were those that could be matched to the AHA Annual Survey Database. This included facilities that were 1) hospital-based and controlled, 2) hospital-based with third party control, or 3) freestanding with hospital affiliation.

Facilities not matched to the AHA Survey were classified as non-hospital-based, as they do not have a hospital indicator in the AHA survey data. As noted above, this may include, but not be limited to, free standing ambulatory surgery centers.

Table 1 shows, by state, the percentage of SASD records that are identified as ambulatory surgery, in both hospital and non-hospital based facilities. Note that this table is based on the revised definition of AS and includes all facilities, not just community, rehabilitation hospitals. As indicated, of 28 states, all provide hospital-based data and 12 provide at least some non-hospital based data.

Table 1: The Share of SASD Records Identified as Ambulatory Surgery in Hospital-Based and Non-Hospital Based Facilities

All SASD			Hospital Based Facilities			Non-Hospital Based Facilities				
State	Total Number of Facilities	Number of Records	% of Total records	% records HCUP_AS = 0	% records HCUP_AS > 0	Total Number of Facilities	% of Total records	% records HCUP_AS = 0	% records HCUP_AS > 0	Total Number of Facilities
California	584	2,375,872	77.27	9.85	90.15	362	22.73	5.06	94.94	222
Colorado	74	377,650	100.00	2.23	97.77	74	0.00	0.00	0.00	0
Connecticut	29	363,223	100.00	0.70	99.30	29	0.00	0.00	0.00	0
Florida	588	3,071,154	51.73	2.70	97.30	218	48.27	0.57	99.43	370
Georgia	144	1,743,500	100.00	55.22	44.78	144	0.00	0.00	0.00	0
Hawaii	16	73,711	100.00	3.25	96.75	16	0.00	0.00	0.00	0
Illinois	328	1,705,036	78.18	9.83	90.17	197	21.82	1.05	98.95	131
Indiana	121	891,125	100.00	0.34	99.66	121	0.00	0.00	0.00	0
Iowa	119	427,794	100.00	11.05	88.95	119	0.00	0.00	0.00	0
Kansas	97	2,289,013	100.00	89.85	10.15	97	0.00	0.00	0.00	0
Kentucky	131	1,757,615	96.39	49.28	50.72	110	3.61	0.00	100.00	21
Maine	58	4,493,071	100.00	92.76	7.24	58	0.00	0.00	0.00	0
Maryland	52	3,401,924	99.93	82.38	17.62	51	0.07	1.27	98.73	1
Michigan	138	1,652,354	97.95	8.02	91.98	136	2.05	2.75	97.25	2
Minnesota	128	1,892,237	100.00	57.67	42.33	128	0.00	0.00	0.00	0
Missouri	138	512,931	89.31	3.46	96.54	115	10.69	2.18	97.82	23
Nebraska	86	168,305	100.00	4.90	95.10	86	0.00	0.00	0.00	0
New Hampshire	25	173,201	100.00	15.58	84.42	25	0.00	0.00	0.00	0
New Jersey	75	452,963	100.00%	6.83	93.17	75	0.00	0.00	0.00	0
New York	304	2,225,482	82.01%	11.38	88.62	223	17.99	1.50	98.50	81
North Carolina	188	1,590,225	83.06%	2.31	97.69	119	16.94	0.00	100.00	69
Ohio	170	1,844,500	100.00%	29.72	70.28	170	0.00	0.00	0.00	0
Oklahoma	147	491,324	70.86%	5.58	94.42	102	29.14	4.39	95.61	45

South Carolina	155	755,884	70.50	0.00	100.00	68	29.50	0.02	99.98	87
South Dakota	34	62,310	100.00	9.69	90.31	34	0.00	0.00	0.00	0
Tennessee	122	1,334,209	100.00	41.31	58.69	122	0.00	0.00	0.00	0
Vermont	14	93,944	100.00	1.94	98.06	14	0.00	0.00	0.00	0
Wisconsin	191	1,011,215	79.83	3.38	96.62	132	20.17	0.59	99.41	59

As indicated, for hospital-based facilities, the percentage of records qualifying as ambulatory surgery varies widely across states. Overall, for 19 states, the percentage of hospital-based records qualifying as ambulatory surgery is greater than 90 percent. However, for example, in Maine, only 7.5 percent of hospital-based SASD records are identified as ambulatory surgery (per revised criteria). The Maine SASD file clearly includes many other services apart from ambulatory surgery.

For those states that provide it, the non-hospital based data are much more likely to qualify as ambulatory surgery. The percentage of records qualifying as ambulatory surgery is greater than 95 percent in non-hospital based data for all 12 states.

3.4 Identification of year of data to be used to develop the pilot NASD

It is suggested that the 2009 data be used for development of the pilot NASD since it will be the most recent data available. The analyses in this report are based on 2009 data.

4. AHA DATA AVAILABLE TO COMPARE TO HCUP

The HCUP AS data must be compared to an external data source that describes the universe of ambulatory surgery to determine the extent to which the NASD would be representative of the nation and not just the HCUP states that submit AS data.

The large majority of hospitals identified in the AHA universe can be linked to hospitals appearing in the SASD data, and a hospital sample can be drawn.

Note that it is assumed that the hospital-based ambulatory surgery data submitted by states is complete given its collection by the state Partner.

4.1 AHA Definition of Ambulatory Surgery

The AHA collects the total number of outpatient surgeries in its annual survey.

In the annual survey instructions, the AHA provides the following guidance:

Outpatient surgical operation. For outpatient surgical operations, please record operations performed on patients who do not remain in the hospital overnight. Include all operations whether performed in the inpatient operating rooms or in procedure rooms located in an outpatient facility. Include an endoscopy only when used as an operative tool and not when used for diagnosis alone. Count each patient undergoing surgery as one surgical operation regardless of the number of surgical procedures that were performed while the patient was in the operating or procedure room.

Unlike the HCUP definition, the AHA definition is not based on standard claims coding. The two different definitions may produce different identification of ambulatory surgeries.

Table 2 examines, by state, the difference between the number of ambulatory surgeries identified through the HCUP data (using the revised AS definition) and the number of outpatient surgeries reported to the AHA for matching community, non-rehabilitation hospitals. An adjusted HCUP AS Visits volume is calculated by adding the “AS Surgeries hospitals in AHA but not in HCUP” to the Number of HCUP Surgeries to account for hospitals missing from the HCUP data.

As indicated, the number of Adjusted HCUP surgeries is consistently higher than the number of AHA surgeries. Across all states, 67.9 percent more ambulatory surgeries are identified in the adjusted HCUP data compared to the AHA data. In many cases, state-level differences are quite large. Of the 28 states, twenty have differences greater than 50 percent. New York is the only state where the difference is less than 5 percent. These differences also hold when comparing the unadjusted number of HCUP surgeries to AHA surgeries.

In contrast, the NEDS Feasibility Study showed only a 1.2 percent difference between 2005 Adjusted HCUP and AHA ED visit volume. Only two of 23 states had an adjusted percent difference greater than 10 percent.

The magnitude and direction of these differences suggest that the HCUP definition of AS is much broader than that applied by hospitals responding to the AHA survey.

Table 2: Comparison of HCUP and AHA AS Visit Counts for Hospital-Based, and Non-Hospital Based with Hospital Affiliation Facilities, 2009

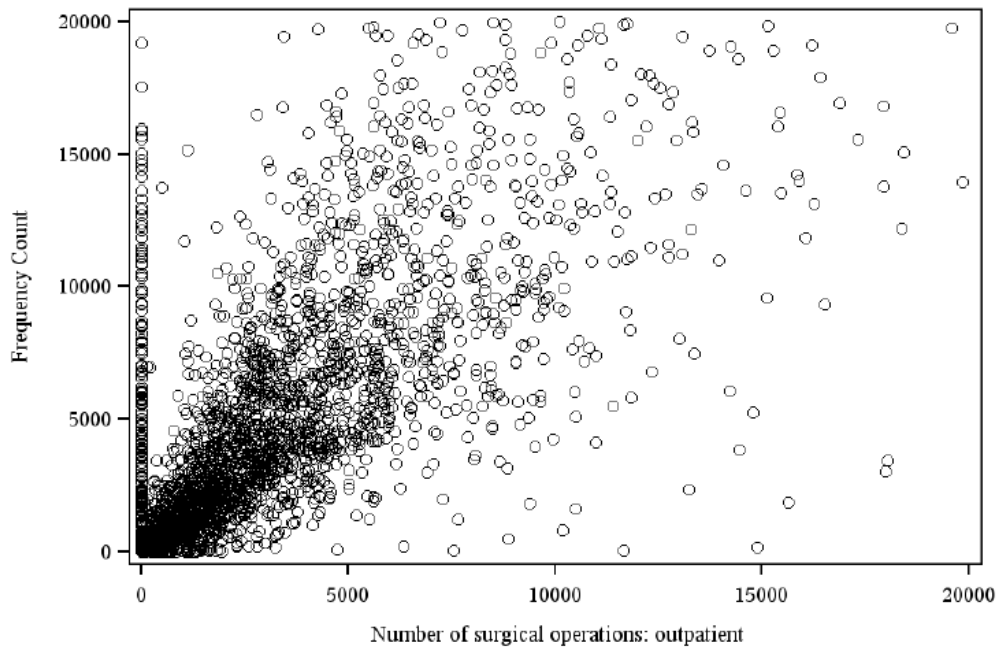
State	Total Number of Facilities	Number of HCUP Surgeries	Number of AHA Surgeries	Percent Difference	AS Surgeries in AHA Hospitals but not in HCUP Hospitals	Adjusted HCUP AS Visits	Adjusted Percent Difference
California	352	1,641,257	1,264,361	29.8%	14,054	1,655,311	30.9%
Colorado	73	368,309	199,427	84.7%	8,749	377,058	89.1%
Connecticut	29	360,688	194,703	85.3%	3,687	364,375	87.1%
Florida	217	1,536,089	818,357	87.7%	11,438	1,547,527	89.1%
Georgia	140	780,714	506,003	54.3%	6,456	787,170	55.6%
Hawaii	16	71,316	56,202	26.9%	5,306	76,622	36.3%
Illinois	183	1,183,925	720,901	64.2%	2,560	1,186,485	64.6%
Indiana	118	882,530	451,620	95.4%	11,966	894,496	98.1%
Iowa	118	379,994	265,368	43.2%	0	379,994	43.2%
Kansas	79	232,371	134,062	73.3%	58,337	290,708	116.8%
Kentucky	107	847,032	369,443	129.3%	3,756	850,788	130.3%
Maine	54	325,126	115,503	181.5%	0	325,126	181.5%
Maryland	47	587,129	354,125	65.8%	318	587,447	65.9%
Michigan	135	1,487,909	675,747	120.2%	18,332	1,506,241	122.9%
Minnesota	127	799,836	293,421	172.6%	18,861	818,697	179.0%
Missouri	112	439,315	372,633	17.9%	10,538	449,853	20.7%
Nebraska	86	160,054	126,840	26.2%	998	161,052	27.0%
New Hampshire	25	146,219	89,566	63.3%	1,929	148,148	65.4%
New Jersey	72	421,529	383,928	9.8%	3,891	425,420	10.8%
New York	214	1,361,294	1,359,153	0.2%	10,880	1,372,174	1.0%
North Carolina	116	1,280,098	554,252	131.0%	10,685	1,290,783	132.9%
Ohio	166	1,284,531	781,814	64.3%	32,130	1,316,661	68.4%
Oklahoma	102	328,735	219,579	49.7%	8,159	336,894	53.4%
South Carolina	68	532,918	295,449	80.4%	5,006	537,924	82.1%
South Dakota	32	56,271	45,221	24.4%	36,797	93,068	105.8%
Tennessee	119	777,994	364,257	113.6%	51,047	829,041	127.6%
Vermont	13	92,121	48,673	89.3%	0	92,121	89.3%
Wisconsin	128	777,152	542,400	43.3%	5,636	782,788	44.3%
Total	3,048	19,142,456	11,603,008	65.0%	341,516	19,483,972	67.9%

In addition, there may be doubt regarding the consistency with which hospitals responding to the AHA survey are applying the AHA ambulatory surgery definition. For example, for New York, the HCUP and AHA volume is almost identical. However, for Florida, the difference is 87.7 percent. The same HCUP definition is used for both states. Therefore, either difference in the completeness and/or coding of the data is driving differences in the identification of HCUP surgeries, or hospitals are interpreting the AHA requirements differently.

Figure 2 is a hospital-level scatter plot showing the number of ambulatory surgeries identified in the SASD against the number of surgeries reported by the hospital to the AHA. As indicated, for many hospitals, there is a large difference between the SASD and AHA counts. In addition,

a large number of hospitals report no ambulatory surgeries to the AHA, but they have submitted ambulatory surgeries that are included in the SASD.

Figure 2: Plot of AHA Surgery Count vs. SASD Surgery Count Based on New Definition and Community Non-Rehab Hospitals, SASD_CNT < 20,000 and AHA_CNT < 20,000



4.2 Facility types in AHA data

Finally, there may be differences in the facilities that are included in the SASD files and the AHA data. As indicated earlier, the AHA data include facilities that were 1) hospital-based and controlled, 2) hospital-based with third party control, or 3) freestanding with hospital affiliation.

The AHA data are used to determine whether a record in the SASD data came from a hospital-based facility. The AHA provides information on several types of ambulatory surgery facilities, as shown in Table 3. In this table, ambulatory surgery facilities are defined as *hospital-based* by the AHA only if they are physically connected to main hospital facilities.

Table 3: Types of Ambulatory Surgery Facilities in the AHA Survey Database

Type of Facility	AHA
AS facility – hospital-based and controlled	Yes
AS facility – hospital-based with third-party control	Yes
AS facility – freestanding with hospital affiliation	Yes
AS facility – freestanding with no hospital affiliation	No
Services originating at other sites, such as physician offices	No

4.2.1 Impact of Differences between AHA and SASD Identification of AS

The selection of a hospital sample and the development of hospital weights is not affected by differences between the definition of AS between the AHA and SASD. The universe of hospitals is captured in the AHA universe and hospitals can be linked to the HCUP data.

However, the development of discharge weights (e.g., as carried out for NEDS) is affected by the differences in the identification and volume of AS between the AHA and HCUP.

