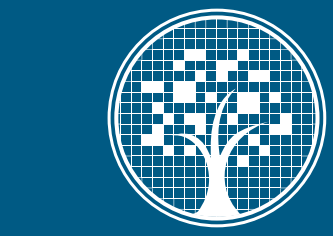

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HEALTHCARE COST AND UTILIZATION PROJECT

HCUP Methods Series

2003 HCUP Nationwide Inpatient Sample (NIS) Comparison Report
Report# 2006-09

Agency for Healthcare Research and Quality

U.S. Department of Health and Human Services
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EXECUTIVE SUMMARY

This report compares estimates calculated from the 2003 Nationwide Inpatient Sample (NIS) with statistics from two comparable databases – the National Hospital Discharge Survey (NHDS) and the Medicare Provider Analysis and Review (MedPAR) – with the objective of assessing potential biases. In addition, NIS estimates were contrasted with summary information from the American Hospital Association (AHA). This report focuses on important measures of inpatient hospital stays, including total discharges, lengths of stay, in-hospital mortality rates, and average hospital charges. In addition to comparisons with national statistics, these data were also evaluated across several categories, including region, expected payer, hospital characteristics, patient demographics, diagnosis groupings, and procedure groupings.

NIS Background

The 2003 NIS was established as part of the Healthcare Cost and Utilization Project (HCUP) to provide data supporting analyses of hospital utilization across the United States. NIS data were selected using a stratified probability sample of hospitals, drawn from a frame of 37 states. Sampling probabilities were calculated to select 20 percent of the universe in each stratum defined by hospital characteristics (region, urban/rural location, number of beds, teaching status, and ownership/control). As a result, the NIS includes approximately 8.0 million discharges from 994 hospitals, with weights to facilitate national estimates. One of the most distinctive features of the NIS is that its large sample size allows for the study of relatively uncommon disorders, procedures, and hospital types; in fact, NIS estimates can be calculated for any number of special sub-populations. In addition, the NIS contains information on hospital charges and includes all payers.

It is important to note that NIS data differed in scope from the two comparison databases in several ways:

- The NIS is a sample, while the MedPAR is a census of fee-for-service Medicare discharges.
- NIS data include Medicare managed care discharges that are generally omitted from the MedPAR data.
- MedPAR and NHDS data are drawn from all 50 states plus the District of Columbia, while the NIS sample is drawn from 37 states.

AHA Background

For 2003, the American Hospital Association Annual Survey Database (also known as the AHA Annual Survey and the AHA Survey of Hospitals) included records for 4,836 hospitals. The AHA Survey data report discharges and inpatient days (overall, Medicare, and Medicaid), as well as hospital information such as bed counts, employment, and payroll. In addition, hospitals indicate specific services offered. The sampling frame for the NIS is based on AHA Survey data.

NHDS Background

In 2003, the National Center for Health Statistics drew a sample of 319,530 short-stay discharges from 426 hospitals, including both general and children's hospitals for the NHDS data set. Statistics from the NHDS are considered geographically representative because the NHDS sampling frame was relatively unrestricted. The NHDS usually presents diagnoses and procedures in the order in which they were listed on the abstract form, with three specific exceptions: (1) code V27, outcome of delivery, was re-ordered as the principal diagnosis when it appeared as a secondary diagnosis; (2) acute myocardial infarction codes were re-ordered as the principal diagnosis when this condition appeared as a secondary diagnosis and another circulatory disease appeared on the record; and (3) if a symptom appeared as a first-listed diagnosis and a diagnosis appeared as a secondary code, the diagnosis replaced the symptom, which was moved to appear after the diagnosis.

MedPAR Background

Obtained from the Centers for Medicare and Medicaid Services (CMS), MedPAR data include all paid fee-for-service Medicare discharges from Medicare-certified, short-stay U.S. hospitals. For calendar year 2003, 12.7 million discharges from U.S. community hospitals were included. One important characteristic of MedPAR data is that the database underreported total Medicare discharges by omitting most managed care discharges (approximately 14 percent of Medicare patients). This particular omission has significant implications for the various comparisons between the MedPAR and NIS data files.

Methods

Statistics compared in the NIS, NHDS, and MedPAR databases included total number of discharges, average length of stay, in-hospital mortality rates, and average total charges (NIS and MedPAR only). These measures of utilization and outcomes were selected because they are common in health services research and serve important roles in health policy and resource planning analyses.

Both the NIS and NHDS are samples, and statistics derived from them are estimates. Therefore, comparisons between NIS and NHDS estimates utilized two-sample *t*-tests. MedPAR data, in contrast, are not a sample. The NIS-MedPAR comparisons employed one-sample *t*-tests, which are useful in comparing an entire population (MedPAR) with sample estimates (NIS).

The report cautions that estimates cannot be expected to be identical when two different samples are drawn. When viewing results, readers should note that statistically significant differences between the NIS and the NHDS can be expected for a number of reasons. These include:

- Random variation between the two samples
- Differences in sampling strategies
- The NHDS practice of reordering some diagnosis codes
- The sheer volume of tests conducted.

Major Findings

Considering all of these possible reasons for significant differences among the samples, data analyses revealed remarkable similarity among the estimates.

NIS estimates of essential health care policy variables (i.e., in-hospital mortality, inpatient population size, length of stay, and charges) were accurate and precise. The estimates were drawn from states that encompass nearly 78 percent of all short-stay hospitals, more than 84 percent of discharges in the United States, and 91 percent of the U.S. population.

NIS hospitals resembled typical hospitals in the AHA universe in bed size and most characteristics, although there was more activity at NIS hospitals as well as higher staffing rates, and larger expenditures compared to the AHA universe. Specifically, NIS facilities admitted and discharged more patients, had more full-time equivalent (FTE) employees per bed, more FTE RNs per 1,000 patient days, had higher expenditures, and had larger payrolls than hospitals in the AHA universe. In addition, Medicaid patients were less prevalent in NIS hospitals than in all AHA facilities.

The following sections provide summary highlights of key findings from this comparative analysis:

Summary of overall and regional comparisons:

- NIS estimates of discharge count, average length of stay, and in-hospital mortality rate measures were statistically consistent with NHDS estimates.

- The NIS over-estimated discharges by 15 percent for Medicare patients, as compared with MedPAR statistics. This discrepancy was likely rooted in the omission of most discharges for managed care patients from the MedPAR file.

- NIS-MedPAR discharge differences were greatest in the Northeast and West – regions with the highest Medicare managed care penetration. This finding was consistent with the hypothesis that MedPAR data underreport Medicare managed care discharges, such as Medicare+Choice. When we examined the percentage of discharges in each region, only two significant differences were observed: NIS estimates were higher in the West, and lower in the Midwest.

- All NIS estimates of average length of stay and in-hospital mortality, along with most estimates of average total hospital charges from the NIS, were consistent with MedPAR statistics.

Comparisons by hospital characteristics:

- NIS discharge estimates differed from NHDS estimates by reporting relatively more discharges from larger hospitals and relatively fewer discharges from smaller hospitals. NIS estimates of discharges by hospital size, however, closely approximated counts from the American Hospital Association.

- NIS discharge estimates routinely exceeded MedPAR statistics, consistent with the absence of most Medicare managed care discharges from MedPAR data, although the

proportion of NIS and MedPAR discharges in the hospital categories was generally consistent.

- Average length of stay, in-hospital mortality, and average total charge estimates from the NIS were consistent with NHDS estimates and MedPAR statistics for most hospital categories.

Comparisons by patient characteristics:

- NIS and NHDS estimates were virtually identical across all patient categories (age group, gender, and race) for discharges, average length of stay, and in-hospital mortality rate. All NIS and NHDS estimates by expected payer were consistent, with the exception of discharges with missing or unknown payer information.

- Both the NIS and NHDS include large numbers of discharges without race information. In the NIS, patterns of missing race are state-specific: some states do not report race information to HCUP. It is not possible to determine whether the pattern of missing race is similar in the NHDS because the NHDS does not include state information.

- Most NIS estimates of Medicare discharges differed from corresponding MedPAR counts, with higher NIS estimates in most cases. Race was not available for approximately one-quarter of NIS discharges, while less than one percent of MedPAR discharges lacked race information.

- NIS-MedPAR differences also occurred for most estimates of age group discharge proportions. In general, the NIS over-estimated Medicare patients aged 65-84 and under-estimated Medicare patients younger than 65 and older than 84.

- Most NIS Medicare estimates of average length of stay and average hospital charge were consistent with corresponding MedPAR statistics. Differences for average length of stay were discovered for only one category: missing race. However, most NIS in-hospital mortality rate estimates differed from MedPAR statistics.

Comparisons by diagnosis and procedure categories:

- NIS and NHDS estimates of discharges and average length of stay were generally consistent across diagnosis categories. Many of the differences that were observed can be attributed to coding changes employed in the NHDS: the NHDS recodes diagnosis codes in certain circumstances, while the NIS does not.

- NIS in-hospital mortality rate estimates for specific diagnosis and procedure categories often differed from NHDS estimates. Only some of these differences can be linked to the recoding of NHDS diagnosis codes.

- The rank order of the most common diagnosis and procedure categories was nearly identical for the NIS and the NHDS. Similarly, the NIS and the MedPAR held almost identical rankings for the most common diagnosis and procedure categories within the Medicare population.

- Because of the omission of managed care patients in the MedPAR data, the NIS discharge estimates were higher for most diagnosis categories, as well as approximately

one-third of the discharge-proportion comparisons. However, there were few differences between the NIS and MedPAR in total charges, inpatient mortality, or length of stay.

Conclusion

Each data source possesses distinct strengths and weaknesses and may be regarded as the optimum choice for answering different research questions. In general, NIS estimates of essential health care policy variables are accurate and precise. The NIS offers a large sample that might allow for the study of disorders, procedures, and hospital types that occur with low frequency in other databases. NIS estimates can be calculated for thousands of special sub-populations that may be of interest to researchers.

