

Sampling Design for the 2010-12 National Hospital Ambulatory Medical Care Survey

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Abstract

The National Center for Health Statistics (NCHS) conducts the National Hospital Ambulatory Medical Care Survey (NHAMCS) to measure utilization of ambulatory medical care service provided in non-Federal, non-institutional general and short-stay hospitals located in the 50 states and the District of Columbia. From its beginning in 1991, NHAMCS has collected data about sample visits made to hospital emergency and outpatient departments. In 2009, the survey also began collecting data about visits made for ambulatory surgery. In 2010, the survey universe was further expanded to include visits made to freestanding (not-hospital based) ambulatory surgery centers. This paper discusses the sampling design for the current survey.

Keywords: Survey design, sampling design, health care survey

1. Introduction

The National Center for Health Statistics (NCHS) conducts the National Hospital Ambulatory Medical Care Survey (NHAMCS) to measure care provided in ambulatory visits made to hospitals and freestanding ambulatory surgery facilities. The survey uses a four stage sample of ambulatory visits made to hospital emergency departments (EDs), hospital outpatient departments (OPDs), hospital based ambulatory surgery locations (ASLs), and freestanding ambulatory surgery centers (FS-ASCs). Data collected on those visits include patient characteristics (age, sex, and race), expected source(s) of payment; principal reason for visit; primary diagnosis; diagnostic services; disposition; and provider type seen.

The current survey combines two surveys that were conducted independently of each other until their merger starting in 2009. The first of these is the original NHAMCS which has been conducted continuously since December of 1991 [1]. Until 2009, NHAMCS targeted only the ambulatory visits made to hospital EDs and hospital OPDs.

The second survey is the National Survey of Ambulatory Surgery (NSAS) which collected ambulatory surgery data from samples of hospitals and FS-ASCs [2, 3]. However, funding was not sufficient to conduct NSAS on a continual basis and, thus, NSAS was conducted in only four years (1994-96 and 2006). Starting in 2009, the addition of ambulatory surgery visits to NHAMCS was phased in over two years. The hospital based ASLs were added in 2009 and FS-ASCs were added in 2010. According to justification given in [4] for combining the NSAS with NHAMCS, there were a number of reasons for expecting lower costs and increased efficiency by collecting the ambulatory surgery data, especially the hospital based ambulatory surgery data, through

NHAMCS rather than in a separate NSAS. Hospital induction costs would be saved because the NHAMCS hospitals are already inducted. Training costs would be saved because the data collected by the two surveys are similar and because some NHAMCS abstractors may have worked on NSAS. Reduced costs for data collection were likely due to the reduced number of months in which records are sampled from each facility (12 months in NSAS versus four weeks in NHAMCS). Also, continual data collection is cheaper than intermittent data collection due to substantial start up costs each time a survey is fielded.

In addition to being merged, the sampling designs for the individual surveys have changed since those surveys were initiated. The sampling design for the combined sample was also affected by plans to replace the NHAMCS in 2013. This paper is an attempt to document the pertinent features of the sampling design for the 2010-12 survey in one place. For convenience in the following discussion, the 2010-12 survey is sometimes referenced as the “current” survey.

The next section discusses the area sample which serves as the first stage sample for most of the sample for the NHAMCS. Sections 3 and 4 discuss the remaining features of the sampling designs for the hospital based and freestanding facility based samples, respectively. Figure 1 presents a flow chart of the sampling stages for the current NHAMCS. The last section discusses the limitations of the current sampling design and outlines survey plans for 2013.

2. Area Sample

Most of the current NHAMCS sample is clustered in a sample of geographic primary sampling units (PSUs) which consist of MSAs (Metropolitan Statistical Areas defined by the Office of Management and Budget), counties, and groups of contiguous counties/parishes (or townships for some PSUs in New England). The area sample is a probability subsample of the PSUs used for the 1985-94 National Health Interview Survey (NHIS) [5]. The NHIS PSU sample was stratified and selected using probability proportional to the projected 1985 population. PSU strata were defined by (a) region (Northeast, Midwest, South, and West), (b) population density and (c) socio-economic and demographic variables correlated with health variables, namely percents for Hispanic persons, persons below poverty level, households with annual income less than \$15,000, persons in urban areas, unemployed persons, and persons employed in manufacturing. The PSUs with the largest populations were selected with certainty and two PSUs were selected from each of the remaining strata. The NHIS PSU sample was split into four nationally representative panels [5]. Two of the four NHIS PSU panels were selected for use in the NHAMCS.