The development of discharge weights involves the following calculation:

$$\text{DISCWT} = \text{DNs(universe)} \div \text{ADNs (sample)}$$

Where DN_s(universe) is the number of ambulatory surgeries from hospitals in the universe (i.e., as identified in the AHA data). AD_{Ns} is the number of ambulatory surgeries from sample hospitals selected for the NASD (i.e., as identified in the SASD data since it is the surgeries in the SASD data that will be included in the NASD). Given the much higher identification of surgeries in the SASD data, the HCUP ambulatory surgeries effectively would need to be down-weighted substantially during creation of the NASD.

In order to support the creation of a NASD that uses AHA AS volume to calculate discharge weights, developing an AS definition that more closely aligns with the AHA definition would be necessary.

The task to further refine the HCUP AS definition may want to investigate how hospitals are interpreting the AHA guidance and how they are identifying outpatient surgeries through their data systems.

In addition, analyses could be undertaken to examine hospitals within a mid-size State (e.g., Missouri) to try to identify the types of procedures/surgeries that may be included by one hospital but not another.

4.2.2 Summary of Findings Regarding Sampling Frame and AHA Universe

The difference between the number of ambulatory surgeries in the sampling frame and the number identified in the AHA universe prohibits the development of discharge weights. Therefore, the sampling strategy is necessarily limited to the selection of hospitals (and the calculation of hospital weights). The inherent assumption will be that the sampled facilities are completely representative of the universe facilities within each stratum, including representative of the total number of AS records and representative of the mix of AS surgeries.

With respect to which states should be included in the sampling frame, at this point, there are no data issues that would warrant exclusion of any specific state from inclusion in the sampling frame for purposes of the NASD Feasibility Study.

4.3 Identification of Other Potential Data Sources

Ambulatory surgeries can occur in any of the following settings:

- Hospital outpatient facilities
- Freestanding ambulatory surgery centers
- Physician offices

The AS Evaluation Study sought to identify data sources that would provide the universe of surgeries done in free standing ambulatory surgery centers.

The reviewed data sources included:

- SDI Freestanding Outpatient Surgery Center (FOSC) Database
- American Hospital Association (AHA) Annual Survey
- Centers for Medicare & Medicaid Services (CMS) Provider of Service (POS) Extract
- National Center for Health Statistics (NCHS) National Survey of Ambulatory Surgery (NSAS)
- NCHS National Hospital Ambulatory Medical Care Survey (NHAMCS)
- NCHS National Ambulatory Medical Care Survey (NAMCS)
- Ambulatory Surgery Center (ASC) Association
- American Association for Accreditation of Ambulatory Surgical Facilities, Inc. (AAAASF)
- Accreditation Association for Ambulatory Health Care (AAAHC)
- Medicare Files
- Medicaid Files
- MarketScan Research Data
- TRICARE Encounter Data (TEDS)
- HCUP State Partner Organizations

A brief summary of each of these data sources appears in Appendix G: Evaluation of AS Universe data sources.

5. NASD DATABASE DESIGN

5.1 Approaches to NASD Design

Analysis of the feasibility of creating a NASD is dependent on first deciding what the NASD should be designed to include. To make this decision, one must answer two design questions: What care settings should the NASD include and what services should it include? This decision is unique to the NASD. Creating the NIS and the NEDS did not face this question because the care settings were implicit and both include all services in these settings. Figure 3 depicts the potential answers to the NASD design questions.

Figure 3: Potential Approaches to NASD Design

1	<p>Only hospital-based</p> <p>Only ambulatory surgeries</p>	2	<p>All care settings</p> <p>Only ambulatory surgeries</p>
3	<p>Only hospital-based</p> <p>All services</p>	4	<p>All care settings</p> <p>All services</p>

5.1.1 Only Hospital-Based, Only Ambulatory Surgeries

In option 1, a NASD could be designed to include only ambulatory surgeries in hospital-based outpatient departments. This data set would have the benefit of limiting the selection to records that are of most interest to researchers analyzing ambulatory surgeries. The disadvantages are that the data set would exclude ambulatory surgeries performed in other settings and other services performed in hospital outpatient departments, if they were not provided during the same visits as the ambulatory surgeries.

5.1.2 All Care Settings, Only Ambulatory Surgeries

In option 2, a NASD could be designed to include only ambulatory surgeries in all care settings—hospital outpatient departments, freestanding ambulatory surgery centers, and physician offices. Like option 1, this dataset would have the benefit of limiting the data set to records that are of most interest to researchers analyzing ambulatory surgeries. It would also have the benefit of providing the opportunity to study ambulatory surgeries across the multiple care settings in which they are provided. However, as noted earlier, current SASD data capture AS data from non-hospital-based settings only for a limited number of HCUP Partners. And where HCUP Partners provide these data, it is not clear if it is captured for all or most of these providers in the state. Furthermore, there is no data source that captures the universe of all AS providers to use as comparison. AHA data capture hospital and hospital-affiliated providers, but it does not include truly freestanding providers and physician offices. We found no other sources of complete data for these providers.

As discussed earlier, Table 1 shows that only 12 of 28 States provide any non-hospital-based data. Table 4 provides the regional representation of these States, showing the total number of states.

As indicated, for 2009, only one state in the Northeast and one state in the West provided any non-hospital based data.

Table 4: Number of SASD States with Non-Hospital Based Data

Region	Number of NIS States	Number of SASD States	Number of SASD States with Non-Hospital Based Data
Northeast	8	6	1
South	13	8	5
Midwest	12	10	3
West	11	4	1
Total	44	28	10

Given the fact that the universe of freestanding ambulatory surgery centers cannot be identified, combined with the inadequacy of the regional representation in the HCUP sampling frame, and the likely under-capture of surgeries completed in freestanding ambulatory surgery centers, we recommend that the NASD be limited to hospital-based facilities.

5.1.3 Only Hospital-Based, All Services

In option 3, a NASD could be designed to include all services provided in hospital-based outpatient departments. Unlike the first two options, this data set would include all services submitted by HCUP Partners as part of outpatient data that are provided in hospital outpatient departments, except for emergency department visits. This means that the data set would include records that meet the AS definition (which include both ambulatory surgeries and other services performed during the same visits) and records that include no ambulatory surgeries. The benefit of this data set would be flexibility; researchers could choose to subset to just ambulatory surgeries or they could study other services if that is their interest. For example, they could study the share of services that are diagnostic versus therapeutic in teaching and non-teaching hospitals. However, HCUP Partners vary greatly in the extent to which they submit outpatient data on services other than ambulatory surgery (see Table 1).

Similar to option 1, the disadvantages are that the data set would exclude ambulatory surgeries performed in other settings and other services performed in hospital outpatient departments, if they were not provided during the same visits as ambulatory surgeries.

The SASD files are unlikely to completely capture all outpatient services as evidenced by the fact that, for some States, the SASD files contain almost exclusively AS. In other words, some providers likely are not reporting other services, such as diagnostics. However, other providers do report these services. Given the variation across States in what is contained in the SASD files, creating a nationwide sample may not produce a meaningful database. For example, it likely could not be considered a representative nationwide database of all hospital outpatient services since, at least some States, are restricting it to ambulatory surgeries. In addition, there may be great inconsistency of the non-ambulatory surgery services included in the SASD files.

Finally, a universe has not been defined that would correspond to the contents of the SASD files. Even if the SASD files were to completely capture all hospital outpatient services, the universe of all hospital outpatient services is not available in the AHA.

5.1.4 All Care Settings, All Services

In option 4, a NASD could be designed to include all services provided in all care settings—hospital outpatient departments, freestanding ambulatory surgery centers, and physician offices.

As in option 3, this data set would include all services submitted by HCUP Partners as part of outpatient data, except for emergency department visits. But it would also include any outpatient data that Partners submit for non-hospital based providers. However, only a limited number of Partners submit data for these providers (see Table 2).

Similar to option 2, this data set would have the benefit of providing the opportunity to study ambulatory surgeries across the multiple care settings in which they are provided. However, HCUP and AHA data limitations preclude this possibility.

5.1.5 Only Hospital-Based, Only Ambulatory Surgeries that are Primarily Performed in Hospitals

In option 5, which is a subset of option 1, a NASD could be designed to include only ambulatory surgeries that are primarily performed in hospital-based outpatient departments. As in option 1, the disadvantages are that the data set would exclude ambulatory surgeries performed in other settings and other services performed in hospital outpatient departments, if they were not provided during the same visits as ambulatory surgeries. However, this subset option would attempt to ameliorate this disadvantage by focusing on ambulatory surgeries that are primarily performed in hospitals so that the data set would capture nearly the universe of these services.

As part of this approach, the database documentation would provide estimates of the missing data to assist users whose research may be impacted by limitation to hospital-based AS NASD.

Analyses conducted for the AS Evaluation Study help to address this option. These analyses were conducted on MarketScan and TriCare data. The analyses identified the number of surgeries by CCS Summary Category (i.e., Body System) and CCS Procedure Category. There are 16 CCS Summary Categories and 142 CCS Procedure Categories. Only surgeries meeting the revised definition for ambulatory surgery were included in the analysis.

The number of surgeries was further divided by setting. Specifically, the analyses examine surgeries carried out on an inpatient and outpatient basis. Note that, although the revised AS definition was intended to identify ambulatory surgeries, the analysis revealed that some of these procedures were, in fact, conducted on an inpatient basis. The outpatient setting was further divided into freestanding ambulatory surgery center, physician office, hospital-based, and other.

As noted earlier, HCUP has relatively complete data on hospital-based ambulatory surgeries, spotty data on ambulatory surgeries carried out in freestanding ambulatory surgery centers, and no data on surgeries conducted in physician offices.

Table 5 shows the top 25 CCS procedure categories where ambulatory surgery is most frequently done in the hospital outpatient setting based on MarketScan data. It also shows the percent of procedures that are done on an outpatient/ambulatory basis as opposed to inpatient. For example, based on this data analysis, 99 percent of PTCAs done on an ambulatory basis are carried out in hospital inpatient settings. However, only 1 percent of PTCAs are done on an outpatient/ambulatory basis.

Overall, the analyses show that there are very few CCS procedure categories for which surgery is almost exclusively carried out in hospital outpatient settings. For only 11 CCS categories was the percent of surgeries conducted in hospital outpatient settings greater than 80 percent. For the vast majority of CCS categories, a substantial percentage of ambulatory surgeries occur in freestanding ambulatory surgery centers, physician offices or other settings.

Table 5: MarketScan Ambulatory Surgeries Performed in Different Settings

A	B	C	D								L	M
			MarketScan File Type		IP	ASC	Office	OPD	Other	Missing		
CCS Category	Total	Percent of Total	Inpatient	Outpatient							Total	Percent of Total
45: Percutaneous transluminal coronary angioplasty (PTCA)	61,661	0.2%	99%	1%	99%	0%	0%	1%	0%	0%	100%	96%
225: Conversion of cardiac rhythm	44	0.0%	0%	100%	0%	5%	0%	93%	2%	0%	100%	93%
220: Ophthalmologic and otologic diagnosis and treatment	1,465	0.0%	0%	100%	0%	15%	0%	84%	1%	0%	100%	84%
10: Thyroidectomy; partial or complete	32,572	0.1%	42%	58%	42%	2%	1%	49%	7%	0%	100%	83%
38: Other diagnostic procedures on lung and bronchus	12,910	0.0%	24%	76%	24%	1%	2%	63%	10%	0%	100%	83%
83: Biopsy of liver	33,188	0.1%	18%	82%	18%	3%	3%	67%	8%	0%	100%	82%
87: Laparoscopy (GI only)	43,837	0.2%	26%	74%	26%	6%	1%	60%	6%	0%	100%	82%
167: Mastectomy	27,407	0.1%	59%	41%	59%	2%	1%	33%	5%	0%	100%	81%
84: Cholecystectomy and common duct exploration	197,728	0.7%	36%	64%	36%	5%	1%	51%	6%	0%	100%	81%
82: Endoscopic retrograde cannulation of pancreas (ERCP)	41,773	0.1%	25%	75%	25%	2%	1%	61%	12%	0%	100%	81%
86: Other hernia repair	132,664	0.5%	28%	72%	28%	7%	1%	57%	7%	0%	100%	80%
57: Creation; revision and removal of arteriovenous fistula or vessel-to-vessel cannula for di a	21,358	0.1%	31%	69%	31%	2%	1%	55%	11%	0%	100%	79%
110: Other diagnostic procedures of urinary tract	10,029	0.0%	29%	71%	29%	1%	1%	56%	13%	0%	100%	79%
24: Mastoidectomy	5,326	0.0%	7%	93%	7%	13%	1%	74%	5%	0%	100%	79%
166: Lumpectomy; quadrantectomy of breast	94,966	0.3%	3%	97%	3%	11%	3%	77%	6%	0%	100%	79%
119: Oophorectomy; unilateral and bilateral	65,993	0.2%	63%	37%	63%	3%	1%	29%	5%	0%	100%	79%
97: Other gastrointestinal diagnostic procedures	19,524	0.1%	40%	60%	40%	3%	3%	47%	7%	0%	100%	78%
85: Inguinal and femoral hernia repair	91,299	0.3%	6%	94%	6%	12%	1%	73%	7%	0%	100%	78%
67: Other therapeutic procedures; hemic and lymphatic system	86,064	0.3%	42%	58%	42%	4%	3%	45%	5%	0%	100%	78%
68: Injection or ligation of esophageal varices	6,077	0.0%	36%	64%	36%	6%	2%	50%	6%	0%	100%	78%
88: Abdominal paracentesis	29,027	0.1%	18%	82%	18%	1%	5%	63%	12%	0%	100%	77%
12: Other therapeutic endocrine procedures	21,439	0.1%	48%	52%	48%	2%	4%	39%	7%	0%	100%	76%
122: Removal of ectopic pregnancy	3,535	0.0%	3%	97%	3%	4%	2%	74%	18%	0%	100%	76%
37: Diagnostic bronchoscopy and biopsy of bronchus	81,897	0.3%	37%	63%	37%	2%	2%	47%	12%	0%	100%	76%
102: Ureteral catheterization	91,712	0.3%	20%	80%	20%	9%	2%	61%	8%	0%	100%	76%

Therefore, it is not recommended that the NASD be limited to specific surgeries since very few are likely to be captured completely enough through the SASD hospital-based data to provide nationwide estimates. In addition, as noted previously, the universe of specific ambulatory surgeries is not available in the AHA data and, therefore, it would not be possible to construct weights for specific types of surgeries.