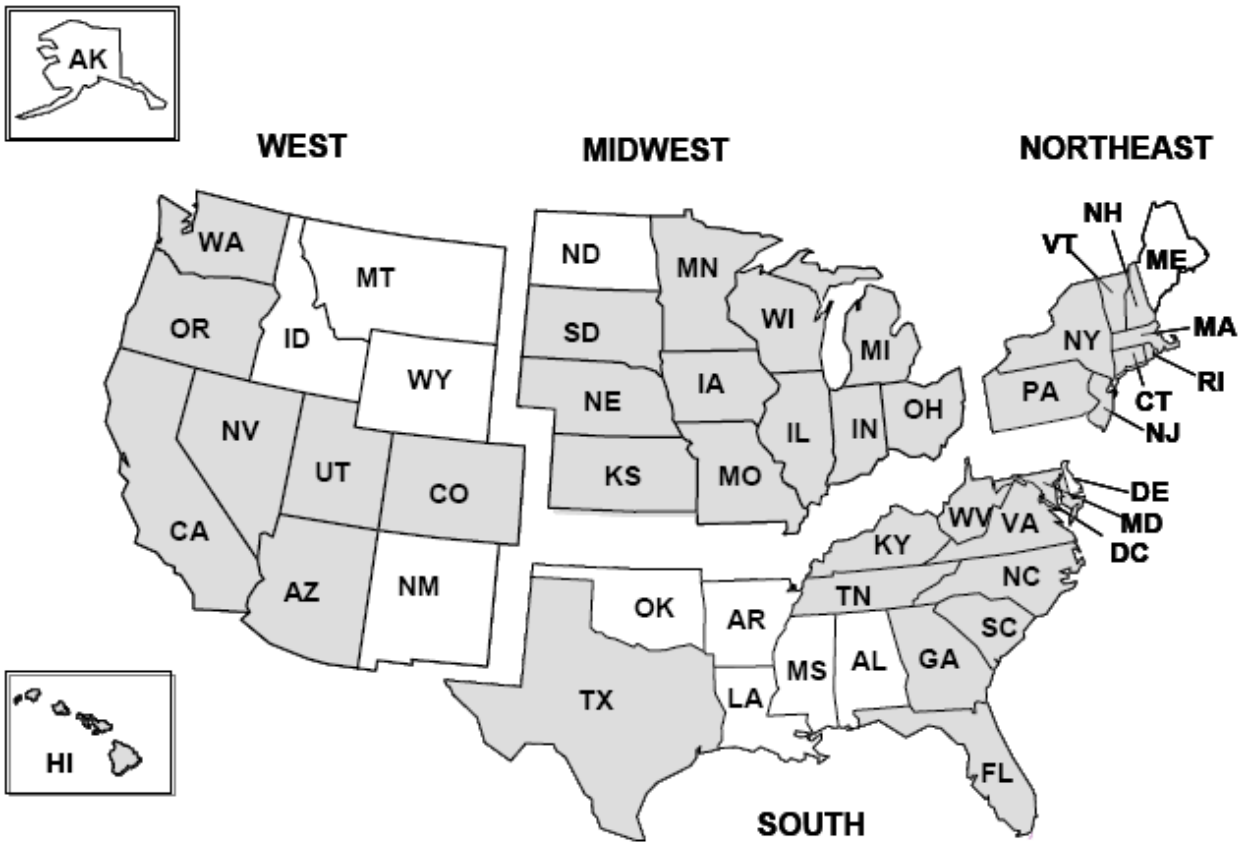
The NHDS sample and MedPAR data were drawn from all 50 states, while only 37 states were included in the NIS database. However, for 2003, NIS states encompassed nearly 78 percent of all short-stay hospitals and more than 84 percent of all United States discharges. The NIS contains charges for each hospital stay, all payers, and a large sample of discharges. In contrast, the NHDS has a smaller number of discharges, does not contain charges, but does sample from all 50 states. The MedPAR database is limited to Medicare discharges and contains all Medicare patients covered by the fee-for-service program, but excludes Medicare patients enrolled in managed care plans. Thus, the appropriateness of each of these databases is dependent on researcher needs and institutional priorities. In conclusion, the NIS appears to provide reliable national estimates when compared with these other national data sources along the dimensions examined in this report.

INTRODUCTION

This report compares statistics estimated from the Nationwide Inpatient Sample (NIS), a database containing patient-level information from a sample of hospital discharges in the year 2003, with estimates from two other data sources. These comparisons will interest researchers who intend to make inferences about hospital outcomes using the 2003 NIS.

This report is the ninth in a series; the eight previous reports compared the NIS with other data sources for the years 1991, 1993, 1995, 1997, 1999, 2000, 2001, and 2002, respectively. These data years correspond to NIS releases that expanded the number of states contributing data: the first release sampled discharges from only eight states, while this latest release sampled discharges from the 37 states shown in Figure 1:

Figure 1. States Participating in the NIS, 2003



NIS coverage of United States discharges is impressive, because these states include nearly 78 percent of United States community hospitals, more than 84 percent of all discharges, and nearly 91 percent of the U.S. population during 2003. By region, the sampling frame for the NIS includes states with 98 percent of the population in the Northeast, 99 percent of the population in the Midwest, 81 percent of the South, and 92 percent of the West. Still, the possibility remains that hospital outcomes from states in the NIS sampling frame may differ from hospital outcomes

in the states not covered by the NIS. This report is designed to explore the representativeness of the NIS in relation to the universe of hospital care in the United States.

Created as a part of the Healthcare Cost and Utilization Project (HCUP) and funded by the Agency for Healthcare Research and Quality (AHRQ), the NIS contains all discharges from a sample of community short-stay hospitals stratified by geographic region, urban vs. rural characteristics, teaching status, bed size, and type of ownership. The hospital sample was drawn from the participating states noted in Figure 1. The final sample contained 8.0 million discharges from 994 hospitals. We compared outcomes from this sample with outcomes from two other hospital discharge databases: 1) the 2003 National Hospital Discharge Survey (NHDS), and 2) the 2003 Medicare Provider Analysis and Review (MedPAR).

The 2003 NHDS was created under the auspices of the National Center for Health Statistics (NCHS). Compared with the 2003 NIS, the 2003 NHDS featured a much smaller sample containing only 319,530 discharges from 426 hospitals. However, the sample was drawn from a frame that included nearly all hospitals in each of the 50 states. The NHDS sampled non-Federal short-stay hospitals in the United States, and then sampled discharges from each of the sampled hospitals. Although the smaller sample size rendered NHDS estimates less precise than NIS estimates, the complete coverage of states and the NHDS sampling design should minimize the potential bias for national estimates of hospital outcomes. This characteristic is the reason the NHDS was used as a comparative database in this study.

The 2003 MedPAR, obtained from the Centers for Medicare & Medicaid Services (CMS), included about 12.7 million fee-for-service Medicare discharges from more than 3,900 Medicare-certified, short-stay hospitals. This was not a *sample* of Medicare discharges. The MedPAR was nearly ideal for comparing NIS estimates of Medicare inpatient outcomes because it represented close to the entire population of Medicare discharges. As a comparative database, its main weakness was that it excluded most Medicare managed care enrollees; these individuals accounted for nearly 14 percent of the Medicare enrollees in 2003.

We compared the estimates from the 2003 NIS with estimates from the 2003 NHDS and the 2003 MedPAR on the following inpatient outcomes:

- Total discharge counts
- Average length of stay (ALOS)
- Inpatient mortality rate
- Average total charges (NIS and MedPAR only).

While many other statistics can be estimated from these data, hospital research commonly focuses on these four outcomes. To the extent that the NIS generates reasonable estimates for these measures, it is likely that estimates for other, similar outcomes will also be reasonable.

Statistics from the three data sources were compared at the national level, as well as within hospital groups and patient categories. We grouped hospitals and made evaluations according to geographic region, bed size, ownership, urban vs. rural location, and teaching status. We also categorized patients and made comparisons within age group, gender, race, primary payer, diagnosis category, and procedure category.

In addition, we compared weighted and unweighted frequencies between the 2003 NIS sample and the 2003 American Hospital Association (AHA) Annual Survey Database. These comparisons are purely descriptive because the NIS sample weights were derived from the AHA survey. Because NIS weights are based on the AHA survey, there was close agreement between the two sources.

This report is divided into four sections. The first section describes the NIS and changes in the sampling strategy that occurred in 1998. The second section provides a discussion of the NHDS, the MedPAR file, and the methodology used in the analysis. The third section presents the results, and the final section includes a discussion and posits several conclusions.

BACKGROUND INFORMATION ON HCUP AND THE NIS

HCUP is a Federal-State-Industry partnership formed to build a standardized, multi-state health data system. In September 2000, AHRQ provided funding to the HCUP project for Medstat to continue developing and expanding this health data system through data year 2003. The 2003 NIS was established as part of HCUP to provide analyses of hospital utilization across the United States.

The 2003 NIS universe included all acute-care discharges from all community hospitals in the United States. It comprised all discharges from a sample of hospitals in this target universe. However, the NIS sampling frame was constructed from the subset of universe hospitals that released discharge data for research use. For the 2003 NIS, AHRQ had agreements with 38 Partner organizations that maintain statewide, all-payer discharge data files. The 2003 NIS contains data from each of these states except Maine; this participation reflects an increase of two more states than the previous release and 29 more states than the first release.

Table 1 illustrates how the NIS sampling frame has grown. It lists the states included in each NIS release, for data years 1988 through 2003.

Table 1. States in the Frame for NIS Releases

Years	States in the Frame
1988	California, Colorado, Florida, Iowa, Illinois, Massachusetts, New Jersey, and Washington
1989-1992	Added Arizona, Pennsylvania, and Wisconsin
1993	Added Connecticut, Kansas, Maryland, New York, Oregon, and South Carolina
1994	No new additions
1995	Added Missouri and Tennessee
1996	No new additions
1997	Added Georgia, Hawaii, and Utah
1998	No new additions
1999	Added Maine and Virginia
2000	Added Kentucky, North Carolina, Texas, and West Virginia
2001	Added Michigan, Minnesota, Nebraska, Rhode Island, and Vermont
2002	Added Nevada, Ohio, and South Dakota; Data from Arizona was not available for inclusion in the NIS
2003	Added Arizona, Indiana, and New Hampshire Data from Maine was not available for inclusion in the NIS

As with previous releases of the NIS, the 2003 NIS sampling frame was subject to further restrictions.

- Thirty-three out of 142 Michigan hospitals (23 percent) were dropped from the sampling frame because they did not report total charges. These hospitals were fairly evenly distributed by hospital type, and their removal did not deplete any Michigan sampling strata: hospitals remained in all strata. In addition, 10 Michigan hospitals identified in AHA data were not included in the data supplied to HCUP.

- Georgia, Hawaii, Indiana, Nebraska, South Carolina, and South Dakota all imposed "small cell" restrictions, which required that we exclude hospitals from the 2003 NIS when a sampling stratum contained a single hospital. This restriction eliminated from the NIS sampling frame one of 143 Georgia hospitals, four of 23 Hawaii hospitals, one of 110 Indiana hospitals, one of 84 Nebraska hospitals, seven of 59 South Carolina hospitals, and two of 50 South Dakota hospitals. Michigan and Ohio also have similar confidentiality requirements, but no hospitals from these states were dropped from the 2003 NIS sampling frame.

- Some hospitals in Georgia, Hawaii, Indiana, Nebraska, South Carolina, and South Dakota were not in the sample frame because discharges from these hospitals were not supplied to HCUP. This eliminated one of the 143 Georgia hospitals, three of the 23 Hawaii hospitals, three of the 110 Indiana hospitals, one of the 84 Nebraska hospitals, two of the 59 South Carolina hospitals, and three of the 50 South Dakota hospitals.

- The Minnesota frame contains 15 fewer hospitals than the state universe because a few of the state's hospitals elected to not participate in HCUP. There are no apparent significant differences between the characteristics of participating and non-participating Minnesota hospitals.

- The Ohio frame contains 11 fewer hospitals than the state universe, including three hospitals that could not be matched to the AHA data because the Partner masked their identities in the data.

- Patient race was not available for discharges from Georgia, Illinois, Kentucky, Minnesota, Nebraska, Nevada, Ohio, Oregon, Washington, and West Virginia.