3. Hospital based sample

3.1. Hospital sample

The hospital universe for the NHAMCS consists of hospitals which are non-Federal, non-institutional, have six or more beds set up and staffed for inpatient use, and are either general service acute care hospitals or hospitals whose average length of stay is less than 30 days. The sampling frame for the hospital sample was constructed from the SMG Hospital Database and its successors, “Healthcare Market Index” and “Hospital Market

Profiling Solution”, which are currently available from SDI at <http://sdihealth.com/healthcare-lists/hrp.aspx>.

A stratified sample of hospitals was selected by systematic random sampling methods from hospitals located in the NHAMCS PSUs. Two hospital strata were defined: an ED/OPD stratum consisting of hospitals for which the frame reported the existence of EDs and/or OPDs and a complement stratum consisting of the remaining hospitals in the sampling frame.

The sample from the ED/OPD stratum was selected with probability proportional to size where size was a function of the annual visit volumes reported in the sampling frame for the EDs and OPDs. Specifically, size for each hospital was defined as the sum of the annual ED visit volume and 65 percent of the annual OPD visit volume. A portion of the reported OPD visits was excluded from the size calculations because OPD visit counts reported in the sampling frame tend to include visits to OPD clinics which are not eligible for the NHAMCS sample (see Section 3.2 for a definition of eligible OPD clinics). To assure every hospital in the stratum had a non-zero chance of selection when no visit volume was reported for an ED or OPD, the numbers 4,000 and 7,000 (approximate average of visit volumes that were reported for frame hospitals) were substituted for the missing ED and OPD visit counts, respectively. Five hospitals were selected from each non-self-representing (NSR) sample PSU in which five or more ED/OPD hospitals were located. In NSR PSUs with fewer than five eligible hospitals, all eligible hospitals in the PSU were selected. The remaining sample hospitals from the ED/OPD stratum were selected from the self-representing (SR) PSUs after the SR PSUs were collapsed within region. To force diversity in the sample in areas where diversity existed among hospitals, hospitals were selected from lists in which the eligible hospitals were arrayed by hospital class (ED only, both ED and OPD, OPD only), ownership class (government, other non-profit, proprietary) and size.

The sample from the complement stratum was selected by simple systematic random sampling from hospitals located in the NHAMCS area sample. These hospitals were selected from a list in which eligible hospitals were arrayed by region, PSU, ownership class, and bed size (number of beds staffed for patients). The sample from the complement stratum was included in the survey to represent the population of hospitals which may be misclassified in the sampling frame because their EDs and/or OPDs were not reported in the database source used for the sampling frame.

To minimize hospital response burden, the hospital sample was divided into 16 nationally representative panels and those panels were randomly ordered for rotation over reporting periods of four weeks each. The panels were formed by systematically assigning hospitals to panels from a list in which the sample hospitals were arrayed according to the order in which they were selected. The rotation of panels over four-week periods limits the frequency of each hospital’s inclusion in the fielded sample to only every 15 months. That frequency, in turn, assures the hospital will be asked to report during different seasons of the year as it is rotated into the sample.

The initial NHAMCS hospital sample was selected in 1991 with 550 hospitals selected from the ED/OPD stratum and 50 from the complement stratum. Most (not all) of those 600 hospitals are in the current sample. To account for changes to the hospital universe since 1991, the sampling frame and the sample were both updated every third year with the latest update being made effective in January 2010. The updates were accomplished

by matching the latest available hospital marketing database with the existing sampling frame. Frame hospitals whose database ID numbers were not matched in the new marketing database were dropped from both the frame and the sample. Universe hospitals in the marketing database with unmatched IDs were added to the sampling frame and the sampling process was extended to the “new” hospitals as if they had been in the initial 1991 hospital sampling frame. That is, the “birth” hospitals were added at the end of the hospital frame list for each sampling stratum and systematic sampling of hospitals was continued to the end of the extended lists by using the random starts and sampling intervals that were used to select the hospital sample in 1991. The current numbers of facilities in the total sample (all 16 panels) and the average numbers in annual samples are shown by stratum in Table A.

3.2. Samples of sites within hospitals

Where they exist within sample hospitals, samples of OPD clinics, ED service areas, and ASLs are selected. In hospital OPDs, a clinic is eligible for the NHAMCS if the clinic meets three basic criteria:

- Care is offered at established locations and at scheduled times
- Care is provided under the supervision of a physician, and
- Care is provided under the authority (responsibility) of the hospital.