Additional reasons for not limiting the NASD to specific surgeries include:

- A NASD that is not restricted to specific surgeries would allow users to examine different types of AS, recognizing that the estimates produced would be limited to hospital-based settings. Restriction to specific surgeries would, in effect, limit the potential usefulness of the NASD to researchers.
- Surgeries migrate over time from setting to setting. Certain surgeries may move from inpatient to hospital outpatient. If the set of surgeries included in the NASD is restricted to those currently done on an outpatient basis, there may need to be a regular/annual review of which ambulatory surgeries, specifically to include those that recently became feasible on an outpatient basis.
- Similarly, as surgeries migrate from hospital outpatient to freestanding ambulatory surgery centers and/or physician offices, specific surgeries may need to be deleted from the set of those included in the database.

It is recommended that estimates of the missing data are provided as part of the NASD documentation to assist users whose research may be impacted by limitation to hospital-based AS. The form/content of this documentation would be based on the above analyses converted to a series of graphics.

5.2 Recommended NASD Design Approach

Based on the advantages and disadvantages of each of the potential NASD design approach options described above, we recommend that the pilot NASD be constructed based on option 1 to include only ambulatory surgeries in hospital-based outpatient departments.

5.3 Pilot NASD File Structure

The following file types may be appropriate for the NASD:

- Core file with discharge-level records
- Supplemental CPT-4 and ICD-9-CM file with procedures on the record (this may be appropriate given the different number of codes provided by states and the fact some provide CPT charge detail)
- Hospital file with hospital characteristics
- Data development file with dates

5.4 Recommended variables for inclusion in pilot NASD

A final list of variables should be developed prior to the creation of the pilot database, should it move forward. These would include the following general categories of variables:

- Diagnoses and external cause of injury codes
- ICD-9-CM and CPT procedure codes
- Patient demographics
- Expected payment source
- Total charges
- Stratification variables as permitted (e.g., urban/rural)

5.4.1 Data Standards and Values

The data elements in the pilot NASD should be consistent with the other HCUP databases, where possible. The following objectives guided the definition of data elements included in all HCUP databases:

- Ensure usability without extensive editing by analysts
- Retain the largest amount of information available from the original sources, while still maintaining consistency among sources
- Structure the information for efficient storage, manipulation, and analysis

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

5.4.2 Missing Data and Variables

Some data elements are not available for all states. However, because of their importance, we recommend including these data elements in the NASD whenever available. The following special SAS missing values are used for HCUP data elements to indicate details of data availability and quality:

- Missing Data (.): When the information is not available from the HCUP Partner

- Invalid Data (.A): When the source data contain undocumented, out-of-range, or invalid values (e.g., an invalid date or an alpha character in a numeric field).
- Inconsistent Data (.C): Related data elements within the same record were checked for logical consistency (e.g., a procedure of hysterectomy reported with a sex of male is inconsistent).

6. WEIGHTING AND STRATIFICATION

While it would be ideal to have information from all payers for all AS visits in the U.S. to create national estimates of AS services and visits, no such data source exists. Akin to the NIS, national estimates can be created using the information from the 29 HCUP Partner states by utilizing weighting and stratification methods. The weighting and sampling strategies are described and assessed in this section.

6.1 Sampling Strategies

There were two potential sampling methods to consider. The first method was to take a stratified sample of hospital-based ambulatory surgical facilities and select all AS visits within the sample of hospitals. This is similar to the HCUP NIS and NEDS design. The second approach was to draw a sample of AS visits from all of the hospitals in HCUP SASD states. This is similar to the design of the HCUP Kids' Inpatient Database (KID).

The main objective of a stratified sample is to ensure that the sample is representative of the target universe which, in this case, is derived from the AHA inventory of hospitals that provide AS. Note that the AHA data describe hospital characteristics, including total number of ambulatory surgeries. We found no satisfactory source of data on the universe of ambulatory surgeries. Since the universe was hospital-derived, a sample of hospitals (similar to the NIS and NEDS) was selected.

The sampling strategy has two steps:

- Match SASD hospitals to AHA hospitals to draw a hospital sample and create hospital weights
- Create discharge weights by comparing the volume of AS captured in the sampled hospitals to the total AS volume in the AHA universe

6.2 Identification of the Universe of Hospital-Based Ambulatory Surgery Facilities

The first issue in determining if a nationally representative sample can be constructed is the identification of the universe of hospital-based ambulatory surgeries in the United States. Possible sources were the AHA Annual Survey and others listed in Section 4.3 Identification of Other Potential Data Sources. The AHA Annual Survey Database is the best source for a number of reasons. First, the AHA Annual Survey Database is the most complete source of information on hospital-based ambulatory surgeries. Second, the crosswalk linkage from the HCUP databases to the AHA data is already established, and the AHA data provides the necessary hospital characteristics, such as teaching status. Third, the AHA Annual Survey Database is also used as the universe for the HCUP NIS and NEDS.

Therefore, the analyses defined the universe of hospital-based ambulatory surgeries as hospital outpatient surgeries from the AHA Annual Survey from community, non-rehabilitation hospitals. Limitation to community, non-rehabilitation hospitals is consistent with the NEDS and NRD.

For 2009, the AHA includes 5,128 community, non-rehabilitation hospitals.

6.3 Identification of the Sampling Frame

The sampling frame was limited to a subset of the universe: hospital-based ambulatory surgery facilities in the states for which HCUP AS data are available. Using the 2009 AHA data as a universe, the representation of AS hospitals in the 2009 HCUP SASD data was examined.

6.4 Identification and Assessment of Potential Stratification Variables

Stratification is advantageous when key outcomes differ substantially between the sampling frame and the target universe.

In this section, first differences in hospital characteristics in the SASD states and other states are examined using the AHA data across potential strata.

Consistent with the NIS and NEDS, the following stratifiers are examined:

- Census region
- Urban/rural location
- Hospital teaching status
- Hospital control
- Bed size

The following sections of this report examine the representation of HCUP SASD hospitals across these strata. Note that all analyses in these sections use the AHA volume of outpatient surgeries.

6.4.1 Census Region

U.S. census region is an important stratifier because patterns of hospital-based ambulatory surgery practice may vary substantially by region. Census regions are defined shown in Table 6.

Table 6: U.S. Census Regions

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
Midwest	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
South	Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia
West	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

Error! Reference source not found. shows the population, number of AHA AS Visits in SASD states, and the percentage of each metric of the AHA total. As indicated, there is adequate representation of SASD hospitals regionally.

Table 7: Percentage of U.S. Population and AHA AS Visits Captured in the 28 HCUP AS States Participating in the NASD, 2009

Region	U.S. Population in HCUP SASD States	Percentage of U.S. Population in HCUP SASD States (%)	AHA AS Visits in HCUP SASD States	Percentage of AHA AS Visits in HCUP SASD States (%)
Northeast	35,032,116	63.40%	2,211,913	60.50%
South	62,306,201	55.00%	3,578,330	53.70%
Midwest	66,190,067	99.00%	4,606,182	98.80%
West	43,281,590	60.50%	1,548,099	53.60%
Nation	205,514,796	66.90%	11,944,524	66.80%

Data from Figure 4 indicate that states contributing data to SASD represent a little over 49 percent of all hospitals in Midwest. On the other hand, states that did not contribute to SASD represent over 67 percent of all hospitals in South and West.

Figure 4: Share of Hospitals in SASD and Non-SASD States by Census Region, 2009

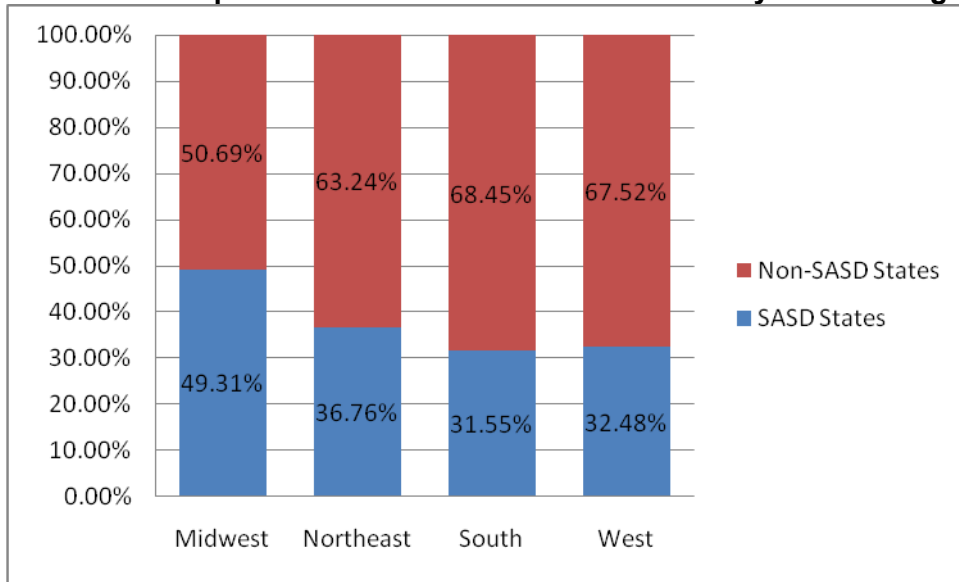
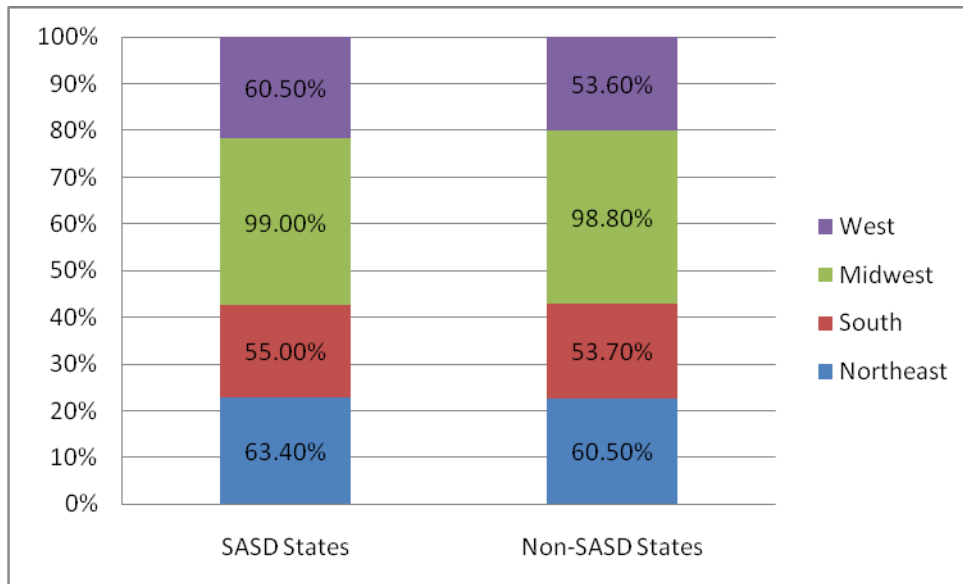


Figure 5 indicates that the distribution of AS visits across census regions varies between states that contribute data to SASD and states that do not. About 61 percent of AS visits in SASD states are in the West, while across non-contributing states, the percentage for the West is about 54 percent. The percentage on AS visits from the Northeast is 63 percent in the SASD states and 60 percent across non-contributing states.

Figure 5: Share of AS Visits by Census Region among SASD and Non-SASD States, 2009



6.4.2 Ownership

Depending on their ownership control, hospitals tend to have different missions and different responses to government regulations and policies. Hospital ownership is categorized according to information reported in the AHA Annual Survey Database. Ownership categories include:

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

Figure 6 indicates that states that contribute to SASD represent 68 percent of all government or private hospitals (collapsed); 66 percent of all private hospitals (collapsed category); and 53 and 54 percent of all government and private, not-for-profit hospitals, respectively. In contrast, a majority of private, investor-owned hospitals (65 percent) are represented by non-SASD states.

Figure 6: Share of Hospitals by Ownership among SASD and Non-SASD States, 2009

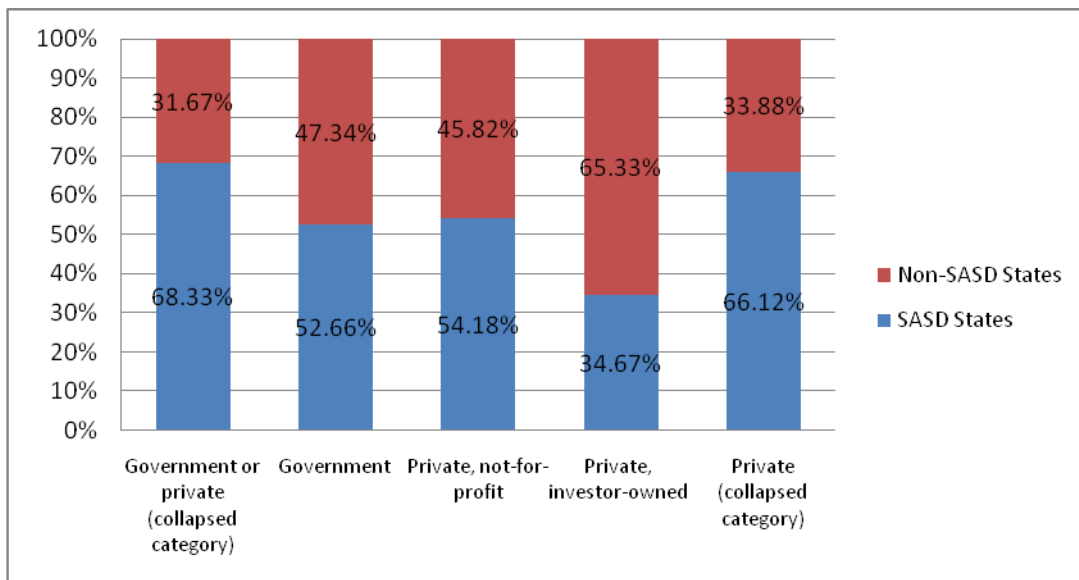
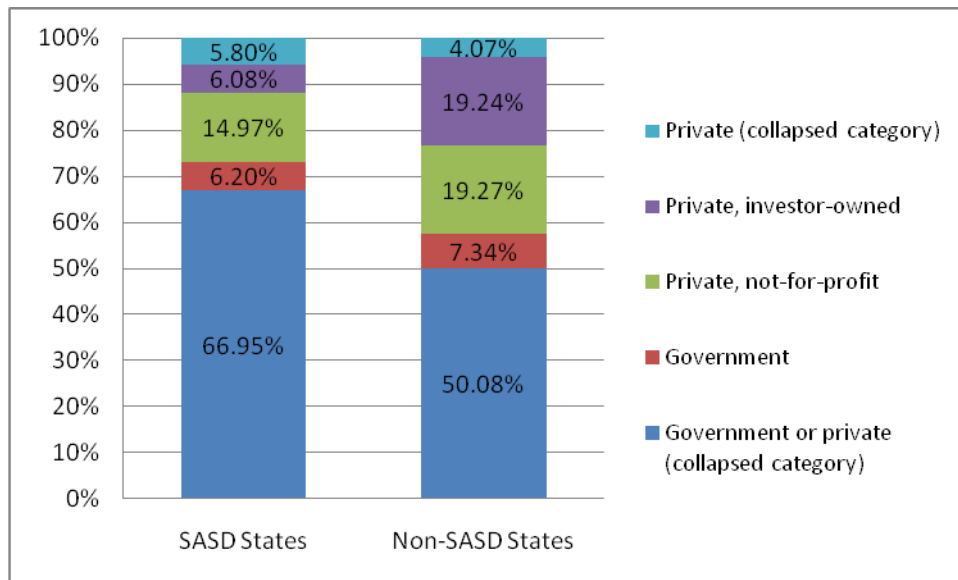


Figure 7 shows the distribution of AS visits by hospital control among SASD and non-SASD states. Data indicate that among SASD states, a majority of AS visits (67 percent) occurred at government or private hospitals. Similarly, a majority of AS visits occurred at government or private hospitals in non-SASD states, although that percentage was lower at 50 percent. Substantial differences were seen for AS visits among SASD and non-SASD states that occurred at private, not-for-profit hospitals (15 percent versus 19 percent) and private, investor-owned hospitals (6 percent versus 19 percent).