- Three additional Nebraska hospitals (out of 80) were dropped from the sampling frame because of a large percentage of missing Medicare discharges in the data supplied to HCUP.

- The Nebraska Hospital Association prohibits the release of discharge records for patients with HIV diagnoses. These discharges were not included in the source file provided to HCUP and are therefore not included in the NIS.

- Some Texas hospitals, mostly small rural facilities, were exempt from statutory reporting requirements. As a result, only 303 of the 414 Texas community hospitals (excluding rehabilitation facilities) supplied data to HCUP for the 2003 NIS. The Texas Health Care

Information Council estimates that these data include 90 to 95 percent of Texas discharges.[1]

NIS Design

The NIS is a stratified probability sample of hospitals in the frame, with sampling probabilities calculated to select 20 percent of the universe contained in each stratum. Beginning in 1998, NIS databases differed from previous years of the NIS because of a sampling redesign. Therefore, longitudinal comparisons of the NIS might indicate differences that can be attributed to the following six changes in the sampling design:

1. Prior to 1998, the NIS design ensured that hospitals drawn for the sample in one year had a high probability of being drawn for the sample in the following year. Including the same hospitals across years improved the precision of trend analyses, although it may have introduced some form of bias into one or more years of the hospital sample. Medstat and AHRQ decided to discontinue any sampling scheme that increased the chance that hospitals would be included in successive years of the NIS.

2. We found that patients treated in short-term rehabilitation hospitals tend to have lower mortality rates and longer lengths of stay than patients in other community hospitals. In addition, the completeness of reporting for rehabilitation hospitals is uneven across the states. Therefore, we decided to eliminate rehabilitation hospitals from the NIS (and from the target universe).

3. In previous NIS designs, we employed strata for geographic region, hospital ownership, urban/rural location, and teaching status. We identified strata that could be nested or collapsed, in order to avoid small cells in the final sample. This process reduced the number of NIS strata from 108 to 60, beginning with the 1998 NIS.

4. In the previous NIS, bed size categories were defined only within location/teaching status. However, even within these location/teaching combinations, the bed size distributions still varied widely by geographic region. We decided to define small, medium, and large bed size categories nested within region and location/teaching combinations such that approximately one-third of the hospitals would be allocated to each category.

5. Prior to 1998, we stratified all hospitals into one of three ownership categories: public, voluntary, and proprietary. In several geographic regions, however, some ownership categories rarely occurred. Therefore, we used all three ownership categories for rural hospitals in the South and for urban non-teaching hospitals in the South and West. However, in the West and Midwest regions, we collapsed the proprietary and voluntary hospitals into a new “private” ownership category.

6. Finally, we redefined teaching hospitals. In prior versions of the NIS, a hospital was designated a teaching hospital only if it had some interns or residents, and if it was either a member of the Council of Teaching Hospitals or the Accreditation Council for Graduate

[1]Sylvia Cook, Texas Health Care Information Council (telephone conversation occurring on March 15, 2005).

Medical Education (ACGME). Hospitals are now classified as *teaching* if they: a) have residency training approval by the Accreditation Council for Graduate Medical Education (ACGME); b) are a member of the Council of Teaching Hospitals (COTH); or c) have a ratio of full-time equivalent interns and residents to beds of .25 or higher. This intern-to-bed ratio is similar to a component of the Centers for Medicare & Medicaid Services' (CMS) definition of teaching hospitals for Medicare payments.

For more information on trend analysis, refer to the summary report, *Using the HCUP Nationwide Inpatient Sample to Estimate Trends Report,*[2] on the HCUP Website.

NIS Sampling

The overall sampling objective was to select a sample of hospitals that could be generalized to the target universe, including hospitals outside the frame (which had a zero probability of selection). To improve the generalizability of the NIS estimates, five hospital sampling strata were used:

1. Geographic Region – Midwest, Northeast, West, and South.

2. Ownership – public, private non-profit, and proprietary (private or investor-owned).

3. Location – urban and rural.

4. Teaching Status – teaching and non-teaching. (Rural hospitals were not split according to teaching status, because rural teaching hospitals were rare.)

5. Bed Size – small, medium, and large. Bed size categories were based on hospital beds and were specific to the hospital's location and teaching status, as shown in Table 2. Bed size cut points were chosen so that approximately one-third of the hospitals in a given region/location/teaching combination would appear in each bed size category. This approach creates different divisions – small, medium, and large – for rural, urban non-teaching, and urban teaching hospitals. For example, a medium-sized urban, teaching hospital would be considered a rather large rural hospital. Further, the size distribution was different among regions for each of the urban/teaching categories. Using differing cut points in this manner avoids strata containing small numbers of hospitals.

To further improve proportional geographic representation, hospitals were sorted by state and by the first three digits of their ZIP Code prior to systematic sampling. Refer to *Design Report: HCUP Nationwide Inpatient Sample, 2003*[3] for more details on the sampling design.

[2] http://www.hcup-us.ahrq.gov/reports/TrendReport2005_1.pdf

[3] http://www.hcup-us.ahrq.gov/db/nation/nis/reports/NIS_2003_Design_Report.pdf

Table 2. Bed Size Categories

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

NIS Weights

Sample weights were developed for the NIS to obtain national estimates of the hospital and inpatient parameters. For example, weights enable estimates of diagnosis-specific average lengths of stay across all United States hospitals. Within each stratum, the discharge weight was set at the ratio of discharges in the universe (estimated from the 2003 AHA hospital survey) to discharges in the sample.

METHODS

Statistics from the NIS were compared with statistics from three other sources, each of which is described below.

American Hospital Association (AHA) Annual Survey of Hospitals

This hospital-level file contains one record for every hospital in the NIS universe, making it a convenient source for calculating various statistics based on both the population of hospitals and the NIS sample of hospitals. Most data are self-reported by hospitals, but some information is imputed by the AHA. The file contains hospital-level statistics for hospital reporting periods, which do not necessarily correspond to the calendar year.

For 2003, the survey included records for 4,836 hospitals. The AHA Survey data report discharges and inpatient days (overall, Medicare, and Medicaid), as well as hospital information such as bed counts, employment, and payroll. In addition, hospitals indicate specific services offered.

Some adjustments were necessary to generate comparison statistics. AHA birth counts (healthy newborns) were added to AHA discharge counts to generate a statistic comparable to total NIS discharges. Average length of stay was computed by dividing inpatient days by the calculated discharges. This implies that same-day stays have a length of one day. Consequently, in comparisons of average lengths of stay between the NIS and AHA data, same-day stays in the NIS were recoded from zero to one for this analysis.

National Hospital Discharge Survey (NHDS)

Conducted by the National Center for Health Statistics (NCHS), the 2003 NHDS included 319,530 discharges from 426 hospitals. The NHDS covered discharges from United States hospitals categorized as short-stay (hospitals with an average length of stay under 30 days), including both general (medical or surgical) and children's hospitals. Federal, military, and Veteran's Affairs hospitals were excluded from the survey.

The NHDS sample included with certainty the largest hospitals: those with at least 1,000 beds, or at least 40,000 discharges. The remaining sample of hospitals was based on a stratified, three-stage design:

1. The first stage involved selecting 112 primary-sampling units (PSUs) that comprised a probability sub-sample of PSUs used in the 1985-1994 National Health Interview Survey.

2. The second stage consisted of selecting non-certainty hospitals from the sampled PSUs. Electronic (purchased) data were available for approximately 40 percent of these hospitals.

3. During the third and final stage, a sample of discharges was selected by systematic random sampling techniques. At this point, electronic data were over-sampled. As a result, approximately 60 percent of NHDS discharges originated from electronic data.

Medical Coding and Edits

The medical information that was recorded manually on the sample patient abstracts was coded centrally by NCHS staff. Up to seven diagnostic codes were assigned for each sample abstract. In addition, if the medical information included surgical or non-surgical procedures, up to four codes for these procedures were assigned. As with the NIS, the system currently used for coding the diagnoses and procedures on the medical abstract forms, as well as on the commercial abstracting services data files, is the *International Classification of Diseases, 9th Revision, Clinical Modification*, or ICD-9-CM.

The NHDS usually presents diagnoses and procedures in the order in which they were listed on the abstract form or obtained from abstract services. However, there were exceptions to this practice. For women discharged after a delivery, a code of V27 from the supplemental classification was entered as the first-listed code, with a code designating either normal or abnormal delivery in the second-listed position. In another exception, a decision was made to reorder some acute myocardial infarction diagnoses. If an acute myocardial infarction was listed with other circulatory diagnoses and was other than the first entry, it was reordered to the first position. The general rule of reordering with the NHDS was as follows: if a symptom appeared as a first-listed code and a diagnosis appeared as a secondary code, the diagnosis replaced the symptom, which was moved to appear after the diagnosis.

Table 3. Comparison of 2003 NIS and NHDS Data Files

Characteristics	2003 NIS	2003 NHDS
Number of hospitals	**994**	**426**
Number of discharges	**7,977,728**	**319,530**
Intended universe	Discharges from community hospitals, as defined by AHA – non-Federal, short-term general, or other specialty hospitals that were not a hospital unit of an institution. Short-term rehabilitation hospitals were excluded.	Discharges from non-institutional hospitals (excludes Federal, military, and VA hospitals) located in the 50 states and the District of Columbia. Only short-stay hospitals (ALOS < 30 days) or those whose specialty is general (medical or surgical) or children's general hospitals are included in the survey.
Bed size	No restriction was placed on bed size in creating the file, but no hospitals in the sample have fewer than six beds.	Must have at least six beds staffed for patient use to be included.
Sample or universe	Sample	Sample
Sampling frame	37 states	50 states and the District of Columbia
Sample design – hospitals	By geographic region, control/ownership, location, teaching status, and bed size.	Includes all hospitals with $\geq$ 1,000 beds or $\geq$ 40,000 discharges annually, plus an additional sample of hospitals in two stages. A sample of 112 PSUs was selected. These PSUs were a probability sample of the counties or metropolitan areas used in the 1985-1994 National Health Interview Survey. A sample of 426 hospitals was selected within these PSUs.
Sample design – discharges	All discharges from sampled hospitals were included.	A systematic random sample of discharges was selected from each hospital.
Reassignment of diagnosis codes	None	For women discharged after delivery, a code of V27 was entered as the first-listed code. If a symptom appeared as a first-listed code and a diagnosis was listed as a secondary code, the diagnosis replaced the symptom. If acute myocardial infarction was listed with other circulatory conditions, it was reordered to the first entry.

Table 3 summarizes some of the key differences in hospitals and discharges represented by the NIS and NHDS data files. Sampling error exists in both the NHDS and the NIS. However, the NIS includes nearly 25 times the number of NHDS discharges and more than twice the number of NHDS hospitals. Further, the NIS contains *all* discharges from sampled hospitals, whereas the NHDS contains a *sample* of discharges from sampled hospitals. Because of these sampling differences, statistics calculated from the NIS usually have much smaller standard errors than those calculated from the NHDS. In addition, it was not always possible to calculate valid estimates of standard errors from the NHDS for statistics calculated from rare subpopulations. For example, mortality estimates for low frequency procedures and diagnoses might be based on fewer than a dozen cases in the NHDS, while the same subpopulations could contain hundreds of discharges in the NIS. Statistics from the NHDS were assumed to be representative geographically, because the sampling frame was relatively unrestricted, encompassing all Federal, acute-care general United States hospitals with six or more beds. In contrast, the NIS sampling frame for 2003 was limited to the 37 states that made their data available for research purposes.