Clinics offering only ancillary services, such as diagnostic X-rays or radiation therapy, are out-of-scope. Services provided in dental or dental surgery clinics, pharmacies, or other settings in which physician services are not typically provided are also out-of-scope. OPD clinics exclude “the hospital as landlord” in which the hospital only rents space to a physician group and is not otherwise involved in the delivery of services. In hospital OPDs with five or fewer NHAMCS eligible clinics, all eligible clinics are selected. In OPDs with more than five eligible clinics, the clinics are stratified by six specialty types (general medicine, surgery, pediatrics, obstetrics/gynecology, substance abuse, other) and clinics which expect fewer than 30 visits during the reporting period are combined with other stratum clinics to form sampling units so that each has an expected total of 30 visits or more. Two sampling units are then selected from each specialty stratum which exists at the hospital by using systematic random sampling with probability proportional to expected visit counts.

If a hospital’s ED is staffed 24 hours daily, it is inscope as an ED for NHAMCS and is a separate sampling stratum within the hospital. The department may be located on hospital grounds or operated off site by the hospital. All emergency service areas of an inscope ED are also deemed inscope, irrespective of whether each of those areas is staffed 24 hours daily. All of the emergency services areas in an inscope ED are included in the NHAMCS sample. On the other hand, if a hospital has an emergency department which is not staffed 24/7, that department is treated as a clinic in the hospital’s OPD for the NHAMCS purposes.

In hospitals offering ambulatory surgery, the eligible ASLs include all hospital locations where ambulatory surgery is performed. These locations include main operating room(s), dedicated ambulatory surgery units, cardiac catheterization laboratories, and rooms for laser procedures, endoscopy, and laparoscopy. All of each sample hospital’s ASLs are included in the NHAMCS sample.

3.3. Visit samples

Visits are sampled at the fourth (last) stage in the hospital based sample. Sampling is done separately at each location included in the sample. A minimum of 30 visits is targeted from each sampled location while minimum total samples targeted from each hospital having them are 100 ambulatory surgery visits, 100 ED visits, and 200 OPD visits. The visits are selected using systematic random sampling from lists of visits made during the hospital's reporting period. The visit lists may be sign-in sheets or appointment lists. The sampling intervals used for each department and location are based on the number of visits expected during the reporting period and the number of visits to be selected.

4. Freestanding based sample

4.1. Facility sample

The universe of FS-ASCs consists of facilities in the U.S. which are regulated by the states and/or certified by the Centers for Medicare and Medicaid Services (CMS) for Medicare participation. The universe includes pain block facilities (added in 2006). Facilities specializing in dentistry, podiatry, abortion, family planning, or birthing are excluded. However, procedures commonly found in the excluded facilities are not excluded when they are provided by facilities which are otherwise in scope for the survey.

A two phase sample of FS-ASCs was used for the 2010-12 NHAMCS. Because this FS-ASC sample would only be used for three years until 2013, a decision was made to use a subsample of the 2006 NSAS FS-ASC sample in order to conserve the resources which would otherwise have been required to compile a new sampling frame. The 2010-12 FS-ASC facility sample can only represent facilities which existed in the 2005 FS-ASC facility files that were used as the sources for the 2006 NSAS sampling frame. However, under the assumption that the characteristics of ambulatory surgery visits probably do not vary with facility age, the sample should enable measuring the current characteristics of ambulatory visits. The 2006 frame sources were the 2005 Verispan Freestanding Outpatient Surgery Center Database [6] and Medicare-certified facilities included in the CMS Provider of Service (POS) file [7]. The 2006 NSAS FS-ASC sample (i.e. the first phase for the 2010-12 sample) was a stratified list sample of 472 FS-ASCs with strata defined by 17 surgery specialty groups. Of those 472 FS-ASCs, 74 were out-of-scope leaving 398 in scope facilities from which to select the 2010-12 sample. Unless otherwise stated in the following, the phrase "NSAS sample" denotes only these 398 in scope sample FS-ASC facilities.

Other requirements for the 2010-12 FS-ASC facility sample (i.e. the second phase sample) were that the sample:

- Be selected from the NHAMCS area sample to the extent possible.
- Be rotated in 16 panels over 4-week reporting periods (same as done for the NHAMCS hospital sample).
- Include 200 facilities annually. Based on results from the 1994-96 NSAS which used a multi-stage sample similar to that for 2010-12, annual samples of 200 FS-ASCs should yield acceptable reliability for most estimates produced in the 1994-96 NSAS.
- Have only five surgery specialty groups (ophthalmic, gastrointestinal, multi-specialty, general, and other) used in definitions of sampling strata. These five

were to be formed by collapsing the 17 specialty group strata used in the NSAS sample.