Figure 7: Share of Ambulatory Surgery Visits by Hospital Ownership Among SASD and Non-SASD States, 2009



6.4.3 Specialty

Consistent with the NEDS and proposed Nationwide Readmissions Database (NRD), the analysis undertaken in this study is limited to community, non-rehabilitation hospitals. However, this section of the report considers the potential impact of hospital specialization on the creation of a NASD.

Hospital specialty issues can take two forms:

- Specialty hospitals
- Within general medical and surgical hospitals, specialization in certain clinical areas (e.g., interventional cardiology)

Table 8 shows the number of hospitals nationwide by hospital specialty as identified in the AHA annual survey through the following question:

Figure 8: AHA annual survey question on hospital specialty

Indicate the ONE category that BEST describes your hospital or the type of service it provides to the MAJORITY of patients:

- | | |
|--|--|
| <input type="checkbox"/> 10 General medical and surgical | <input type="checkbox"/> 46 Rehabilitation |
| <input type="checkbox"/> 11 Hospital unit of an institution (prison hospital, college infirmary) | <input type="checkbox"/> 47 Orthopedic |
| <input type="checkbox"/> 12 Hospital unit within an institution for the mentally retarded | <input type="checkbox"/> 48 Chronic disease |
| <input type="checkbox"/> 13 Surgical | <input type="checkbox"/> 62 Institution for the mentally retarded |
| <input type="checkbox"/> 22 Psychiatric | <input type="checkbox"/> 80 Acute long-term care hospital |
| <input type="checkbox"/> 33 Tuberculosis and other respiratory diseases | <input type="checkbox"/> 82 Alcoholism and other chemical dependency |
| <input type="checkbox"/> 41 Cancer | <input type="checkbox"/> 49 Other-specify treatment area: _____ |
| <input type="checkbox"/> 42 Heart | _____ |
| <input type="checkbox"/> 44 Obstetrics and gynecology | |
| <input type="checkbox"/> 45 Eye, ear, nose, and throat | |

It also shows the number of outpatient surgeries, as reported to the AHA.

Table 8: Specialty Hospitals

All AHA hospitals in the 4 regions. OPSurgeries=sum(Number of surgical operations: outpatient) [Number of surgical operations: outpatient]	All Regions							
	AHA				SASD			
	N Hosp.		OPSurgeries		N Hosp.		OPSurgeries	
	N	%	N	%	N	%	N	%
10: General medical and surgical	4,837	77.16	19,481,698	94.40	2,844	96.21	13,487,188	96.33
11: Hospital unit of an institution	15	0.24	23,300	0.11	1	0.03	6,179	0.04
12: Unit of an institution for the mentally retarded	3	0.05	4,389	0.02	1	0.03	3,511	0.03
13: Surgical	36	0.57	103,906	0.50	8	0.27	34,241	0.24
22: Psychiatric	468	7.47	30,883	0.15	6	0.20	1,011	0.01
33: Tuberculosis and other respiratory diseases	2	0.03	0	0.00				
41: Cancer	10	0.16	34,944	0.17	7	0.24	21,206	0.15
42: Heart	13	0.21	23,068	0.11	5	0.17	16,016	0.11
44: Obstetrics and gynecology	12	0.19	46,390	0.22	5	0.17	15,818	0.11
45: Eye, ear, nose and throat	5	0.08	76,448	0.37	3	0.10	47,350	0.34
46: Rehabilitation	237	3.78	1,492	0.01	8	0.27	318	0.00
47: Orthopedic	20	0.32	71,859	0.35	11	0.37	39,927	0.29
48: Chronic disease	4	0.06	5,454	0.03	2	0.07	5,454	0.04
49: Other specialty	53	0.85	49,915	0.24	7	0.24	10,976	0.08
50: Children's general medical and surgical	60	0.96	487,073	2.36	33	1.12	290,844	2.08
52: Children's psychiatric	47	0.75	470	0.00				
56: Children's rehabilitation	10	0.16	2,971	0.01				
57: Children's orthopedic	15	0.24	11,189	0.05				
58: Children's chronic disease	1	0.02	0	0.00	1	0.03	0	0.00
59: Children's other specialty	12	0.19	9,325	0.05	3	0.10	3,414	0.02
62: Institution for the mentally retarded	8	0.13	0	0.00				
80: Acute long-term care	360	5.74	170,264	0.83	11	0.37	18,270	0.13
82: Alcoholism and other chemical dependency	38	0.61	1,444	0.01				
90: Children's acute long-term care	3	0.05	1,313	0.01				

Note: uses AHA variable Z210 – Hospital Type.

The same figures are provided for hospitals in the SASD. Note that the outpatient surgeries reported under the SASD section are based on outpatient surgeries reported by hospitals in the SASD to the AHA, not the number of surgeries identified in the SASD using HCUP criteria.

As indicated 77.16 percent of hospitals are “general medical and surgical” and they account for 94.40 percent of all outpatient surgeries nationwide. Children’s general medical and surgical hospitals also provide a relatively large number of ambulatory surgeries. Both are included in the definition of community, non-rehabilitation hospitals.

There are also a large number of psychiatric, rehabilitation and acute long-term care hospitals. None of these hospitals are included in the definition of community, non-rehabilitation hospitals.

However, there are a relatively small number of specialty hospitals that likely provide ambulatory surgeries of specific types in specific clinical areas. These include: surgical, cancer, heart, obstetrics and gynecology, eye/ear/nose/throat, orthopedic, children’s orthopedic and children’s other specialty. Together, they account for 11.82 percent of total ambulatory surgeries in the AHA universe and 1.26 percent of total ambulatory surgeries in the SASD data.

The relatively large number of specialty categories combined with the relatively small number of hospitals makes stratification by all hospital specialties impractical.

However, their inclusion in the sampling frame may make estimates produce by a NASD unstable for some types of procedures as the specialty hospitals may be included in the sample in some years and not others.

One appropriate specialty on which to stratify may be “children’s general medical and surgical”. As shown in Table 9, there are 60 of these hospitals in the AHA universe, of which 33 appear in the SASD data, capturing 59.7 percent (290,844/487,073) of total AHA volume. Appendix XX shows the number of hospitals by region in the AHA universe and the SASD. As indicate, there is strong regional representation in the Midwest and West, but relatively poor representation in the Northeast. Given the poor representation in the Northeast, children’s general medical and surgical hospitals were not evaluated as a potential stratification variable.

Table 9: Number of “Children’s General Medical and Surgical” Hospitals

Region	Number of AHA hospitals	Number of SASD hospitals
Northeast	6	1
Midwest	17	17
South	21	4
West	16	11
Total	60	33

Within the (non-pediatric) general medical and surgical categories, hospitals may have specialized and/or high volume practices in specific clinical areas (e.g., interventional cardiology). However, the AHA universe only provides total AS volume. Breakdowns by specific types of procedures or clinical areas are not provided. Therefore, a sample stratified by type of procedure or clinical area cannot be developed.

Therefore, it is assumed that the random sampling within strata would develop a sample that is representative of specialization within general medical and surgical hospitals. Note that this is approach is consistent with the sampling strategy for the NIS.

6.4.4 Urban-rural location

The urban-rural location of hospitals is determined by the county of the hospital. The categorization is a simplified adaptation of the 2003 version of the Urban Influence Codes (UIC) (United States Department of Agriculture Economic Research Service 2007). The 12 categories of the UIC are combined into four broader categories that differentiate between large and small metropolitan, micropolitan, and noncore residual counties:

- Large metropolitan area – areas with at least one million residents
- Small metropolitan area – areas with less than one million residents

- Micropolitan area – non-metropolitan area with at least 10,000 people or more
- Non-Urban

Figure 9 indicates that states contributing to SASD represent almost 62 percent of all hospitals in large metropolitan areas and almost 58 percent in micropolitan areas. SASD states make up slightly lower representation in small metropolitan and non-urban areas at 54 and 55 percent, respectively.

Figure 9: Share of Hospitals by Urban-Rural Location, 2009

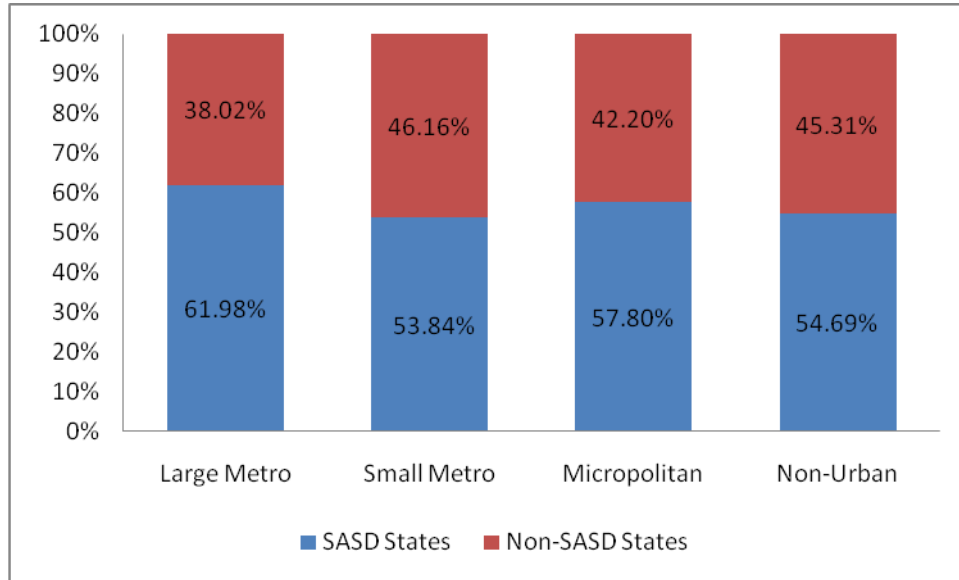
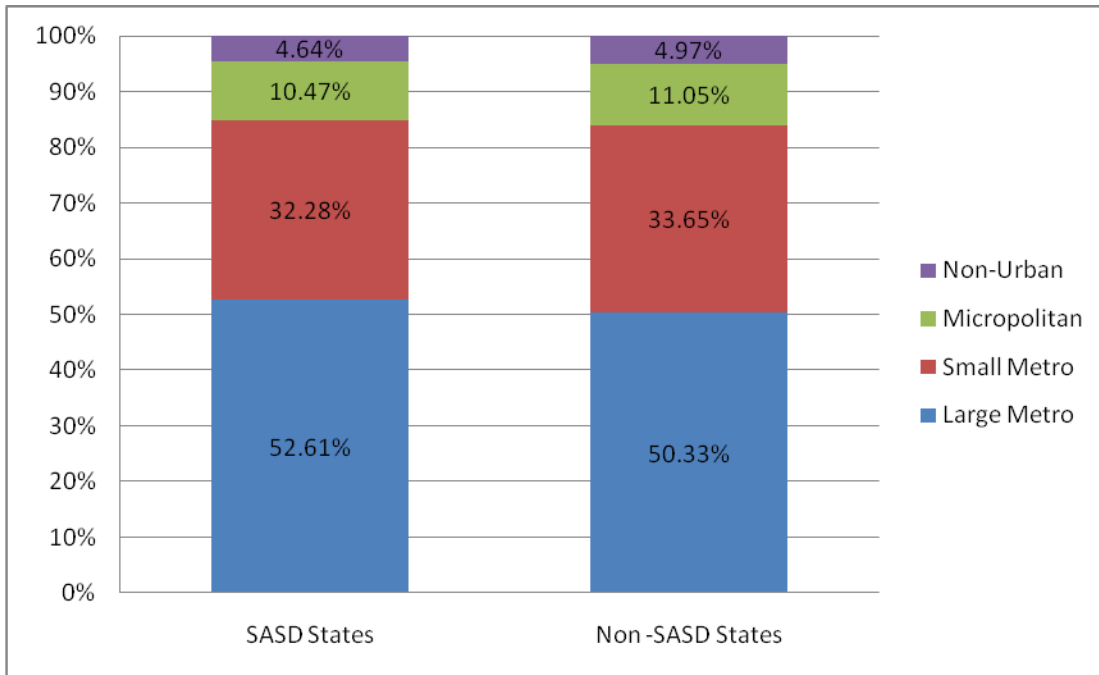


Figure 10 shows the distribution of AS visits by hospital locations among SASD and non-SASD states. Data indicate that among SASD states, almost 53 percent of all AS visits were in a large metropolitan area. Among non-SASD states, 50 percent of all AS visits were in a large metropolitan area. In contrast, only 5 percent of all AS visits were in a non-urban area among the SASD and non-SASD groups.