Medicare Provider Analysis and Review (MedPAR)

The MedPAR data obtained from the Centers for Medicare & Medicaid Services (CMS) include all records for each fee-for-service Medicare discharge from a Medicare-certified, short-stay United States hospital. Federal fiscal year records for 2003 and 2004 were used to create a calendar year 2003 MedPAR file with slightly more than 12.7 million discharge records. To ensure that the hospital composition of the MedPAR file was consistent with the NIS universe, only AHA-defined community hospitals – as specifically designated by the American Hospital Association – were retained in the MedPAR-derived file for this study. In the MedPAR data, same-day stays (admission and discharge on the same day) were assigned a length of stay of one day. Consequently, in comparisons of average lengths of stay between the NIS and MedPAR data, same-day stays in the NIS were recoded from zero to one for this analysis.

Table 4 summarizes some of the key differences in hospitals and discharges represented by the NIS and MedPAR data files. Medicare discharge statistics from MedPAR have no sampling error associated with them because this file represents a census of 2003 fee-for-service Medicare discharges. However, analyses suggest that the MedPAR data underreport total Medicare discharges by omitting most discharges for managed care. In 2003, nearly 14 percent of Medicare enrollees were in managed care, including HMOs (CMS, 2004). However, virtually no calendar year 2003 MedPAR discharges were identified as managed care enrollees (less than 1/100th of a percent), suggesting that nearly 14 percent of the Medicare population may have been excluded. As will be discussed throughout the report, this omission has significant implications for the various uses of the MedPAR and NIS data files.

Table 4. Comparison of 2003 NIS Medicare Discharges and MedPAR Data Files

Characteristic	2003 NIS (Medicare Only)	2003 MedPAR
Number of hospitals	**991 (with Medicare discharges)**	**3,698**[1]
Number of discharges	**2,956,310**	**12,416,980**[2]
Intended universe	Discharges from community hospitals, except rehabilitation hospitals, as defined by AHA – non-Federal, short-term general, or other special hospitals that were not a hospital unit of an institution.	All Medicare discharges. *Only discharges from non-rehabilitation, community hospitals were included, for comparison purposes.*
Bed size	No restriction was placed on bed size in creating the file, but no hospitals in the sample have fewer than six beds.	No restriction was placed on bed size in creating the file, but no hospitals in the sample have fewer than six beds.
Sample or universe	Sample	Universe
Sampling frame	37 states	50 states and the District of Columbia
Sample design – hospitals	By geographic region, control/ownership, location, teaching status, and bed size.	All hospitals were included.
Sample design – discharges	All discharges from sampled hospitals were included.	All fee-for-service discharges were included.
Reassignment of diagnosis codes	None	None

[1]*Short-term general and specialty community hospitals.*
[2]*Discharges from short-term general and specialty community hospitals.*

Variables Compared

The following measures were chosen to compare the NIS to the NHDS and MedPAR databases:

- Total number of discharges
- Average length of stay
- In-hospital mortality rate
- Average total charges (NIS and MedPAR only).

These measures of utilization and outcomes were selected because they are common in health services research and important for health policy and resource planning analyses.

The NIS-MedPAR comparison included total hospital charges in addition to the three variables noted previously. When comparing NIS records to MedPAR data, only the NIS discharges for which Medicare was the expected primary or secondary payer were examined.

Statistical Testing

Estimates derived from both the NIS and NHDS were based on weighted discharge records from stratified samples. The SAS software PROC SURVEYMEANS was used to compute standard errors for the NIS (see the *NIS Variance Report*[4] for details). The stratifier variable included in the NIS (NIS_STRATUM) was specified as the stratum, and the unique hospital identifier (HOSP_ID) was specified as the cluster variable. A description of the method used for calculating standard errors for the NHDS is provided in Appendix D.

NIS-AHA Comparisons

Tables comparing characteristics from AHA universe hospitals and NIS hospitals (Table 7 and Table 8) appear in Appendix A. All numbers in these tables come from the AHA Annual Survey; no significance tests were performed for these comparisons because the AHA is a census of hospitals, not a sample. Therefore, the comparison statistics have no associated sampling error.

Significance tests were conducted for the discharge comparisons of AHA counts and NIS estimates (Table 9 - Table 11). The AHA data are a population, based on the annual AHA survey, so a one-sample *t*-statistic was computed for these comparisons. AHA discharges represent the survey counts adjusted for the number of well newborns. An estimate of the average length of stay (ALOS) was obtained from the AHA by dividing the total number of days by the total number of discharges reported in the 2003 AHA survey of hospitals.

Same-day discharges from the NIS were recorded with length of stay equal to zero. However, for comparisons with AHA statistics, the length of stay measures for NIS same-day discharges were changed to one day. The standard error for the NIS estimates used in these calculations was generated by the SURVEYMEANS procedure.

In order to assess the extent to which hospitals invested in technology, we created a high-technology index based on information from the AHA survey. The index is a simple additive index of the number of selected technologies reported by individual hospitals. The following 10 technologies were included in this index: cardiac catheterization, computerized tomography (CT) scanner, neonatal intensive care unit, magnetic resonance imaging (MRI), open heart surgery, organ transplant services, x-ray radiation therapy, extracorporeal shock wave lithotripsy, coronary angioplasty, and positron emission tomography (PET) scanner. These high technology services were identified by Spetz and Baker (1999)[5] and were used to assess the impact of managed care on the availability of medical technology.

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[4] http://www.hcup-us.ahrq.gov/reports/CalculatingNISVariances200106092005.pdf

[5] Spetz, J. and Baker, L. *Has Managed Care Affected the Availability of Medical Technology?* Public Policy Institute of California, 1999. http://www.ppic.org/content/pubs/R_599JSR.pdf (Accessed December 16, 2004.)

We compared the mean number of high technology services provided among hospitals selected for the NIS with non-NIS hospitals, as illustrated in Table 12. Comparisons include the high-technology index, along with percentages of hospitals that offer individual services.

NIS-NHDS Comparisons

For each NIS-NHDS comparison, a statistical test determined whether the NIS and NHDS estimates differed significantly. Because the NIS and NHDS estimates were both based on samples, two-sample *t*-tests were performed whenever valid estimates of the NHDS standard error could be made. Because of the limited sample size, valid estimates were not available for all breakdowns of the NHDS data. Please refer to Appendix D for a description of comparison tests and an explanation of restrictions on calculating NHDS sample errors. Differences were reported at the 0.01 and 0.05 significance levels.

Tables comparing NIS and NHDS statistics (Table 13 -Table 17) appear in Appendix B.

NIS-MedPAR Comparisons

Because the MedPAR data represent the population, and not a sample, a one-sample *t*-statistic was computed for these comparisons. The standard error for the NIS estimate used in these calculations was generated by the SURVEYMEANS procedure for the subset of NIS discharges with Medicare identified as the principal payer. Same-day discharges from the MedPAR are recorded with a length of stay equal to one day, while same-day discharges from the NIS are recorded with a length of stay equal to zero. Therefore, for NIS-MedPAR comparisons, NIS length of stay measures for same-day discharges were changed to one day.

Tables comparing NIS and MedPAR statistics (Table 18 - Table 24) appear in Appendix C.

Comparisons by Diagnosis and Procedure Categories

NIS data were compared with both NHDS and MedPAR data across selected diagnosis and procedure groups. For NHDS comparisons, the 25 diagnosis and procedure groups observed most frequently in the NIS were selected. For MedPAR comparisons, the 25 diagnosis and procedure groups selected were those found most frequently on NIS discharges for which Medicare was the expected payer. The diagnosis and procedure groups represent a majority of pertinent discharges. For both the NHDS and MedPAR comparisons, more than one-half of all discharges were represented by the 25 diagnosis groups, while the 25 procedure groups represent nearly 60 percent of discharges that include procedure codes. In addition, MedPAR comparisons included the 25 most frequent Diagnosis Related Group (DRG) codes observed for NIS Medicare discharges.

Grouping of diagnoses and procedures was done with Clinical Classifications Software (CCS). The CCS, formerly known as the Clinical Classifications for Health Policy Research (CCHPR), was developed as a means to categorize diagnoses and procedures into a limited number of clinically relevant categories. Developed for health policy analysis, the CCS can be used for aggregating the thousands of ICD-9-CM diagnoses and procedures into a manageable number of meaningful categories. CCS codes were assigned based on the principal, or first-listed, diagnosis and procedure for each discharge.

RESULTS

Prior to discussing the results of our analyses, we should note that estimates from different samples will not be identical because of sampling variation. Statistically significant differences can be expected for a variety of reasons, including different sampling strategies. In addition, recoding of certain conditions – as sometimes occurs in the NHDS – may lead to significant differences in the affected categories. Finally, the sheer number of tests (more than 800), will produce some statistically significant results purely by chance.[6]

NIS-AHA Comparisons

This section refers to a series of tables in Appendix A (Table 7 - Table 11) comparing:

- Hospitals in the NIS sample to the universe of United States community hospitals
- NIS estimates with AHA annual survey data.

It is important to note that NIS and AHA facilities are not separate entities; NIS hospitals represent a subset of the AHA universe. As such, NIS averages and medians are very similar to AHA statistics. These tables suggest that while NIS hospitals were similar in size to hospitals in the AHA universe, NIS facilities tended to accommodate more patients and perform more procedures. In addition, Medicaid patients were less prevalent in NIS hospitals than in all AHA facilities. These differences may be factors contributing to the observed variations for NHDS and MedPAR comparisons to the NIS.

General Hospital Characteristics

Comparisons of general hospital characteristics revealed some differences, as illustrated in Table 8. In general, NIS hospitals admit and discharge more patients than hospitals in the AHA universe: the NIS averages were slightly higher than the AHA averages. In contrast, the average NIS hospital's length of stay – *not adjusted for hospital size or discharge counts* – was 4.6 percent shorter than the AHA average (when adjusted for well newborns). Because of these two factors, there was little difference in occupancy rates (51.4 percent for NIS hospitals and 51.3 percent for AHA hospitals). In addition, hospital size (as measured by bed count) was comparable for NIS and AHA facilities. NIS hospital size was only modestly larger than AHA hospital size (155.1 beds, compared to 152.7 beds), while the median NIS hospital was slightly smaller than the median AHA hospital.

Activity at NIS hospitals tended to be higher than in the AHA universe, as reflected in the following outcomes:

- Discharges from NIS hospitals were slightly higher than equivalent statistics for the AHA universe.

[6]While some type of correction for the number of tests could be applied, given the large number of tests, this would greatly increase the risk of a Type II error, that is, tests would fail to show significant differences that might indeed be true.

- Births at NIS facilities were slightly higher than the AHA count (869 births per hospital in the NIS, compared with 797 in the AHA universe).