To satisfy these conditions, a total of 246 FS-ASCs was required from the 2006 NSAS sample. All of the in-scope NSAS sample facilities located within the NHAMCS area sample were selected. However, the area sample included only 216 NSAS facilities so a sample of 30 other facilities was required in addition to the area sample of facilities. A stratified list sample of 30 facilities was selected from the remaining NSAS sample with strata defined by the four regions and the five collapsed surgery specialty groups. To assure the annual NHAMCS sample would include at least two facilities from each stratum as the sample is rotated over 16 four-week reporting periods, the 30 facilities from outside the area sample were allocated to strata which had fewer than three sample facilities in the area sample. When the remaining NSAS sample in one of these strata had more facilities than needed to supplement the area facility sample, systematic random sampling was used to select the additional sample facilities needed for NHAMCS from that stratum.

4.2. Visit samples

As done in hospitals with ASLs, all ASLs in sampled FS-ASCs are included in the sample and a total sample of 100 visits is targeted from each FS-ASC. Systematic random sampling is used separately at each location or group of locations for which a separate chronologic list of visits is maintained by the facility.

5. Discussion

The National Hospital Ambulatory Medical Care Survey has been conducted continually since 1991 to measure the care provided in hospital emergency departments and hospital outpatient departments. In 2009 and 2010, the NHAMCS universe was expanded to include the universe of ambulatory surgery visits and the freestanding ambulatory surgery centers (FS-ASCs) that were formerly included only in the universe for the National Survey of Ambulatory Surgery (NSAS) conducted in 1994-96 and 2006. To conserve resources, a subsample of the 2006 NSAS FS-ASCs was selected for use in the 2010-12 NHAMCS instead of a more current sample. This paper outlines the sampling design for the current expanded survey.

It is recognized that the 2006 subsample of FS-ASCs used for the current NHAMCS is out dated and does not represent visits to current FS-ASCs which were non-existent in 2005. However, until a new FS-ASC sample is selected, the current NHAMCS sample at least permits measuring the characteristics (if not numbers) of ambulatory surgery visits occurring in FS-ASCs.

Starting in 2013, the NHAMCS will be replaced with the new National Hospital Care Survey (NHCS) where a list sample of hospitals will be used to collect both the hospital based ambulatory care data collected in the current NHAMCS and the inpatient care data formerly collected in the National Hospital Discharge Survey. A fresh sample of FS-ASCs is also anticipated in 2013 as part of the new NHCS.

References

- [1] McCaig LF, McLemore T (1994). Plan and operation of the National Hospital Ambulatory Medical Care Survey. National Center for Health Statistics Vital Health Stat 1(34). (PHS) 94-1310.
http://www.cdc.gov/nchs/data/series/sr_01/sr01_034acc.pdf
- [2] McLemore T, Lawrence L (1997). Plan and operation of the National Survey of Ambulatory Surgery. National Center for Health Statistics. Vital Health Stat 1(37). (PHS) 98-1313. http://www.cdc.gov/nchs/data/series/sr_01/sr01_037.pdf.
- [3] Cullen KA, Hall MJ, Golosinskiy A (2009). Ambulatory Surgery in the United States, 2006. National health statistics reports; no 11. Revised. Hyattsville, MD: National Center for Health Statistics.
<http://www.cdc.gov/nchs/data/nhsr/nhsr011.pdf>
- [4] Burt C (2008). Supporting Statement for Request for Clearance: NATIONAL HOSPITAL AMBULATORY MEDICAL CARE SURVEY OMB No. 0920-0278. National Center for Health Statistics, Hyattsville, MD. Unpublished document.
- [5] Massey JT, Moore TF, Parsons VL, Tadros W. (1989). Design and estimation for the National Health Interview Survey, 1985-94. National Center for Health Statistics. Vital Health Stat 2(110). (PHS) 89-1384. PB90-155466. PC A03 MF A01. http://www.cdc.gov/nchs/data/series/sr_02/sr02_110.pdf
- [6] Verispan LLC. (2005). Freestanding Outpatient Surgery Centers Database. Chicago: Health Information Specialists. (SDI acquired Verispan in 2008) The database is currently available at <http://sdihealth.com/healthcare-lists/OP-surgery.aspx>.
- [7] Centers for Medicare and Medicaid Services (2005). Provider of Services File. Baltimore, MD.
http://www.cms.gov/NonIdentifiableDataFiles/04_ProviderofServicesFile.asp#TopOfPage

Table A: Numbers of sampled facilities in the 2010-12 National Hospital Ambulatory Medical Care Survey

Facility type	Stratum	Number	
		Total	Approximate annual average*
Hospitals		591	480
	ED/OPD	511	415
	Complement	80	65
Freestanding ambulatory surgery centers		246	200
	Ophthalmic	20	16
	GI	22	18
	Multi-specialty	46	37
	General	59	48
	Other	99	80

* Facility sample is divided into 16 panels which are rotated over four-week reporting periods.