Figure 10: Share of Ambulatory Surgery Visits by Hospital Urban-Rural Location among SASD and Non-SASD States, 2009



6.4.5 Teaching status

In the HCUP databases, a hospital is considered to be a teaching hospital if the hospital had an American Medical Association (AMA) approved residency program, is a member of the Council of Teaching Hospitals (COTH), or has a ratio of full-time equivalent interns and residents to beds of 0.25 or higher according to the AHA Annual Survey Database.

Figure 11 indicates that SASD states represent a majority of teaching and non-teaching hospitals at 69 and nearly 55 percent, respectively.

Figure 11: Share of Hospitals by Teaching Status, 2009

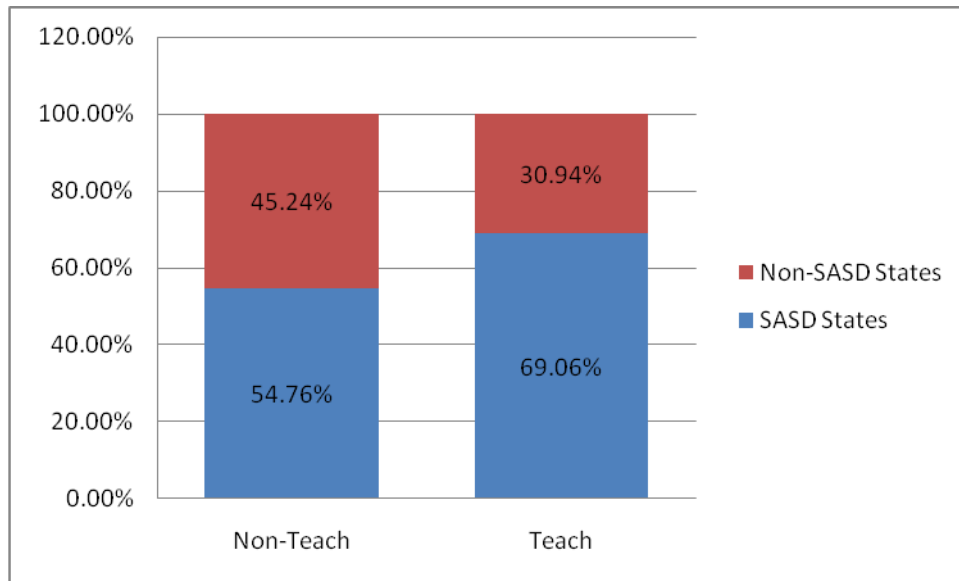
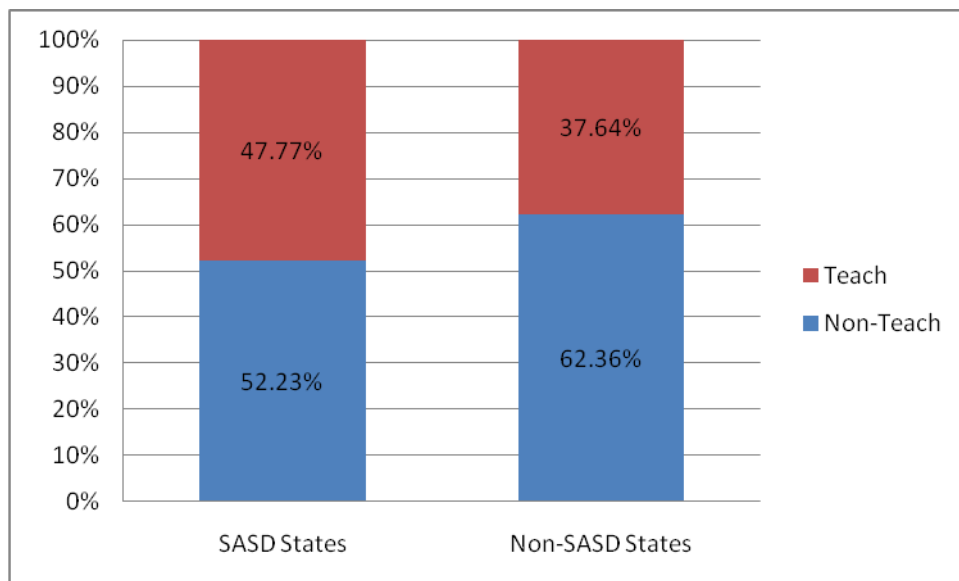


Figure 12 shows the distribution of AS visits by hospital teaching status. Close to 52 percent of all AS visits were at non-teaching hospitals among the SASD states, in contrast to over 62 percent for non-SASD states.

Figure 12: Share of Ambulatory Surgery Visits by Teaching Status among SASD and Non-SASD States, 2009



6.4.6 Bed Size

Bed size is defined as: small (less than 199 beds), medium (200-499 beds), and large (500 or more beds).

Figure 13 indicates that states that contribute to SASD represent almost 70 percent of all large hospitals, while SASD representation drops to almost 48 percent among small hospitals.

Figure 13: Share of Hospitals by Bed Size among SASD and Non-SASD States, 2009

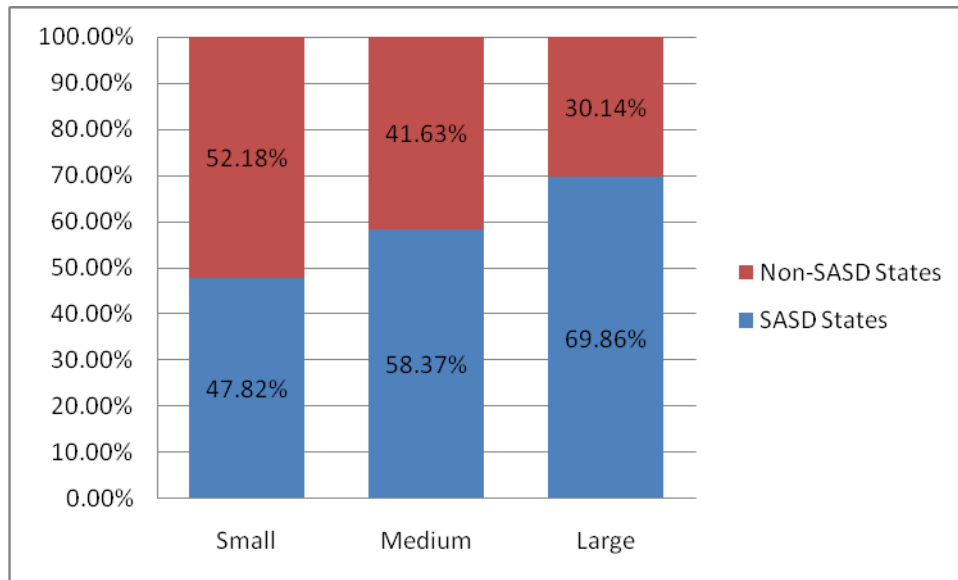
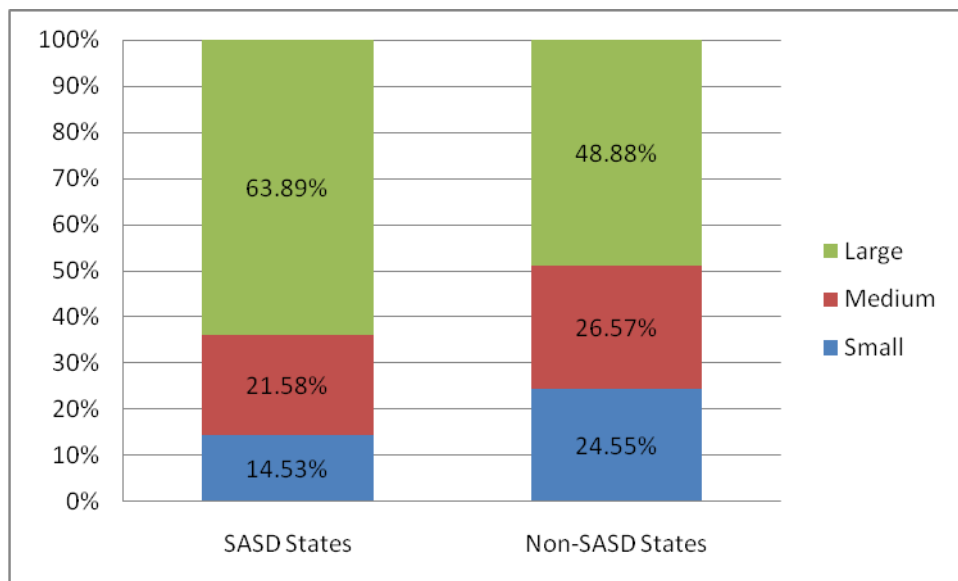


Figure 14 shows the distribution of AS visits by bed sizes. Among SASD states, a majority (64 percent) of all AS visits occurred at large hospitals, while only 15 percent occurred at small hospitals. On the other hand, only 49 percent of all AS visits occurred at large hospitals among non-SASD states. Among non-SASD states, a proportion of AS visits were evenly distributed among medium and small hospitals at 27 and 25 percent, respectively.

Figure 14: Share of Ambulatory Surgery Visits by Bed Size among SASD and Non-SASD States, 2009



Appendix H: Total Ambulatory Surgery Volume and Share by AHA and SASD Data Source, 2009 shows the total AS volume as per the AHA definition as well as the total AS volume as per the revised definition of AS. These include community, non-rehab hospitals in SASD that match to the AHA. Substantial differences are seen in total AS volume between stratifiers in both groups. Minor differences are seen in the proportion of AS volume between the AHA definition and the revised definition with the exception of larger differences seen for the Northeast (21.5 percent for the AHA definition compared to 14.1 percent for the revised definition) and the Midwest (34.2 percent for the AHA definition compared to 40.1 percent for the revised definition) in regional strata.

6.4.7 Summary of Findings with Respect to Representation Across Strata

Taken together, these analysis does not raise any concerns regarding the adequate representation of HCUP hospitals across these strata.

6.5 Analysis of Potential Stratification Variables

Several approaches were taken to conduct stratification analysis and finally select stratifiers for NASD sampling.

6.5.1 Identification of 30 Most Common Ambulatory Surgeries

The first step in conducting this analysis was to limit the 2009 SASD to top 30 types of ambulatory surgeries by CCS (Table 10). This became the subset from which analysis would be conducted. The revised definition of ambulatory surgery was used. That is, the total number of a specific ambulatory surgery (example, GI surgeries) divided by the total number of top 30 ambulatory surgeries. The next step was to look for hospital (facility) factors that explain variation in the proportion of a specific procedure across facilities.

Table 10 Top 30 Ambulatory Surgeries by CCS, 2009

CCS Procedures (all listed)	CCS Procedures Description	Frequency Count
76	Colonoscopy and biopsy	4,986,458
70	Upper gastrointestinal endoscopy; biopsy	3,063,374
15	Lens and cataract procedures	2,420,268
5	Insertion of catheter or spinal stimulator and injection into spinal canal	2,419,261
47	Diagnostic cardiac catheterization; coronary arteriography	2,063,804
160	Other therapeutic procedures on muscles and tendons	1,063,198
170	Excision of skin lesion	993,367
162	Other OR therapeutic procedures on joints	866,086
95	Other non-OR lower GI therapeutic procedures	853,726
169	Debridement of wound; infection or burn	745,128
54	Other vascular catheterization; not heart	728,935
33	Other OR therapeutic procedures on nose; mouth and pharynx	714,364
165	Breast biopsy and other diagnostic procedures on breast	670,331
151	Excision of semilunar cartilage of knee	624,105
23	Myringotomy	593,906
61	Other OR procedures on vessels other than head and neck	573,501
30	Tonsillectomy and/or adenoidectomy	555,527

CCS Procedures (all listed)	CCS Procedures Description	Frequency Count
84	Cholecystectomy and common duct exploration	546,502
175	Other OR therapeutic procedures on skin and breast	543,909
19	Other therapeutic procedures on eyelids; conjunctiva; cornea	463,232
9	Other OR therapeutic nervous system procedures	458,769
85	Inguinal and femoral hernia repair	449,533
130	Other diagnostic procedures; female organs	444,774
8	Other non-OR or closed therapeutic nervous system procedures	442,669
6	Decompression peripheral nerve	407,956
174	Other non-OR therapeutic procedures on skin and breast	403,183
125	Other excision of cervix and uterus	387,063
166	Lumpectomy; quadrantectomy of breast	381,322
154	Arthroplasty other than hip or knee	377,464
86	Other hernia repair	363,697

Note: Includes PRCCS and CPTCCS from states that submit ICD-9, CPT, or both.

6.5.2 Stepwise Logistic Regression Used to Select Stratification Variables

To investigate hospital (facility) factors that explain variation in the proportion of a specific procedure across facilities, the second step involved estimating regression models using possible facility level stratifiers (from AHA) including hospital bedsize (less than 100, 100-199, 200-499, and 500 or more), hospital location (private not for profit, government, and private for profit, government and private collapsed, and private collapsed categories), hospital region (Midwest, Northeast, South, and West), hospital location (large metropolitan, small metropolitan, micropolitan, and non-urban areas), and hospital teaching status (teaching and non-teaching). These stratifiers were nominated as they are likely to have an impact on AS outcomes. The dependent variable was proportion of ambulatory surgeries that are a specific CCS procedure (for example, proportion of ambulatory surgeries that are colonoscopy and biopsy [may need different e.g.]). Separate stepwise logistic models were conducted for each of the dependent variable.

The SAS procedure PROC LOGISTIC was used with STEPWISE selection method. A stepwise model finds the “best” first variable, and then selects the second, third, and so on from the remaining variables. In this case, “best” is defined as the model specification with the largest variance explained. There are advantages to using stepwise selection method. The stepwise technique decreases drastically the total number of models under consideration and to produce the final model. The final result depends substantially on the 2 parameters: SLENTY (the significance level for entering) and SLSTAY (the significance level for stay). In our selection, we proposed a conservative significance level of 10 percent.

30 stepwise logistic models were conducted to see if facility characteristics were of significance in predicting variation in the proportion of specific types of ambulatory surgeries across facilities (only one outcome is shown in Table 11; for complete results, see Appendix I: Logit estimates for all 30 outcomes). All facility level characteristics entered and stayed in the 30 models at a 10% significance level. The facility variable that entered first in the equation varied from model to model, although hospital region came into the equation before any other variables for majority of models (16 out of 30 models). In the colonoscopy and biopsy model (CCS 76), hospital region came into the equation before any other variables indicating hospital region as a strong predictor of that outcome. This is followed by hospital location, hospital teaching status, hospital bedsize, and hospital control.