- Inpatient surgeries at NIS facilities were slightly higher than the AHA total.

Along with the higher level of activity found at NIS facilities, staffing and expenditures were also generally higher than rates observed across the AHA hospitals. Overall employment, as measured by full-time equivalent (FTE) counts, was four percent higher at NIS hospitals. Adjusting for size and usage also demonstrated higher staffing levels in NIS facilities:

- FTEs per bed were slightly higher in NIS hospitals.

- Registered Nurse FTEs per 1,000 patient days were slightly higher in NIS facilities.

Table 8 also shows that NIS hospitals tended to spend more than hospitals in the AHA universe. Even when adjusted for hospital size (bed counts), expenses at NIS hospitals were higher than AHA averages. Compared to AHA hospitals, NIS hospital spending was slightly higher on the four financial measures:

- Total expenditures

- Expenditures per bed

- Total hospital payroll

- Hospital payroll per bed.

Discharge and Average Length of Stay Comparisons

Table 9 through Table 11 contrast NIS discharge and average length of stay estimates with AHA statistics. These tables present analyses across a number of categories: overall, by region, by hospital control, by bed size within hospital control, by location and teaching status, and by hospital size within location and teaching status.

Nearly all NIS discharge estimates closely align with the discharge counts from the AHA survey. This is not surprising, because NIS sampling strata and NIS discharge weights were based on AHA annual survey results. The AHA-derived sampling weights in the NIS yield discharge counts consistent with the AHA universe, overall, by region, and for most categories of hospital control and type. Of the 35 discharge comparisons shown in Table 10, only one significant difference was observed: the NIS discharge estimate for proprietary hospitals with more than 500 beds was moderately larger than the AHA total.

For average length of stay (ALOS), the NIS differs from the AHA in nearly one-third of the comparisons. Overall, the NIS ALOS estimate was slightly longer than the AHA statistic. Differences were observed in regional comparisons for the South and West.

Most ALOS comparisons on hospital control and bed size were consistent between the NIS and the AHA. Where differences were found, the NIS estimate was slightly longer than the AHA average. Affected categories were:

- Private, non-profit hospitals (overall, 10-199 beds, 300-499 beds, and 500+ beds)
- Proprietary hospitals with 500+ beds.

NIS ALOS estimates generally agree with AHA statistics for hospital location, teaching status, and size. Of the 12 ALOS comparisons, only four significant differences were observed. With one of the differences – for small rural hospitals – the NIS estimate was slightly shorter than the AHA statistics. For urban teaching hospitals, the NIS estimate was slightly longer than the AHA length of stay calculation (overall, medium hospitals, and large hospitals).

Specialty and Technology Services

Some differences between the NIS and the universe of AHA hospitals may be caused by the fact that the sampling frame for the NIS is less than the universe of all U.S. hospitals. Specifically, the NIS might include hospitals that employ more technologically-intense services. To examine this idea, we compared NIS hospitals to non-NIS hospitals across a number of specialty and technology-intensive services, and results are depicted in Table 12. This table includes a simple (additive) index of technologies reported by individual hospitals. The technology services considered in this analysis were identified by Spetz and Baker (1999) to assess the impact of managed care on the availability of medical technology. The following 10 services were included in this high-technology index:

1. Cardiac catheterization
2. Computerized tomography (CT) scanner
3. Neonatal intensive care unit
4. Magnetic resonance imaging (MRI)
5. Open heart surgery
6. Organ transplant services
7. X-Ray radiation therapy
8. Extracorporeal shock wave lithotripsy
9. Coronary angioplasty
10. Positron emission tomography (PET) scanner.

Differences between NIS and non-NIS hospitals were generally small. The high-technology index count was 3.11 services for NIS hospitals and 2.91 services for non-NIS facilities. This was the cumulative effect of many slight differences. Nine of the 10 services that comprise the index were more prevalent in NIS hospitals. These differences were generally small: around two percentage points. The largest areas of difference included the following three services:

- Open heart surgery unit
- Coronary angioplasty unit
- Positron emission tomography (PET) scanner.

In addition to the high-technology index, Table 12 also examines a handful of other specialty services and units within hospitals. For three of these measures, the specialty units were more prevalent in non-NIS hospitals (Pediatric Specialty Hospitals, Rehabilitation Units, and Alcohol/Chemical Dependency Units). The other two specialty units (Trauma Centers, and Emergency Departments) were more often found within NIS facilities. In particular, Emergency Departments were more widespread among NIS hospitals as compared with non-NIS facilities.

NIS-NHDS Comparisons

NIS and NHDS estimates agreed in overall comparisons and across patient categories. This was also true for most hospital comparisons and specific diagnosis and procedure categories. Overall, agreements were observed for 72 percent of the discharge comparisons and 98 percent of the average length of stay (ALOS) comparisons. The degree of consistency for in-hospital mortality rates was also high: no significant differences were found with region and patient categories, and estimates agreed for 76 percent of hospital category comparisons. Of the NIS-NHDS differences discovered, most occur in diagnosis and procedure groupings. Appendix B includes Table 13 through Table 17, which provide comparisons of NIS and NHDS estimates. The following sections describe these tables in more detail.

Overall and Regional Comparisons

Overall and by region, no statistically significant differences emerged between the NIS and NHDS data for discharges, ALOS, or in-hospital mortality rates (Table 13). ALOS comparisons could not be made for the Northeast and Midwest because a reliable standard error for the NHDS estimate could not be determined. However, the magnitudes of the differences between the NIS and NHDS estimates in these regions were small and appear consistent with the non-significant differences shown in other regions.

Comparisons by Hospital Characteristics

NIS and NHDS estimates were similar for each of the three hospital control/ownership categories. However, some significant differences for discharge estimates were discovered between the NIS and NHDS in the bed size groupings within control/ownership categories (Table 14), particularly for private non-profit hospitals.

It is likely that these differences were caused by the composition of the two samples: a greater proportion of the NIS discharges originate in larger hospitals, while a larger share of NHDS discharges originate in smaller hospitals. Figure 2 through Figure 4 illustrate numbers of discharges from the AHA, NIS, and NHDS. These charts reveal that NIS discharge statistics generally agreed with AHA numbers – an expected outcome since NIS discharges are weighted within each stratum to AHA discharge counts. NHDS discharge estimates tended to over-estimate discharges from small hospitals (1-99 beds) and under-estimate discharges from very large hospitals (500+ beds), when compared with AHA counts.

Because of these discrepancies in sample composition, significant differences exist in discharge count comparisons by hospital bed size. Significant differences occur with eight of the 14 discharge comparisons by hospital bed size within control/ownership categories. The NIS estimate was lower than the NHDS figure in four cases (categories with fewer than 300 beds) and higher in the four other instances (categories with more than 300 beds). In a separate category – proprietary hospitals with 500 or more beds – NIS discharges exceeded the NHDS statistic, but no comparison was made because the NHDS estimated zero discharges and a valid estimate of standard error was unavailable. In contrast to the zero discharges estimated by the NHDS, the NIS estimate for proprietary hospitals with 500 or more beds was 310,000 discharges. According to the AHA data, there were 474,000 discharges for this category (refer to Table 10).