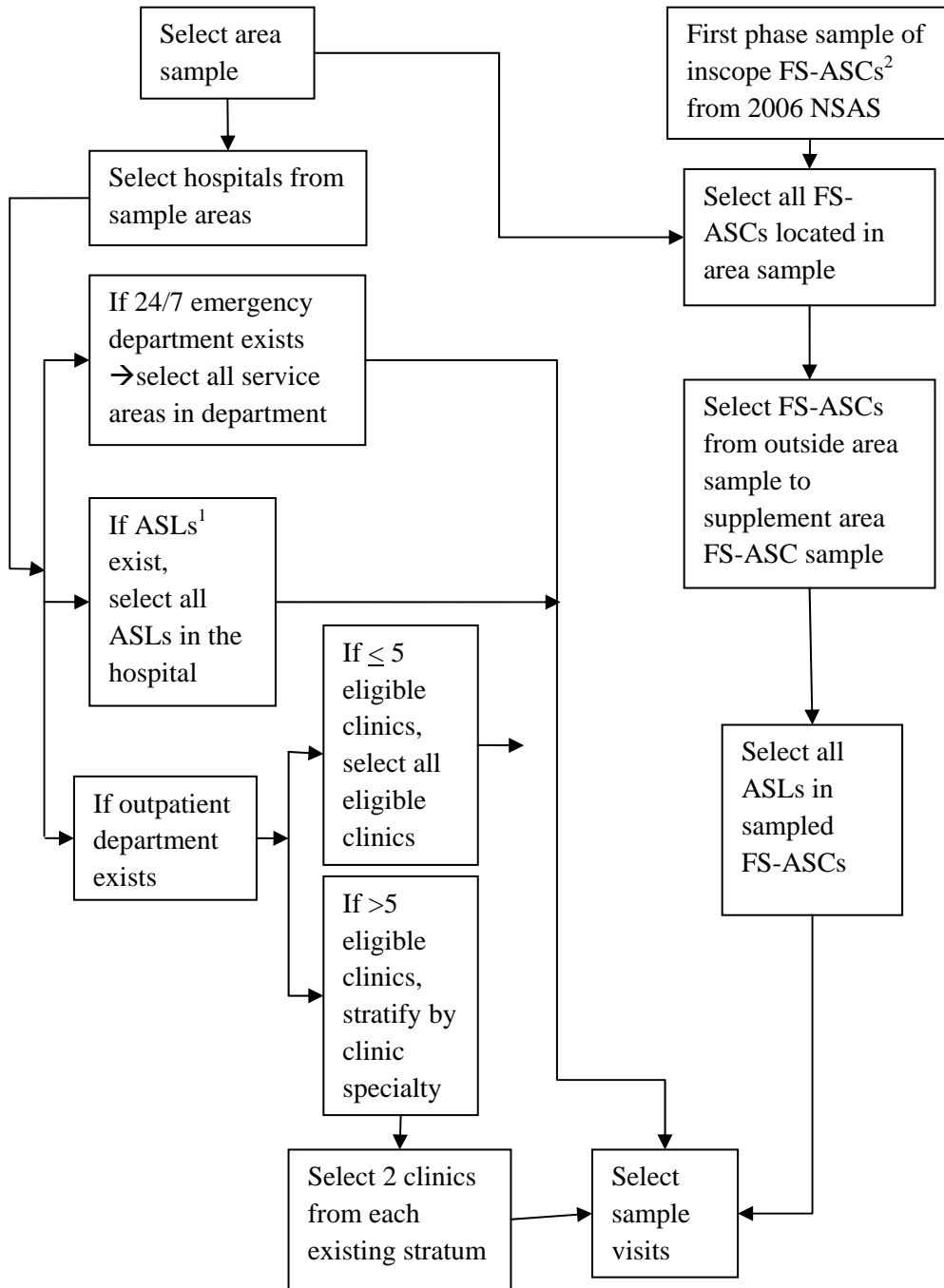


Figure 1: Flow chart of sample selection process for the 2010-12 National Hospital Ambulatory Medical Care Survey

¹ ASL = Ambulatory surgery location

² FS-ASC = Freestanding ambulatory surgery Center