Table 11. Logit Estimates for Colonoscopy and Biopsy (CCS 76) Outcome from Stepwise Logistic Regression with Selected Stratifiers, 2009

	Estimate	Std. Error	Pr>ChiSq
FACILITY CHARACTERISTICS			
Hospital Region			
South	Reference		
Northeast	0.157	0.0015	<.0001
Midwest	-0.004	0.0011	0.0002
West	0.177	0.0015	<.0001
Hospital Teaching Status			
Non-teaching	Reference		
Teaching	-0.138	0.0008	<.0001
Hospital Location			
Rural	Reference		
Urban	-0.172	0.0010	<.0001
Hospital Control			
Private, not for profit	Reference		
Government or private (collapsed)	0.078	0.0017	<.0001
Government	0.081	0.0019	<.0001
Private, investor owned	-0.217	0.0021	<.0001
Private (collapsed)	0.016	0.0023	<.0001
Hospital Bedsize			
Small	Reference		
Medium	0.020	0.0009	<.0001
Large	-0.146	0.0008	<.0001

In conclusion, all facility characteristics included in stepwise regression analysis were significant and could be nominated as stratifiers for NASD sampling. Some characteristics consistently appear to come into the equation before other characteristics such as hospital region, followed by teaching status, hospital bedsize, hospital control, and hospital location. Differences in facility characteristics indicate that several factors are at play including long standing practice patterns, availability of resources, and number of available hospital ambulatory surgery centers.

6.6 Selection of Stratification Variables and Identification of Full List of All Strata

Choosing strata which make the units homogeneous **within** and heterogeneous **between** is considered a “good” choice of strata. Stratification can often be very effective with just a few strata; more strata lead to diminishing returns with greater effort. Too many strata will usually require more effort to sample and lead to less heterogeneity between strata. Table 11 above shows substantial difference in AS volume between strata. Further analysis of a similar type using more outcomes of interest listed above would yield more information on the justification and use of stratifiers listed in Table 11.

7. FINAL SAMPLE DESIGN

Once the weighting and stratification have been determined, the final sample design can be developed. This includes sample size determination, identification of sample shortfalls and development of both facility and procedure weights, as described below.

7.1 Determination of Sample Size

Once the issues raised in the report have been addressed, the sample size will be determined. Assuming the hospital-based approach assessed in this report is followed and once the stratifiers have been finalized, the use of a 20 percent sample, consistent with NEDS, will be explored.

As part of the determination of the sample size, an assessment will be made of the size of the resulting NASD database, highlighting any impact the size may have on usability.

7.2 Evaluation of the Adequacy of the HCUP Data to Support the Desired Sample

A Table identifying all strata, the number of hospitals in the universe and the number of hospitals in the sampling frame will be developed. It will then be determined if there are enough hospitals in each strata to provide a 20 percent sample. Strata with shortfalls will be identified. As warranted, an approach to collapsing across strata during sampling will be identified to address any strata shortfalls.

7.3 Development of facility Weights as $N(\text{Universe})/N(\text{Sample})$ for each Stratum

To obtain nationwide estimates, hospital weights would be developed using the AHA universe.

Hospital-level weights would be calculated to extrapolate the NASD sample hospitals to the universe of AHA hospitals. Similarly, discharge-level (i.e., surgery level) weights would be developed to extrapolate the NASD sample of ambulatory surgeries to the AHA universe of ambulatory surgeries.

Hospitals would be stratified using the variables selected for sampling (e.g., geographic region, urban/rural etc.). Any strata collapsed for sampling would also be collapsed for sample weight calculations.

Within each stratum, s , each NASD hospital would receive a weight:

$$\text{HOSPWT} = W_s(\text{universe}) = N_s(\text{universe}) \div N_s(\text{sample})$$

Where $W_s(\text{universe})$ is the hospital universe weight, and $N_s(\text{universe})$ and $N_s(\text{sample})$ are the number of hospitals within stratum s in the universe and sample, respectively. Each hospital's universe weight (HOSPWT) would be equal to the number of universe hospitals it represents. If 20 percent is selected as the sample, the hospitals weights should be around 5.

8. LIMITATIONS OF A PILOT NASD

8.1 Hospital-based Ambulatory Surgeries

Provide estimates of the missing data as part of the NASD documentation to assist users whose research may be impacted by limitation to hospital-based AS.

8.2 ICD-9-CM and CPT Procedure Codes both Identify Ambulatory Surgery

A single AS record can have multiple ICD-9-CM and CPT procedure codes. The following describes the capture of codes related to ambulatory surgery. As indicated, ambulatory surgeries can be identified through either the ICD-9-CM procedure or CPT coding systems (as well as revenue codes and bill type). SASD records can contain either or both types of procedure codes. Further, each record can contain multiple procedure codes. It is important to note that, if any of the procedure codes (ICD-9-CM or CPT) meets the AS criteria above, the record is identified as an ambulatory surgery record. The other codes on the record may or may not meet the AS criteria. For example, a record for a laminectomy may also contain a related lab test. The procedure code for the laminectomy would meet the AS criteria and the record would be identified as an AS record. The record would contain the lab test code, which would not, by itself, meet the criteria for AS.

The occurrence of multiple procedure codes on the record impacts analyses that classify records, for example into CCS categories. Specifically, consideration should be given to implications of analyses that examine all-listed procedures. If all listed procedures are used, it is possible that the same record would fall into two or more CCS categories and be counted multiple times.

In addition, there are two types of records that contain CPT codes: the “core” files and the “charge detail” files. The core file supplies a fixed number of CPT code variables on a single record for each surgical visit. In contrast, the charge detail file may include a CPT code for each individual charge. A single surgical visit is represented by as many records as necessary to supply all of the charge information.

Finally, it should be noted that diagnosis codes are not part of the definition of ambulatory surgery. In general, diagnosis coding should be consistent with the surgery. ICD-9-CM coding guidelines indicate that, for ambulatory surgery records, the first-listed diagnosis should be “the reason for the surgery”. Analyses conducted for the HCPU Special Study, “The Meaning of the First-listed Diagnosis on Emergency Department and Ambulatory Surgery Records” indicated that the guidelines are likely being followed by most hospitals, although it is difficult to draw firm conclusions about the consistency of the coding with the guidelines.

The use of the two different systems, either at a hospital or State-level, can lead to differences in the identification of ambulatory surgeries. This, in turn, may have an impact on representativeness of the NASD. This section of the report discusses the potential implications of the availability of data using either or both of the procedure coding systems.

Note that analyses are based on those run for the SASD Comparison Report. However, these analyses were rerun using the revised definition of ambulatory surgery and limited to community, non-rehabilitation hospitals.

There are several factors to consider when comparing coding availability and its impact across States:

- The greater granularity of service identification afforded by the CPT coding system (which is comprised of 8,800 codes compared to 3,800 for ICD-9)
- The differential availability of data using both coding systems across States
- The different maximum number of each code that may be available by State in the SASD record

- The greater number for CPT codes populated on SASD records compared to ICD-9-CM codes

Table 12 shows the availability of the two different coding systems by State. As indicated, of 28 States, nine provide only CPT codes, six provide only ICD-9-CM codes and 13 provide both.

Table 12: HCUP State Partners' Use of CPT and ICD-9-CM

State	Data elements available on the SASD to apply HCUP criteria for identifying AS records	
	CPT codes	ICD-9-CM codes
California	Y	--
Colorado	Y	Y
Connecticut	--	Y
Florida	Y	Y
Georgia	Y*	Y
Hawaii	Y	Y
Illinois	Y	--
Indiana	--	Y
Iowa	Y*	--
Kansas	--	Y
Kentucky	Y*	Y
Maine	Y*	--
Maryland	Y*	--
Michigan	Y	Y
Minnesota	Y*	Y
Missouri	Y*	Y
Nebraska	Y*	--
New Hampshire	--	Y
New Jersey	Y*	Y
New York	Y*	--
North Carolina	Y	Y
Ohio	--	Y
Oklahoma	Y	--
South Carolina	--	Y
South Dakota	Y*	--
Tennessee	Y*	Y
Vermont	Y*	Y
Wisconsin	Y*	Y

"Y" indicates data element is available of the SASD; "--" indicates data element is not available.

* indicates the 14 state that provide line-item detail with revenue codes and associated charges.

Note also that, from the 2009 SASD Comparison Report analyses, for States that use both coding systems, the average number of ICD-9-CM codes is 1.9 compared to 4.1 CPT codes in the core file and 5.6 CPT codes in the charge detail file. Thus, there tend to be more CPT codes than ICD-9-CM codes, especially if the CPT codes are derived from the charge detail file.

Among States that employ both coding systems, Table 13 shows the percentage of records that have: 1) both CPT codes and ICD-9-CM codes, 2) only ICD-9-CM codes, and 3) only CPT codes. As indicated, even when a State employs both coding systems, not all records contain both codes. This may be due to differences in hospital-level coding practices. For example, in Minnesota, only 24.36 percent of ambulatory surgery records are coded with both ICD-9-CM

and CPT codes and 74.65 percent have only CPT codes. Whereas, in North Carolina, 100 percent of records have both ICD-9-CM and CPT codes.

Table 13: Share of Records from HCUP State Partners that use both CPT and ICD-9-CM

State	Number of Records	Percent with both coded	Percent ICD Only	Percent CPT Only	Neither
Colorado	369,220	71.17%	28.81%	0.02%	0.00%
Florida	3,030,334	67.10%	0.00%	32.90%	0.00%
Georgia	781,397	82.66%	12.45%	4.72%	0.17%
Hawaii	71,325	96.30%	3.52%	0.18%	0.00%
Kentucky	933,271	68.15%	31.75%	0.10%	0.00%
Michigan	1,522,128	92.77%	7.17%	0.06%	0.00%
Minnesota	845,683	24.36%	0.99%	74.65%	0.00%
Missouri	497,947	65.06%	9.48%	12.84%	12.62%
New Jersey	423,111	74.99%	0.24%	24.70%	0.08%
North Carolina	1,567,682	100.00%	0.00%	0.00%	0.00%
Tennessee	783,378	86.64%	11.63%	1.70%	0.02%
Utah	307,435	71.25%	8.57%	20.18%	0.00%
Vermont	92,815	95.53%	2.21%	2.22%	0.03%
Wisconsin	989,579	92.76%	6.60%	0.62%	0.02%

Finally, Table 14 shows the percentage of CCS categories that match between the two systems among surgical visits that code procedures using both coding systems (dual coding). When ICD-9-CM and CPT codes are both present on a surgical visit record, they often provide different information. For ICD-9-CM codes, the frequency with which the information provided in the two systems translates to the same set of CCS categories varies widely, ranging from 38.4 percent to 77.1 percent, depending on the State. For CPT codes, the range was 3.3 percent to 72.7 percent.

As an example, in Colorado 57.1 percent of the ICD-9-CM CCS categories had matching CPT CCS categories on dually coded records. Conversely, 39.5 percent of the CPT CCS categories had matching ICD-9-CM CCS categories on dually coded records in Colorado.

It should be noted that these statistics are based on all procedure codes available on the record. In Colorado, there are fewer CPT codes than ICD-9-CM codes in Colorado. Therefore, the denominator (number of CPT CCS categories) is smaller, causing a higher match rate for CPT CCS categories compared with ICD-9-CM CCS categories.

On the other hand, New Jersey collects dual-coded data from their hospitals and show similar match rates between the two systems. Other States mandate the submission of only CPT codes; consequently, there is often not a matching ICD-9-CM code for each CPT code.

Table 14: Percent of Records with Matching CCS Categories Among All Surgical Visit Records with Dual Coding, by State, 2009 SASD Ambulatory Surgeries

State	Percent of ICD-9-CM Codes CCS Matched	Percent of CPT Codes CCS Matched
Colorado	57.1%	39.5%
Florida	73.5%	34.1%
Georgia	47.4%	21.4%
Hawaii	71.9%	35.4%
Kentucky	65.1%	45.9%
Michigan	66.1%	46.0%
Minnesota	61.8%	9.7%
Missouri	38.4%	16.0%
Nebraska	69.4%	3.3%
New Jersey	77.1%	72.7%
North Carolina	60.3%	14.8%
Tennessee	38.7%	15.8%
Utah	72.1%	67.4%
Vermont	59.6%	30.6%
Wisconsin	57.0%	27.9%

The varying use and availability of ICD-9-CM and/or CPT procedure codes affect both the number and types of ambulatory surgeries that are identified in the SASD data. The hospital-level use of coding systems is not available in the AHA universe. Therefore, there is no

sampling method available to compensate for these differences. Furthermore, the use of the coding systems will likely change in the future, with CPT codes becoming increasingly available.

Therefore, it is suggested that the use/availability of ICD-9-CM and/or CPT codes not be considered in the creation of the NASD. However, the limitations this places on the potential usefulness of the NASD should be carefully considered in determining whether to proceed.

9. CONCLUSION AND RECOMMENDATIONS

In summary, the number of HCUP state Partners that submit ambulatory surgery data has grown sufficiently to suggest a potential nationwide data set. It may be feasible to select a sample of HCUP hospital-based ambulatory surgery facilities that is generalizable to the target universe –U.S. hospital-based ambulatory surgery facilities. The 29 HCUP Partner states with 2009 AS data (California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Utah, Vermont, and Wisconsin) provide a sufficient number of records to fulfill this purpose, encompassing 20 percent of all hospital-based AS visits. However, due to differences in the definition of ambulatory surgery used by HCUP and AHA, which defines the universe, it should be understood that a pilot NASD database sample would differ from the universe of all U.S. hospital-based ambulatory surgery facilities.

Alternatively, HCUP could construct a NASD without drawing a sample that would not be generalizable to the target universe –U.S. hospital-based ambulatory surgery facilities. For instance, SASD data could be aggregated into an AS database that would include a census of records available in participating states and would therefore describe experience in those states.