Figure 2. Estimated Discharges from Public Hospitals, 2003

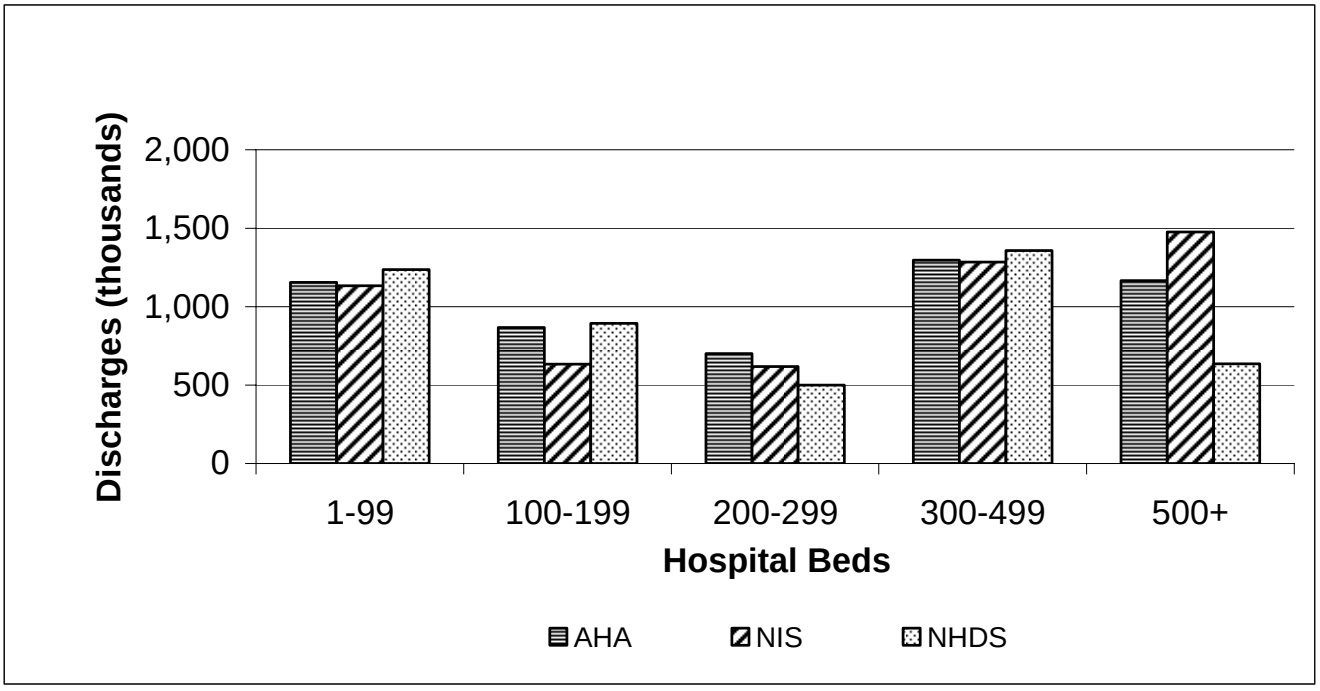


Figure 3. Estimated Discharges from Private Non-Profit Hospitals, 2003

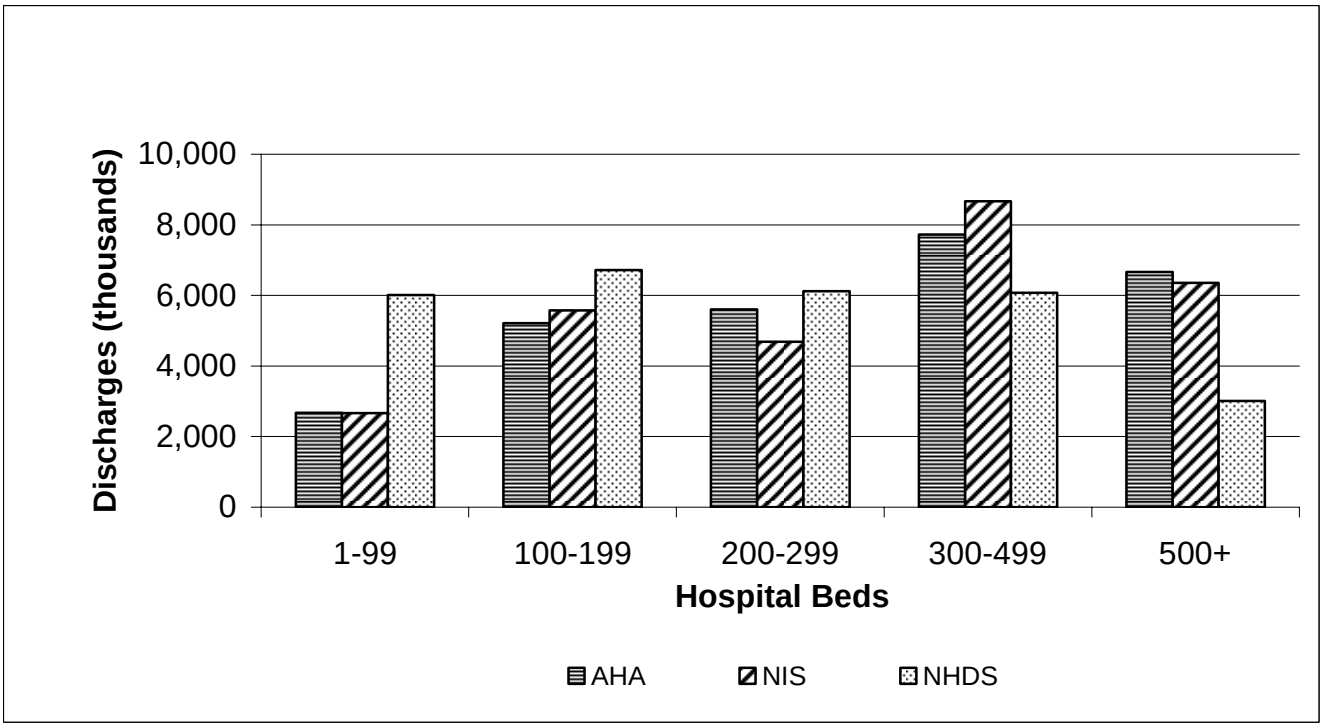
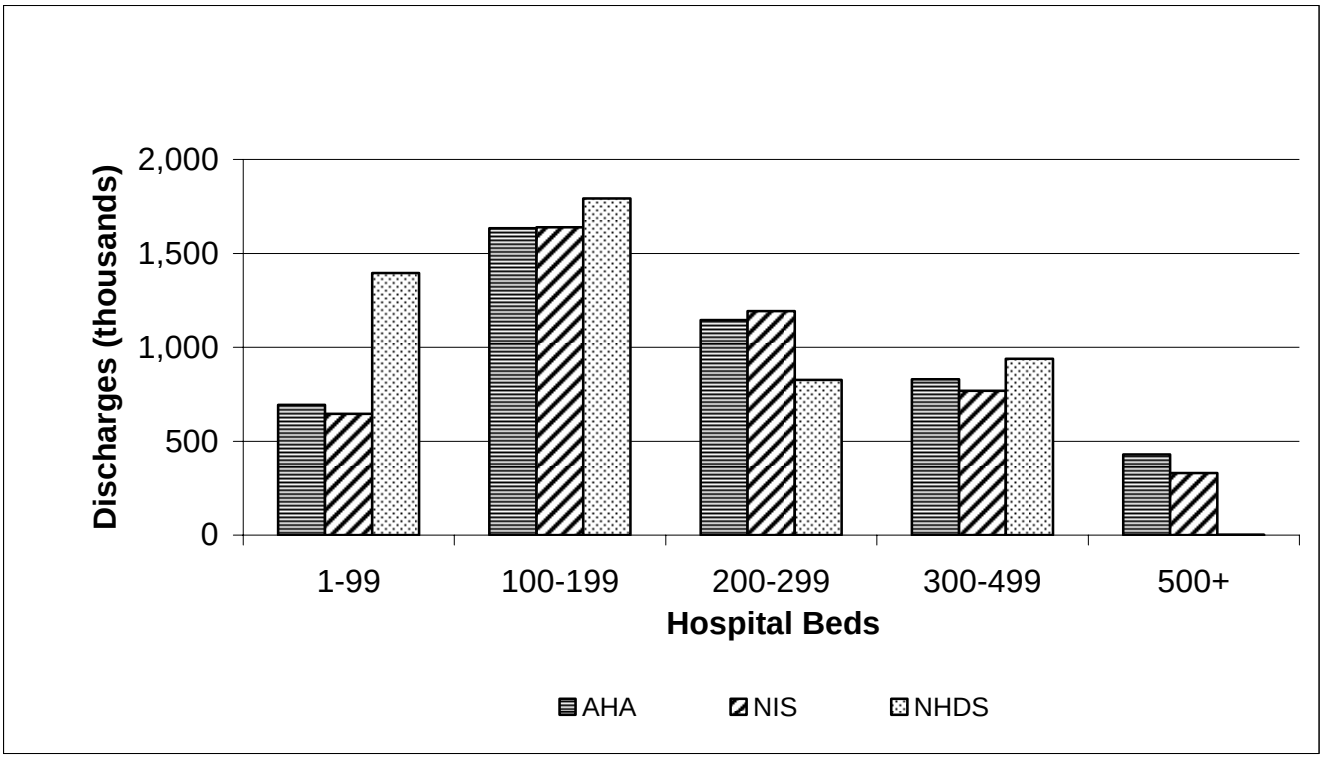


Figure 4. Estimated Discharges from Proprietary Hospitals, 2003



ALOS and in-hospital mortality estimates for hospital categories were consistent. No significant differences were observed with any ALOS estimates, and only four in-hospital mortality estimates were inconsistent (Table 14). Small differences – less than one percentage point – were observed for:

- Public hospitals with 500+ beds (larger NIS estimate)
- Proprietary hospitals with 100-199 beds (larger NIS estimate)
- Proprietary hospitals with 200-299 beds (smaller NIS estimate)
- Proprietary hospitals with 300-399 beds (smaller NIS estimate).

No comparison was possible for proprietary hospitals with more than 500 beds because standard error estimates were unavailable for the NHDS statistics: the NHDS reported no discharges from this type of hospital.

Comparisons by Patient Characteristics

For nearly all comparisons by patient categories (Table 15), agreement existed between the NIS and NHDS estimates. The NIS and NHDS samples aligned closely across most age groups, gender, and payer categories. There were no differences in ALOS estimates, and only one difference with in-hospital mortality rates. Comparisons of discharge estimates differed in only three categories; differences were discovered in relation to two race categories and one principal payer category.

The racial composition of the two samples also differed greatly; this is reflected in the two discrepancies that arose with race categories. The NHDS contains proportionately more discharges for white patients than does the NIS. In contrast, the relative number of discharges for "other" race patients in the NIS is considerably higher than in the NHDS. Both samples include large numbers of discharges without racial information; this information was missing for 27 percent of NIS discharges and 23 percent of NHDS discharges. (Some states do not report race/ethnicity to HCUP: race is missing for 11 states in the NIS).[7] Because the NHDS does not include state information, it is not possible to determine if the pattern of missing information is similar. Looking only at discharges with race information, however, the NIS appears more representative of the U.S. population than the NHDS, as shown in Table 5.

Table 5. Racial Composition of the U.S., NIS Sample, and NHDS Sample, 2003

Race	U.S. Population[8]	NIS Discharges with Race Information	NHDS Discharges with Race Information
White	68%	67%	79%
Black	13%	14%	15%
Other	19%	19%	5%

For "other payer," the NIS statistic was lower than the NHDS estimate by a large amount: approximately 987,000 discharges. Much of that difference seems to stem from discharges without payer information. Missing payer discharges account for 30 percent of "other payer" discharges from the NHDS but less than one percent of NIS discharges.

[7]NIS states for which race was not available include Georgia, Illinois, Kentucky, Maine, Minnesota, Nebraska, Nevada, Ohio, Oregon, Washington, and West Virginia.

[8]U.S. Census Bureau, *Annual Estimates of the Population by Sex, Race and Hispanic or Latino Origin for the United States: April 1, 2000 to July 1, 2003* (NC-EST2003-03).

Comparisons by Diagnosis Category

While comparisons of diagnosis categories revealed more significant differences than any other grouping, there was still a great deal of consistency between the NIS and NHDS samples, as illustrated in Table 16. The majority of comparisons in these categories revealed no significant differences. Where differences were observed, however, they were often quite large. For example, the NIS estimate of discharges for “Other complications of birth, puerperium affecting management of mother” was nearly nine times larger than the NHDS estimate. NIS discharge estimates differed significantly from NHDS estimates for seven of the 24 most common diagnosis categories. The NIS estimate was higher in three categories and lower in the remaining four groupings:

Higher NIS Discharge Estimates	Lower NIS Discharge Estimates
• Nonspecific chest pain • Other complications of birth, puerperium affecting management of mother • Other complications of pregnancy	• Affective disorders • Fluid and electrolyte disorders • Urinary tract infections • Asthma

Of these seven significant differences in the number of discharges, three can be attributed to code reordering in the NHDS (“nonspecific chest pain,” and two pregnancy/delivery categories). The NIS does not change the sequence of diagnosis codes: the first diagnosis listed for each discharge was assigned as the principal diagnosis. This contrasts with the NHDS, where diagnoses were reordered under certain conditions. For example, when a symptom appeared as the first-listed code, the NHDS re-assigned the symptom as a secondary diagnosis. This explains the dramatically higher figure for non-specific chest pain in the NIS sample, as compared with the NHDS (nearly 14 times higher).

Four of the seven significant discharge differences could not be attributed to NHDS coding changes. With each of these four categories, the NIS estimates were lower than NHDS estimates (“affective disorders,” “fluid and electrolyte disorders,” “urinary tract infections,” and “asthma”). Disparities for these four categories have persisted over the past several years of data. For three of the four groups, the discrepancy has been constant over the past five years; however, the difference between NIS and NHDS estimates for “affective disorders” grew during that same period.

Of the 25 most common diagnoses, four relate to pregnancy and delivery, including the category "normal pregnancy." Significant differences emerged for three of these categories. (No statistical comparison was possible for the fourth category, “trauma to the perineum and vulva,” because a valid estimate of the NHDS standard error was not available.) These differences between the NIS and the NHDS can be attributed to reordering of diagnosis codes in the NHDS data.

The NHDS assigns a code of V27 ("outcome of delivery" included in the CCS category of "normal delivery") as the principal diagnosis for all women discharged after delivery, regardless of the original principal diagnosis. As a result, the NHDS estimates for the three common pregnancy/delivery classifications were much lower than the NIS estimates.

Pregnancy/delivery categories were also responsible for the two significant ALOS differences. The NIS estimate was shorter than the NHDS estimate for both "Other complications of birth, puerperium affecting management of mother" and "Other complications of pregnancy".