APPENDICES

APPENDIX A: PILOT NASD DATABASE DOCUMENTATION

State	Data Source
California	Office of Statewide Health Planning and Development
Colorado	Colorado Hospital Association
Connecticut	Connecticut Hospital Association
Florida	Florida Agency for Health Care Administration
Georgia	Georgia Hospital Association
Hawaii	Hawaii Health Information Corporation
Illinois	Illinois Department of Public Health
Indiana	Indiana Hospital Association
Iowa	Iowa Hospital Association
Kansas	Kansas Hospital Association
Kentucky	Kentucky Cabinet for Health and Family Services
Maine	Maine Health Data Organization
Maryland	Health Services Cost Review Commission
Michigan	Michigan Health & Hospital Association
Minnesota	Minnesota Hospital Association
Missouri	Hospital Industry Data Institute
Nebraska	Nebraska Hospital Association
New Hampshire	New Hampshire Department of Health & Human Services
New Jersey	New Jersey Department of Health and Senior Services
New York	New York State Department of Health
North Carolina	North Carolina Department of Health and Human Services
Ohio	Ohio Hospital Association
Oklahoma	Oklahoma State Department of Health
South Carolina	South Carolina State Budget & Control Board
South Dakota	South Dakota Association of Healthcare Organizations
Tennessee	Tennessee Hospital Association
Vermont	Vermont Association of Hospitals and Health Systems
Wisconsin	Wisconsin Department of Health Services

APPENDIX B: STATES WITH NON-HOSPITAL-BASED DATA

State	Hospital-Based	Non-Hospital-Based
Northeast		
New York	Yes	Yes
Connecticut	Yes	No
New Hampshire	Yes	No
New Jersey	Yes	No
Maine	Yes	No
Vermont	Yes	No
Pennsylvania	No	No
Rhode Island	No	No
South		
Florida	Yes	Yes
Kentucky*	Yes	Yes
North Carolina	Yes	Yes
Oklahoma	Yes	Yes
South Carolina	Yes	Yes
Georgia	Yes	No
Maryland	Yes	No
Tennessee	Yes	No
Texas	No	No
Louisiana	No	No
Arkansas	No	No
West Virginia	No	No
Virginia	No	No

*only 1 percent of all SASD records are freestanding

Midwest		
Michigan	Yes	Yes
Missouri	Yes	Yes
Wisconsin	Yes	Yes
Illinois	Yes	Yes
Indiana	Yes	No
Iowa	Yes	No
Kansas	Yes	No
Minnesota	Yes	No
Nebraska	Yes	No
Ohio	Yes	No
South Dakota	Yes	No
North Dakota	No	No

West

Utah	Yes	Yes
California**	Yes	No
Colorado	Yes	No
Hawaii	Yes	No
Arizona	No	No
Washington	No	No
Oregon	No	No
Nevada	No	No
Montna	No	No
Wyoming	No	No
New Mexico	No	No

APPENDIX C: STATES THAT PROVIDE COMBINED SASD AND SEDD FILES

States	Availability of Intramural SASD (Years)	Availability of Intramural SEDD (Years)	Separate AS and ED files? (Yes - AS separated from ED, No - AS and ED are combined)
Arizona		2005-2009	Yes (ED only)
California	2005-2009	2005-2009	Yes
Colorado	1988-2009		Yes (AS only)
Connecticut	1993-2009	1996-2009	Yes
Florida	1997-2009	2005-2009	Yes
Georgia	2002-2009	2002-2009	Yes
Hawaii	2007-2009	2003-2009	Yes
Illinois	2009	2009	No
Indiana	2003-2009	2003-2009	Yes
Iowa	1996, 2004-2009	2004-2009	No
Kansas	2005-2009	2005-2009	No
Kentucky	2000-2009	2008-2009	No
Maine	1999-2003, 2006-2009	1999-2003, 2006-2009	No
Maryland	1990-2009	1999-2009	No
Massachusetts		2002-2009	Yes (ED only)
Michigan	2004-2009		Yes (AS only)
Minnesota	2001-2009	2001-2009	No
Missouri	1999-2009	1999-2009	No
Nebraska	2001-2009	2001-2009	No
New Hampshire	2003-2009	2003-2009	No
New Jersey	1988-2009	2004-2009	Yes
New York	1988-2009	2005-2009	Yes
North Carolina	2000-2009	2007-2009	Yes
Ohio	2005-2009	2005-2009	No
Oklahoma	2006-2009		Yes (AS only)
Rhode Island		2006-2009	Yes (ED only)
South Carolina	1996-2009	1999-2009	Yes
South Dakota	2005-2009	2005-2009	No
Tennessee	1999-2009	2000-2009	No
Utah	1997-2008	2000-2009	Yes
Vermont	2001-2009	2002-2009	No
Wisconsin	1994-2009	2004-2009	No

APPENDIX D: AS DEFINITION INCLUDED AND EXCLUDED CPT CODES

CPT Codes Excluded from AS Definition	
Excluded CPT codes	Descriptions
G0105	Colorectal cancer screening; colonoscopy on individual at high risk
G0121	Colorectal cancer screening; colonoscopy on individual not meeting criteria for
G0260	Injection procedure for sacroiliac joint; provision of anesthetic, steroid and/or other therapeutic agent, with or without arthrography
10021-69990: Codes for Surgery	
10021-10022	General
10040-19499	Integumentary system
20000-29999	Musculoskeletal system
30000-32999	Respiratory system
33010-37799	Cardiovascular system
38100-38999	Hemic & lymphatic systems
39000-39599	Mediastinum & diaphragm
40490-49999	Digestive system
50010-53899	Urinary system
54000-55899	Male genital system
55920-55980	Reproductive system & intersex
56405-58999	Female genital system
59000-59899	Maternity care & delivery
60000-60699	Endocrine system
61000-64999	Nervous system
65091-68899	Eye & ocular adnexa
69000-69930	Auditory system

Included CPT codes within the range of 10021-69930	
CPT codes	Descriptions
20979	Us bone stimulation
29550	Strapping of toes
29580	Application of paste boot
29581	Application of multi-layer extremity compression bandage
36415	Routine venipuncture
36416	Capillary blood draw
36511	Apheresis wbc
36512	Apheresis rbc
36513	Apheresis platelets

36514	Apheresis plasma
36515	Apheresis, adsorp/reinfuse
36516	Apheresis, selective
38204	BI donor search management
38207	Cryopreserve stem cells
38211	Tumor cell deplete of harvest
38212	Rbc depletion of harvest
38213	Platelet deplete of harvest
38214	Volume deplete of harvest
38215	Harvest stem cell concentrate
50300	Remove cadaver donor kidney
50320	Remove kidney, living donor
50547	Laparo removal donor kidney
55859	
62252	Csf shunt reprogram

APPENDIX E: EXCLUDED CCS SERVICES AND PROCEDURE CODES

CPTCCS codes	Labels
2	Insertion; replacement; or removal of extracranial ventricular shunt
4	Diagnostic spinal tap
27	Control of epistaxis
34	Tracheostomy; temporary and permanent
36	Lobectomy or pneumonectomy
43	Heart valve procedures
44	Coronary artery bypass graft (CABG)
50	Extracorporeal circulation auxiliary to open heart procedures
51	Endarterectomy; vessel of head and neck
52	Aortic resection; replacement or anastomosis
56	Other vascular bypass and shunt; not heart
58	Hemodialysis
64	Bone marrow transplant
66	Procedures on spleen
72	Colostomy; temporary and permanent
73	Ileostomy and other enterostomy
74	Gastrectomy; partial and total
75	Small bowel resection
78	Colorectal resection
79	Local excision of large intestine lesion (not endoscopic)
91	Peritoneal dialysis
104	Nephrectomy; partial or complete
105	Kidney transplant
107	Extracorporeal lithotripsy; urinary
108	Indwelling catheter
126	Abortion (termination of pregnancy)
133	Episiotomy
134	Cesarean section
135	Forceps; vacuum; and breech delivery
136	Artificial rupture of membranes to assist delivery
137	Other procedures to assist delivery
138	Diagnostic amniocentesis
139	Fetal monitoring
140	Repair of current obstetric laceration
153	Hip replacement; total and partial
156	Injections and aspirations of muscles; tendons; bursa; joints and soft tissue
171	Suture of skin and subcutaneous tissue
176	Other organ transplantation

177	Computerized axial tomography (CT) scan head
178	CT scan chest
179	CT scan abdomen
180	Other CT scan
181	Myelogram
182	Mammography
183	Routine chest X-ray
184	Intraoperative cholangiogram
185	Upper gastrointestinal X-ray
186	Lower gastrointestinal X-ray
187	Intravenous pyelogram
188	Cerebral arteriogram
189	Contrast aortogram
190	Contrast arteriogram of femoral and lower extremity arteries
191	Arterio- or venogram (not heart and head)
192	Diagnostic ultrasound of head and neck
193	Diagnostic ultrasound of heart (echocardiogram)
194	Diagnostic ultrasound of gastrointestinal tract
195	Diagnostic ultrasound of urinary tract
196	Diagnostic ultrasound of abdomen or retroperitoneum
197	Other diagnostic ultrasound
198	Magnetic resonance imaging
199	Electroencephalogram (EEG)
200	Nonoperative urinary system measurements
201	Cardiac stress tests
202	Electrocardiogram
203	Electrographic cardiac monitoring
204	Swan-Ganz catheterization for monitoring
205	Arterial blood gases
206	Microscopic examination (bacterial smear; culture; toxicology)
207	Radioisotope bone scan
208	Radioisotope pulmonary scan
209	Radioisotope scan and function studies
210	Other radioisotope scan
212	Diagnostic physical therapy
213	Physical therapy exercises; manipulation; and other procedures
214	Traction; splints; and other wound care
215	Other physical therapy and rehabilitation
216	Respiratory intubation and mechanical ventilation
217	Other respiratory therapy
218	Psychological and psychiatric evaluation and therapy

219	Alcohol and drug rehabilitation/detoxification
221	Nasogastric tube
222	Blood transfusion
223	Enteral and parenteral nutrition
224	Cancer chemotherapy
226	Other diagnostic radiology and related techniques
227	Other diagnostic procedures (interview; evaluation; consultation)
228	Prophylactic vaccinations and inoculations
229	Nonoperative removal of foreign body
230	Extracorporeal shock wave lithotripsy; other than urinary
231	Other therapeutic procedures
232	Anesthesia
233	Laboratory - Chemistry and hematology
234	Pathology
235	Other laboratory
236	Home health services
237	Ancillary services
238	Infertility Services
239	Transportation - patient, provider, equipment
240	Medications (Injections, infusions and other forms)
241	Visual aids and other optical supplies
242	Hearing devices and audiology supplies
243	DME and supplies

Appendix F: Reviewed Data Sources

SDI Freestanding Outpatient Surgery Center (FOSC) Database	<p>The SDI group (www.sdihealth.com) profiles freestanding ambulatory surgery centers on an annual basis in their Freestanding Outpatient Surgery Center (FOSC) database. The SDI facility profile product encompasses two databases that can be used to categorize and identify freestanding outpatient surgery centers: 1) the FOSC file, which contains current and historical operational statistics, and 2) the Healthcare Market Index (HMI) file, which contains demographic information.</p>
American Hospital Association (AHA) Annual Survey	<p>The AHA Annual Survey Database (www.ahadata.com/ahadata/html/AHASurvey.html) identifies hospital-associated ambulatory surgery facilities. These survey-based data include hospital descriptors and counts of outpatient surgeries from nearly all hospital-affiliated facilities nationwide. Annual updates are generally available toward the end of the year following the survey. AHA data do not include facilities such as freestanding outpatient surgical facilities lacking hospital affiliations and facilities originating from other sites such as physician offices.</p>
Centers for Medicare & Medicaid Services (CMS) Provider of Service (POS) Extract	<p>The Centers for Medicare & Medicaid Services (CMS) defines an ambulatory surgery center (ASC) for Medicare purposes as “a distinct entity that operates exclusively for the purpose of furnishing outpatient surgical services to patients. The Provider of Services (POS) Extract (www.cms.gov/NonIdentifiableDataFiles/04_ProviderofServicesFile.asp) is created from the Online Survey and Certification Reporting System (OSCAR) database. The file contains an individual record for each Medicare-approved provider and is updated quarterly. The POS files also include data elements for ambulatory surgery centers.</p>
National Center for Health Statistics (NCHS) National Survey of Ambulatory Surgery (NSAS)	<p>The National Survey of Ambulatory Surgery (NSAS; www.cdc.gov/nchs/nsas.htm) is a survey of ambulatory surgery cases from a nationally representative sample of hospital-based and freestanding ambulatory surgery centers. The NSAS was conducted by the National Center for Health Statistics (NCHS) in 1994, 1995, and 1996; however, it was discontinued due to lack of resources in subsequent years. In 2006, the NSAS was conducted again and included additional questions about patient symptoms during and after surgery, and patient follow-up within 24 hours after leaving the ambulatory surgery facility. The 2006 NSAS also asked additional questions about the facilities. No information about the NSAS beyond the 2006 file.</p>
NCHS National Hospital Ambulatory Medical Care Survey (NHAMCS)	<p>The National Hospital Ambulatory Medical Care Survey (NHAMCS; www.cdc.gov/nchs/ahcd.htm) collects national data on the utilization of ambulatory care services in hospital emergency and outpatient departments. In an effort to fill the gap left by the discontinuation of the NSAS, the 2009 NHAMCS includes hospital-based ambulatory surgery centers, and freestanding ASC's were added to the NHAMCS in 2010. In the future, it is also anticipated that additional facility data will be available. However, currently available data is limited to hospital emergency and outpatient departments.</p>
NCHS National Ambulatory Medical Care	<p>The National Ambulatory Medical Care Survey (NAMCS; www.cdc.gov/nchs/ahcd.htm) collects national data on visits to non-federal office-based physicians. Each physician is randomly assigned to a 1-week</p>