Significant differences were also discovered with 13 of the 25 mortality contrasts. Two of these differences were related to pregnancy/delivery conditions and reordering that occurred for some NHDS discharges, but the remaining differences are unexplained. Overall, there were nine conditions where the NIS estimate was higher than the NHDS estimate, and four where the NIS estimate was lower:

Higher NIS Mortality Estimates	Lower NIS Mortality Estimates
• Nonspecific chest pain	• Affective disorders
• Other complications of birth, puerperium affecting management of mother	• Spondylosis, intervertebral disc disorders, other back problems
• Cardiac dysrhythmias	• Osteoarthritis
• Complication of device, implant, or graft	• Urinary tract infections
• Fluid and electrolyte disorders	
• Acute cerebrovascular disease	
• Asthma	
• Skin and subcutaneous tissue infections	
• Complications of surgical procedures or medical care	

Comparisons by Procedure Category

Table 17 provides comparison results across groups of procedures. With discharge estimates, NIS statistics differed significantly from NHDS results for four of the 25 categories. In each case, the NIS estimate was significantly higher than the NHDS estimate:

- Other procedures to assist delivery

- Diagnostic cardiac catheterization
- Percutaneous transluminal coronary angioplasty (PTCA)
- Colorectal resection.

No significant differences for ALOS comparisons were found by procedure groups. But NIS-NHDS differences were discovered for 14 of the in-hospital mortality comparisons. The NIS mortality estimate was lower than the NHDS statistic for one-half of these differences.

Higher NIS Mortality Estimates	Lower NIS Mortality Estimates
• Cesarean section • Upper gastrointestinal endoscopy, biopsy • Percutaneous transluminal coronary angioplasty [PTCA] • Hip replacement, total and partial • Alcohol and drug rehabilitation/ detoxification • Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator • Appendectomy	• Diagnostic cardiac catheterization, coronary arteriography • Prophylactic vaccinations and inoculations • Arthroplasty knee • Cholecystectomy and common duct exploration • Coronary artery bypass graft • Laminectomy, excision intervertebral disc • Colonoscopy and biopsy

NIS-MedPAR Comparisons

With the exception of discharge counts, NIS estimates of Medicare measures were generally consistent with MedPAR statistics. NIS discharge estimates were uniformly higher than the MedPAR numbers by approximately 15 percent (Table 18). The foremost cause of this discrepancy seems to be the omission of most managed care clients from the MedPAR. While 12.9 percent of Medicare patients were enrolled in managed care programs, the MedPAR data contain virtually no managed care discharges (only 1,313 out of 12,416,980 total discharges, or 0.01 percent).

File composition was another contributing factor. While the MedPAR represents actual fee-for-service claims paid by Medicare, the NIS-Medicare sample consists of discharges (both fee-for-service and managed care) for which Medicare was the expected payer (either primary or secondary). This may explain the higher NIS counts: the *expected* payer may not be the *actual* payer.

Because the overall NIS estimate of Medicare discharges exceeds the actual number in the MedPAR data, it was not surprising to find that nearly all the NIS discharge estimates were also significantly higher than the corresponding MedPAR totals. Significant differences were observed for 73 percent of the discharge comparisons. This suggests the need for a more useful comparison of discharges, so we have included a test of discharge proportions in the various categories. For most comparisons of discharge proportions, the test revealed few meaningful differences. In fact, proportions were consistent for 67 percent of all categories.

NIS Medicare estimates were also consistent with MedPAR measures of ALOS, in-hospital mortality rates, and average total hospital charges. No significant differences were observed for:

- 78 percent of ALOS comparisons
- 81 percent of in-hospital mortality rate comparisons
- 97 percent of average hospital charge comparisons.

Across hospital categories only a handful of meaningful differences were observed. The tables in Appendix C (Table 18-Table 24) compare NIS Medicare estimates with MedPAR statistics. The following sections refer to these tables.

Overall and Regional Comparisons

Overall, the NIS estimate of Medicare discharges was 14 percent higher than the total number of MedPAR discharges (Table 18). For most Census regions, the NIS estimates were also higher than MedPAR counts, although the difference was not significant in the Midwest. The magnitude of difference was greatest in the West and Northeast; these are the regions with the largest Medicare managed care penetration. When examined from the perspective of proportions (percentage of discharges), significant differences were discovered in the West (the NIS estimate was higher) and in the Midwest (the NIS estimate was lower).

No significant NIS-MedPAR differences were found for ALOS or average total hospital charge measures, either nationally or regionally. For in-hospital mortality rates, the overall NIS estimate was slightly higher than the MedPAR rate. Similarly, the NIS in-hospital mortality rate estimate for the West was higher than the MedPAR rate.

Comparisons by Hospital Characteristics

Two sets of hospital characteristics were compared for Medicare discharges: first, hospital control and number of beds (categories used in the NHDS comparisons); and second, hospital location, teaching status, and size (NIS stratification variables). While nearly one-half of the NIS discharge estimates exceed MedPAR counts, most other statistics, including discharge proportions, were quite similar between the two databases. Statistics agreed in more than 80 percent of the comparisons.

Hospital Control

When exploring the initial dimension of hospital control (ownership), significant differences were observed for NIS estimates of Medicare discharges for public hospitals and private, non-profit hospitals (Table 19), with NIS estimates higher than MedPAR counts. For all other measures (discharge proportion, ALOS, in-hospital mortality, and average total charge), most NIS

estimates were similar to the MedPAR results. Three exceptions demonstrated slight differences: 1) the ALOS estimate for public hospitals where the NIS estimate was shorter than the MedPAR average, 2) the in-hospital mortality rate for private, non-profit hospitals was higher than the MedPAR number, and 3) the in-hospital mortality rate for proprietary hospitals where the NIS estimate was higher than the MedPAR statistic.

When hospital control was examined by number of beds (Table 19), many NIS discharge estimates were actually in agreement with Medicare counts; significant differences were observed for only four of the 15 discharge comparisons by number of beds. Differences in discharge counts include:

- Public hospitals, 1-99 beds (NIS estimate was higher)
- Private non-profit hospitals, 1-99 beds (NIS estimates was higher)
- Private non-profit hospitals, 300-499 beds (NIS estimate was higher)
- Proprietary hospitals, 500+ beds (NIS estimate was lower).

Most discharge proportions were also similar between the NIS and MedPAR databases. Only three significant differences emerged for the hospital control and bed size comparisons. One bed size difference was observed within each control category. In all three cases, the NIS proportion was lower than the MedPAR percentage:

- Public hospitals with 1-99 beds
- Private, non-profit hospitals with 1-99 beds
- Proprietary hospitals with 500+ beds.

For each of the remaining measures – ALOS, in-hospital mortality, and average total charge – NIS and MedPAR statistics were highly similar when control was examined across bed size categories. Of the 15 comparisons, few meaningful differences emerged.

Four significant differences were discovered for average length of stay comparisons, most differences were small:

- For public hospitals with 100-199 beds, the NIS estimate was shorter than the MedPAR average.
- For public hospitals with 300-499 beds, the NIS estimate was shorter than the MedPAR average.
- For proprietary hospitals with 1-99 beds, the NIS estimate was longer than the MedPAR average.
- For proprietary hospitals with 300-499 beds, the NIS estimate was shorter than the MedPAR average.

Analysis also revealed three differences for in-hospital mortality rates with NIS estimates higher than MedPAR rates:

- For proprietary hospitals with 1-99 beds
- For proprietary hospitals with 100-199 beds
- For proprietary hospitals with more than 500 beds

Finally, no significant differences were observed for average total charge:

To summarize the hospital control comparisons, most NIS estimates for hospital control and bed size categories were consistent with equivalent MedPAR statistics. Where differences were observed, there was no apparent pattern. Of the 18 hospital categories, we observed only two groups with more than one significant difference (ignoring comparisons of discharge counts). These two exceptions were:

- Proprietary hospitals with 1-99 beds (the NIS ALOS estimate was longer; the NIS in-hospital mortality rate estimate was higher).
- Proprietary hospitals with more than 500 beds (the NIS discharge proportion estimate was lower; the NIS in-hospital mortality rate estimate was higher).

Hospital Location and Teaching Status

A second set of hospital comparisons examined NIS and MedPAR statistics by two dimensions of hospital type: location and teaching status (Table 20). Most NIS discharge estimates, including statistics for all three hospital types, were significantly higher than the MedPAR counts. However, for discharge proportions, only two substantial differences were observed: compared to MedPAR discharge proportions, the NIS estimate was lower for large rural hospitals, but higher for small rural hospitals.

Comparisons of other measures again revealed consistency between the NIS and MedPAR databases. In overall comparisons of location, teaching status, and size, few significant differences were found.

There were two significant differences in ALOS comparisons:

- The NIS ALOS estimate for rural hospitals was shorter than the MedPAR average.
- The NIS estimate of ALOS for small-sized urban non-teaching hospitals was longer than the MedPAR average.

There were four significant differences with in-hospital mortality rate estimates

- The NIS in-hospital mortality rate estimate was higher than the MedPAR rate for urban, non-teaching hospitals.
- The NIS in-hospital mortality rate estimate was higher than the MedPAR rate for small urban, non-teaching hospitals.

- The NIS in-hospital mortality rate estimate was higher than the MedPAR rate for large urban, non-teaching hospitals.

- The NIS average hospital charge estimate for small urban teaching hospitals was lower than the MedPAR average.

Comparisons by Patient Characteristics

Comparisons by the patient characteristics of race, age, and gender revealed significant differences for most discharge count comparisons and all discharge proportions (Table 21). In addition, significant differences emerged in most comparisons of in-hospital mortality rates. In contrast, nearly all ALOS and average total charge evaluations were consistent between the NIS and MedPAR.

NIS estimates of discharges for whites and blacks were actually lower than MedPAR counts. And unlike comparison by hospital characteristics, discharge proportion differences surfaced for all patient categories of race, age, and gender. The NIS and MedPAR present different mixes of patient characteristics:

- One of every four NIS Medicare discharges lack race information, while less than one percent of MedPAR discharges are missing race information.

- Where race information was available, the NIS, when compared with the MedPAR, includes fewer patients in the “white” category and more patients in the “other” category.

- Of discharges with race information, the proportion of discharges with “other” race in the NIS was nearly 85 percent larger than the percentage in the MedPAR (8.21 percent vs. 4.44 percent). This finding was likely a result of the NIS’ geographic composition: the NIS includes the most racially diverse states in the nation (New York and California) and excludes many of the least diverse states (such as North Dakota).

Relative to MedPAR numbers, the NIS tends to over-estimate patients between 65 and 84 years of age (the age group responsible for approximately two-thirds of Medicare inpatient discharges) and to under-estimate patients younger than 65 and older than 85. While statistically significant, the differences are small.

ALOS and average hospital charge estimates were generally in agreement between the two databases; in nearly every category, no meaningful differences emerged between the NIS and MedPAR numbers. The NIS ALOS estimate was lower than the MedPAR average only where race was unknown. The NIS average charge estimate for unknown race was also lower than the MedPAR average.

Significant differences were observed for most patient category comparisons of in-hospital mortality rates. The only category where the NIS-MedPAR agreement was the age-group 65-74 years. For the other nine comparisons, the NIS in-hospital mortality rate estimate was slightly larger than the MedPAR statistic.