Survey (NAMCS)	reporting period during which data for a systematic random sample of visits are recorded by the physician or office staff on an encounter form provided for that purpose. Data are obtained on patients' symptoms, physicians' diagnoses, and medications ordered or provided. The survey also provides statistics on the demographic characteristics of patients and services provided, including information on diagnostic procedures, patient management, and planned future treatment. While information is collected about "other surgical procedures" at this visit, the NAMCS "Patient Record Form" does not differentiate between ordering or performing surgical procedures.
American Association for Accreditation of Ambulatory Surgical Facilities, Inc. (AAAASF)	With more than 1100 accredited outpatient surgical facilities in 2011, AAAASF (www.aaaasf.org) is the largest accrediting organization of its kind in United States. However, the vast majority of ambulatory surgery facilities are not accredited, operating independently of any peer review and inspection process. AAAASF's Internet-based Quality Assurance and Peer Review Reporting System collect data on outcomes for all surgery centers it accredits. Reporting is mandatory for all surgeons operating in AAAASF-accredited facilities. Each surgeon must report all unanticipated sequela and at least six random cases reviewed by an accepted peer review group biannually. Presently, the AAAASF has data on about 3.5 million cases. However, this data is not yet available to outside researchers and is based only on accredited facilities.
Ambulatory Surgery Center (ASC) Association	The ASC Association (www.ascassociation.org/) is the largest national association of single- and multi-specialty ambulatory surgery centers (ASCs) and the health care professionals who deliver services in such ASCs. The ASC Association's Outcomes Monitoring Project incorporates a national survey of outcomes measures in ASCs, including clinical outcomes, staff indicators, and billing performance. It is the largest, most diverse resource of its kind. More than 650 ASCs participate in this quarterly project, which includes the five ASC quality measures developed by the ASC Quality Collaboration and approved by the National Quality Forum.
Accreditation Association for Ambulatory Health Care (AAHC)	The AAHC (www.aaahc.org/eweb/StartPage.aspx) is a private, non-profit organization formed in 1979. It develops standards to advance and promote patient safety, quality and value for ambulatory health care through peer-based accreditation processes, education and research. Accreditation is awarded to organizations that are found to be in compliance with AAHC standards. The Accreditation Association currently accredits over 4,600 organizations in a wide variety of ambulatory health care settings, including ambulatory and surgery centers, managed care organizations, as well as Indian and student health centers, among others.
Medicare Files	Medicare files include "Medicare Standardized Analytic File (SAF) – Outpatient" and "Carrier Claim File (previously called the Physician/Supplier Part B)-Ambulatory Surgical Center (ASC) Payment System". SAF contains information collected by Medicare to pay for health care services provided to a Medicare beneficiary. SAFs are available for each institutional (inpatient, outpatient, skilled nursing facility, hospice, or home health agency) and non-institutional (physician and durable medical equipment providers) claim type. The record unit of SAFs is the claim (some episodes of care may have more than one claim). The outpatient data is available as

	5% and 100% files and contains data on ambulatory surgeries occurring in hospital-based outpatient departments. The Carrier File is created mainly based on physician/supplier (Part B) bills. Freestanding ambulatory surgical center claims are included in this file.
Medicaid Files	CMS State Medicaid Research Files (SMRF) and the Medicaid Analytic Extract files (MAX which replace SMRF for 1999 data forward) are considered research identifiable files (www.cms.gov/MedicaidDataSourcesGenInfo/07_MAXGeneralInformation.asp). Person-level identifiable information is included in these Medicaid enrollment and utilization files. The MAX files include one file with enrollment information (Personal Summary File) and four claim files (Inpatient, Other Therapy, Long Term Care, Prescription Drug) for each year of data. The claims represent final action claims. The Other Therapy File contains claim records for all non-institutional Medicaid services, including physician services, lab/X-ray, clinic services and premium payments. As appropriate the claims include diagnosis, procedure and date of service.
MarketScan Research Data	The MarketScan (http://marketscan.thomsonreuters.com/marketscanportal) includes several claims databases that offer the largest convenience sample available in proprietary databases with over 107 million unique patients since 1996. Its sample size is large enough to allow creation of a nationally representative data sample of Americans with employer-provided health insurance and Medicaid. MarketScan claims databases capture the full continuum of care in all settings, including: physician office visits; hospital stays; retail, mail order, and specialty pharmacies; and carve-out care. MarketScan data can be used to examine volume of claims and procedure breakdown in ambulatory surgery centers and physician's offices.
TRICARE Encounter Data (TEDS)	America's Military Health System (MHS) is a unique partnership of medical educators, medical researchers, and healthcare providers and their support personnel worldwide (www.health.mil). TRICARE is the family of health plans for the MHS. Three types of data files are created based on all health care contacts; TED-I contains claims for institutions, TED-NI contains all other claims and TED-PR contains records of providers. TED-I and TED-NI includes information about place of services that include ambulatory surgery centers.
HCUP State Partner Organizations	The selected HCUP State Partners (CA, FL and NY) use the license status/certification status of facilities to define ambulatory surgery centers. Information included in SASD varies depending on the states; for example, CPT codes are the only procedure codes included in CA and NY SASD, while FL SASD includes both CPT and ICD-9-CM procedure codes. NY and FL SASD include information about both hospital-based and freestanding ambulatory surgery centers. The number of freestanding ambulatory surgery centers included in CA SASD decreased after 2007.

APPENDIX G: EVALUATION OF AS UNIVERSE DATA SOURCES

The AS Evaluation Study indicated that the universe of ambulatory surgeries carried out in freestanding ambulatory surgery centers, at this point, cannot be reliably identified. The most promising data sources were the FOSC database and the CMS POS extract. However, attempts to link facilities across these databases were unsuccessful and neither is thought to accurately and completely identify either free standing ambulatory surgery centers or ambulatory surgery volume.

Subsequent to the AS Evaluation Study, at AHRQ's request, TR reviewed the websites of the following organizations to determine if they might have complete surgery registry data on specific type of surgeries. These organizations were identified as supporters of the National Survey of Ambulatory Surgery (NASD) on its website:

- American College of Surgeons
- American Health Information Management Association
- American Academy of Ophthalmology
- Federated Ambulatory Surgery Association
- Society for Ambulatory Anesthesia

The search indicated that none of the organizations provide either facility information or the total volume of specific surgeries and, therefore, did not have adequate information to define the universe of specific facilities/surgeries for sampling purposes. However, some provide definitions of specific surgeries that may be useful in the further refinement of the ambulatory surgery definition.

Hospital-based ASCs were added to the scope of the NHAMCS beginning in 2009, and freestanding ASCs will be added in 2010.

The universe of hospital-based facilities is available from the American Hospital Association (AHA) Annual Survey of Hospitals. AHA data do not include facilities such as freestanding outpatient surgical facilities lacking hospital affiliations and facilities originating from other sites such as physician offices. The AHA Annual Survey database contains only summarized, facility-level data and does not contain visit-level data. This data source has been used for the creation of the Nationwide Inpatient Sample (NIS) and the Nationwide Emergency Department Sample (NEDS).

APPENDIX H: TOTAL AMBULATORY SURGERY VOLUME AND SHARE BY AHA AND SASD DATA SOURCE, 2009

Hospital Characteristics	AHA±		SASD§	
	Total AS Volume	%	Total AS Volume	%
Region (HOSP_REGION)				
Northeast	2,953,375	21.5%	2,706,977	14.1%
West	1,610,621	11.7%	2,080,882	10.9%
South	4,455,091	32.5%	6,670,709	34.8%
Midwest	4,698,133	34.2%	7,683,888	40.1%
Urban/Rural Designation				
Large metropolitan county	7,217,294	52.6%	9,349,323	48.8%
Small metropolitan county	4,427,666	32.3%	6,764,605	35.3%
Micropolitan	1,436,404	10.5%	2,143,229	11.2%
Non-Urban	635,856	4.6%	885,299	4.6%
Teaching Status				
Teaching	6,552,066	47.8%	8,756,964	45.7%
Non-Teaching	7,165,154	52.2%	10,385,492	54.3%
Bed Size				
Small	1,992,810	14.5%	2,971,577	15.5%
Medium	2,960,811	21.6%	4,515,450	23.6%
Large	8,763,599	63.9%	11,655,429	60.9%
Hospital Control (HOSP_CONTROL)				
Government or private (collapsed category)	9,183,514	66.9%	12,333,032	64.4%
Government	850,899	6.2%	1,199,572	6.3%
Private, not-for-profit	2,053,373	15.0%	3,297,495	17.2%
Private, investor-owned	834,278	6.1%	1,163,118	6.1%
Private (collapsed category)	795,156	5.8%	1,149,239	6.0%
±community, non-rehab hospitals in SASD states that match to the AHA – the number of outpatient surgeries per the AHA; §community, non-rehab hospitals in SASD states that match to the AHA – the number of outpatient surgeries from SASD per the revised definition of AS				

APPENDIX I: LOGIT ESTIMATES FOR ALL 30 OUTCOMES

OUTCOME	Intercept	BEDSIZE		HOSPITAL CONTROL			HOSPITAL LOCATION	HOSPITAL TEACHING STATUS	HOSPITAL REGION			
		Medium	Large	Government or Private (Collapsed)	Government	Private, investor owned	Private (collapsed)	Urban	Teaching	Northeast	Midwest	West
Colonoscopy and biopsy	-1.55668	0.02046	-	0.07818	0.08116	-	0.01646	-0.17207	-0.1387	0.15741	-0.00414	0.17726
Upper gastrointestinal endoscopy; biopsy	-2.1305	0.01158	-	0.07181	0.07665	-	-0.03254	-0.10328	-0.02948	0.03608	-0.06997	0.11601
Lens and cataract procedures	-2.58162	0.01775	-	0.34365	0.12548	-	0.13816	-0.30869	-0.16242	-0.17684	-0.1571	0.33017
Insertion of catheter or spinal stimulator and injection into spinal canal	-2.65833	0.09166	-	-0.09144	-0.18681	-	-0.05114	0.08845	-0.13093	0.08152	0.16777	-0.181
Diagnostic cardiac catheterization; coronary arteriography	-3.1526	0.0477	-	-0.38579	-0.19254	-	0.15043	0.39236	0.32684	-0.13507	0.32917	-
Other therapeutic procedures on muscles and tendons	-3.25604	0.00459	-	0.02451	0.09393	-	0.07761	0.08036	-0.04602	-0.00166	-0.06908	0.23288
Excision of skin lesion	-3.26685	0.03302	-	0.20902	0.01609	-	-0.5909	-0.24216	0.17819	0.19678	0.24016	0.22478
Other OR therapeutic procedures on joints	-3.57038	0.05941	-	-0.01956	0.01275	-	0.25191	0.17391	-0.06385	0.1179	-0.0653	0.23738
Other non-OR lower GI therapeutic procedures	-3.55256	0.05866	-	0.09966	-0.01407	-	0.03238	-0.16764	-0.16975	0.05222	0.336	-
Debridement of wound; infection or burn	-4.15425	0.1609	-	-0.3117	0.11647	-	-0.73822	0.2126	-0.07941	-0.82942	0.61713	-0.5577
Other vascular catheterization; not heart	-3.7036	0.07408	-	-0.09772	0.04633	-	-0.17484	0.12078	0.23276	-0.09186	-0.04644	-

OUTCOME	Intercept	BEDSIZE		HOSPITAL CONTROL			HOSPITAL LOCATION	HOSPITAL TEACHING STATUS	HOSPITAL REGION			
		Medium	Large	Government or Private (Collapsed)	Government	Private, investor owned	Private (collapsed)	Urban	Teaching	Northeast	Midwest	West
Other OR therapeutic procedures on nose; mouth and pharynx	-3.72768	0.03525	0.06138	-0.05191	-0.01097	0.01571	0.09647	0.18615	0.07416	0.04062	-0.20026	0.35209
Breast biopsy and other diagnostic procedures on breast	-3.85826	0.123	0.18747	-0.10478	-0.09014	0.11417	-0.04542	0.24209	0.07548	0.05896	0.05347	-
Excision of semilunar cartilage of knee	-3.75151	0.02826	0.14088	-0.04293	0.06033	0.16671	0.19813	0.06775	-0.12176	0.23464	-0.18574	0.2361
Myringotomy	-3.78859	0.03506	0.17302	0.07982	0.05514	0.13967	0.03375	-0.11442	0.16892	-0.17536	0.05752	0.02223
Other OR procedures on vessels other than head and neck	-4.25483	0.11354	0.35291	-0.18839	-0.21551	0.22179	0.13472	0.37658	0.2002	-0.12353	0.2833	0.41642
Tonsillectomy and/or adenoidectomy	-3.74948	0.02469	0.15953	0.01518	0.02081	0.09516	0.05383	-0.10272	0.14842	-0.10435	-0.0807	0.18769
Cholecystectomy and common duct exploration	-3.6759	0.08009	0.07299	-0.07294	0.08067	0.00141	-0.10411	-0.16346	-0.11253	-0.25593	-0.03428	0.22329
Other OR therapeutic procedures on skin and breast	-4.34429	0.11462	0.15127	-0.07289	-0.05727	0.08028	0.13426	0.48094	0.13776	-0.02079	-0.13127	0.16545
Other therapeutic procedures on eyelids; conjunctiva; cornea	-4.52996	0.12617	0.0263	0.22104	0.03119	0.03318	-0.02443	0.15308	0.17472	-0.29581	-0.13736	0.53775
Other OR therapeutic nervous system procedures	-4.35027	0.06476	0.03175	-0.16851	0.02188	0.38241	-0.22044	0.11443	0.16384	-0.11382	0.14601	-0.027
Inguinal and femoral hernia repair	-3.89049	0.03575	-0.0248	-0.06222	0.08577	0.06549	0.07226	0.05396	0.00573	0.20423	-0.25369	0.28041

OUTCOME	Intercept	BEDSIZE		HOSPITAL CONTROL			HOSPITAL LOCATION	HOSPITAL TEACHING STATUS	HOSPITAL REGION			
		Medium	Large	Government or Private (Collapsed)	Government	Private, investor owned	Private (collapsed)	Urban	Teaching	Northeast	Midwest	West
Other diagnostic procedures; female organs	-4.31459	0.03848	0.16623	0.07339	0.1121	-	-0.17325	0.15422	0.12553	0.23418	0.02061	-
Other non-OR or closed therapeutic nervous system procedures	-4.48117	0.00364	0.06245	-0.01194	-0.08295	0.02111	-0.15277	-0.03363	0.06547	-0.40678	0.45917	-
Decompression peripheral nerve	-4.18568	0.00115	-0.1216	0.09008	0.01165	-0.1298	0.14418	-0.106	-0.09112	0.09682	-0.0467	0.10269
Other non-OR therapeutic procedures on skin and breast	-4.27926	0.02627	0.02191	0.25858	-0.03707	0.00817	-0.20256	-0.19999	0.10066	-0.17091	0.17632	-
Other excision of cervix and uterus	-4.28786	0.13389	0.05132	-0.0602	0.06784	0.01834	0.01272	0.15641	-0.0229	0.15118	-0.03788	0.06045
Lumpectomy; quadrantectomy of breast	-4.17086	0.0539	0.11175	-0.11383	0.06587	-	0.01822	0.15727	0.07794	0.36406	-0.27161	0.12983
Arthroplasty other than hip or knee	-4.34415	0.03642	0.11392	-0.04865	0.02488	-0.1993	0.22099	0.13867	-0.10242	0.02812	-0.16509	0.25574
Other hernia repair	-4.1058	0.05791	0.04189	-0.09352	0.07218	0.03743	0.05823	0.04455	-0.03918	0.13044	-0.18884	0.19284