Comparisons by DRG

In comparisons of diagnosis related group (DRG) categories (Table 22), most NIS estimates were consistent with corresponding MedPAR statistics, with the usual exception of discharge

counts. In fact, significant differences were discovered for 22 of the 25 DRG comparisons of discharge counts. The NIS estimate was higher than the MedPAR count in every case; the median difference in number of discharges was 18 percent.

No meaningful differences were observed for average hospital charge comparisons. For DRG comparisons of discharge proportions, ALOS, and in-hospital mortality, the NIS and MedPAR statistics were fairly similar. Most of the differences emerging for these measures were relatively small.

There were eight significant differences for discharge percentages. The NIS estimate was slightly lower in two instances and higher in six other instances. There were also six significant differences with ALOS comparisons. In each instance, the difference was small, with NIS estimates approximately two percent shorter than the MedPAR average. Only one in-hospital mortality rate comparison revealed a significant difference (rehabilitation).

Of the few meaningful discrepancies found, no pattern emerged with these DRG comparisons. In only four categories were three or more significant differences discovered, one of which was discharge counts.

Comparisons by Diagnosis Category

As with DRG comparisons, most NIS outcome estimates for diagnosis categories were consistent with MedPAR measures (Table 23). The exception, as with other NIS-MedPAR contrasts was discharge counts. Significant differences were observed between NIS estimates of Medicare discharges and MedPAR discharges by count for 21 of the 25 principal diagnosis categories. The median difference was 17 percent.

Comparisons for other measures indicated a high degree of consistency between the NIS and MedPAR statistics. All NIS estimates of average hospital charge were consistent with MedPAR averages. The 25 diagnosis category comparisons revealed few significant differences for any of the other three measures (discharge proportions, ALOS, and in-hospital mortality rates). Key differences were discovered in the following areas:

- Ten significant differences emerged in relation to discharge proportions, six with higher NIS estimates and four with lower estimates.

- Seven ALOS differences were observed, with the estimated NIS stays significantly shorter than the MedPAR averages in six cases. The absolute discrepancies were relatively small in all cases.

- For in-hospital mortality rate comparisons, one significant difference emerged. The NIS estimate for “rehabilitation care, fitting of prostheses” was more than twice as high as the MedPAR rate, although the absolute difference was less than one-half of a percentage point (0.66 for the NIS estimate, as compared to 0.23 for the MedPAR number).

Although CCS diagnosis categories and DRG categories do not necessarily correspond, the two sets of comparisons were very similar. Significant differences in one table were often mirrored in the other:

- For the DRG "heart failure and shock" and the diagnosis "congestive heart failure, nonhypertensive," the NIS estimates of discharge proportion were slightly higher than the MedPAR ratio.

- For the DRG "simple pneumonia & pleurisy" and the diagnosis "pneumonia," the NIS estimates of discharge proportion were higher than the MedPAR ratio, and both NIS ALOS estimates were shorter than the MedPAR average. All differences were small

- For the DRG "rehabilitation" and the diagnosis "rehabilitation care, fitting of prosthesis, and adjustment of devices," both of the NIS in-hospital mortality rate estimates were higher than the MedPAR rate.

- For the DRG "psychosis" and the diagnosis "affective disorders," the NIS estimates of discharge proportion were moderately lower than the MedPAR results.

Comparisons by Procedure Category

Procedure group comparisons revealed slightly greater variability in discharge counts with a somewhat wider range in differences than that observed for diagnosis or DRG categories. As depicted in Table 24, 18 NIS discharge estimates by procedure significantly exceeded the corresponding MedPAR total; the median difference was 13 percent.

For the majority of other measures, the NIS estimates were consistent with MedPAR statistics. Only a handful of differences in other outcomes were observed across the 25 most frequent procedure categories, all differences were relatively small:

- For discharge proportions, five procedure categories revealed NIS estimates that were significantly different from the MedPAR statistics. In one instance ("colonoscopy and biopsy"), the NIS estimate exceeded the MedPAR proportion. With four other differences, the NIS estimate was lower.

- For ALOS comparisons, five differences were statistically significant. The NIS-estimated stay for "debridement of wound, infection or burn" was longer than the MedPAR average. In four other procedure categories, the NIS estimate was shorter than the MedPAR stay.

- For in-hospital mortality rate comparisons, only one significant difference emerged. The estimated NIS rate was more than twice as high for "physical therapy." The difference appears large, but the mortality rates were very low and the absolute difference was approximately one-half of a percentage point. (The MedPAR in-hospital mortality rate was 0.45 percent and the NIS estimated rate was 1.01 percent.)

- For average hospital charge comparisons, only one significant difference emerged. For "laminectomy, excision intervertebral disc," the NIS estimate was larger than the MedPAR average.

Finally, only one of the procedure categories revealed more than one significant difference among the three outcome measurements of discharge proportion, ALOS, and in-hospital mortality rate. For the category “colonoscopy and biopsy,” significant differences were observed for both discharge proportion and ALOS comparisons.

DISCUSSION

These results indicate that estimates from the 2003 NIS were generally similar to statistics from the 2003 NHDS and the 2003 MedPAR. Most NIS estimates were consistent with NHDS estimates for discharges and in-hospital mortality rates. Additionally, nearly all of the average length of stay estimates were consistent in relation to the two samples. Differences occurred primarily when comparing estimates for specific diagnosis or procedure groups. A critical difference between the 2003 NIS and 2003 NHDS data was that the NHDS reordered some diagnosis codes (in an effort to achieve more uniformity within that sample). As a result of these coding alterations, some significant differences appear in the findings related to diagnosis categories.

Comparisons were made for as many as four outcomes across dozens of different categories. While some differences were observed, few patterns were discernable. In our analysis of nearly 100 comparisons, only one category exhibited discrepancies across data sources. For the diagnosis "affective disorders" – NIS discharge estimates were lower than both the NHDS estimate and the MedPAR count (by 19 and 11 percent, respectively).

Most NIS estimates were consistent with MedPAR statistics. However, one pattern was discovered throughout the NIS-MedPAR comparisons: overall NIS estimates of Medicare discharge counts were 14 percent higher than MedPAR estimates. The likely reason for this difference is the absence of most managed care discharges from the MedPAR data. This discrepancy was exaggerated because the NIS was drawn from states that have higher managed care penetration than the national average. In contrast, most average length of stay, in-hospital mortality, and average total charge estimates from the NIS were consistent with the corresponding MedPAR statistics.

The key difference between the NIS and the databases with which it was compared relates to geographic scope. Both the NHDS and the MedPAR are national in coverage; MedPAR data include all Medicare-paid, fee-for-service discharges in the United States, while NHDS data were gathered from a sampling frame of all 50 states plus the District of Columbia. In contrast, the 2003 NIS was drawn from only 37 states (as shown in Table 1); these states comprise more than 84 percent of all community hospital discharges in the United States. This difference may be a factor for researchers who require comprehensive geographic representation. Some significant differences between the states excluded and included in the NIS may offer explanations for several of the observed differences.

NIS states are disproportionately the more densely populated states. The average population density of NIS states was 125.8 persons per square mile in 2003. This compares with a national average of 81.4 persons per square mile and an average population density for non-NIS states of 29.0 persons per square mile. Of the 10 most densely populated states, all but two were included in the NIS. These NIS states, and their rank in terms of population density order, are: New Jersey (1), Rhode Island (2), Massachusetts (3), Connecticut (4), Maryland (5), New York (7), Florida (8), and Ohio (9). At the other end of the spectrum, only four of the 10 least populous states were included in the NIS: Utah (41), Nebraska (42), Nevada (43), and South Dakota (46).[9]

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[9]Source of state rankings: *State and Metropolitan Area Data Book - 5th Edition* and the Annual Estimates of the Population for the United States. December 22, 2005. http://www.census.gov/popest/states/tables/NST-EST2005-01.xls

Because of these population differences between NIS and non-NIS states, the NIS sampling frame begins with few hospitals in sparsely populated areas. Even weighting the discharges from rural states does not adequately account for the remote areas of the country, which include a disproportionate number of the smallest hospitals. The most rural states included in the sample, Nevada and South Dakota, have population densities of 20.4 and 10.1 persons per square mile, respectively. This contrasts with population densities of 1.1, 5.2, and 6.3 persons per square mile in Alaska, Wyoming, and Montana, which are not included in the sample.[10]

One impact of the specific subset of states selected for the NIS was an overrepresentation of Medicare patients in managed care. In the 37 states included in the 2003 NIS, the market penetration of managed care providers for Medicare enrollees averaged 13.5 percent. In contrast, for the 13 states not included in the NIS, the mean market penetration of managed care providers was only 5.5 percent. Table 6 examines managed care penetration by region of NIS and non-NIS states. In 2003, Medicare managed care market penetration in all regions was higher in NIS states than in non-NIS states; the greatest penetration discrepancies were observed in the West and Northeast.[11] This finding was consistent with the hypothesis that the MedPAR under-represents total stays by omitting most managed care discharges.[12]

Table 6. Medicare Managed Care Market Penetration by Region

	Non-NIS States		NIS States		All States in Region	
	Mean	**N**	**Mean**	**N**	**Mean**	**N**
Northeast	0.1%	1	16.2%	8	15.7%	9
South	5.4%	6	8.2%	10	7.6%	16
Midwest	0.7%	1	6.6%	11	6.5%	12
West	8.0%	5	25.8%	8	24.4%	13

This exclusion by MedPAR was inconsequential in those areas with minimal market penetration by managed care providers; its impact was greater for regions in which managed care participation by Medicare patients was higher. Because the NIS includes discharges for all Medicare managed care patients and not just fee-for-service patients, it may be preferable to the MedPAR file for estimating total Medicare discharges.

[10]None of these three states was eligible for HCUP inclusion because none collected all-payer hospital discharge data for the year 2003.

[11]The NIS includes all Northeast states except Maine.

[12]Source: *CMS State County file, 2002-2005* http://www.cms.hhs.gov/HealthPlanRepFileData/Downloads/SC-2003.zip accessed 8/2/2006.

NIS Strengths

While the previous discussion focused on differences between the NIS and other data sources, it should be noted that these differences are only of concern when there is a reason to expect that geographic region might relate to the variable of interest. We must emphasize that the NIS provides a large sample size that tends to yield estimates with much smaller standard errors than does a sample such as the NHDS. Without a sample of several million, as provided by the NIS, estimates for less common procedures and diagnoses are unreliable. While the NIS may over-represent urban areas, the prevalence of higher-density states in the NIS yields data on atypical conditions rarely included in a smaller sample.

NIS discharge estimates were quite similar to AHA numbers, regardless of the hospital characteristics. NIS statistics were generally parallel to NHDS estimates, as well. When estimating ALOS and in-hospital mortality for the nation, or within any major categories, NIS rates were consistent with the NHDS data. Because NIS estimates have greater precision – the result of the large sample size – it may be preferred for certain analyses based on relatively uncommon conditions. Furthermore, the NIS contains total hospital charges, while the NHDS does not. For analysis involving charges on all payers, the NIS is the only choice.

The NIS provides a large sample of Medicare discharges both in managed care and fee-for-service plans; it would therefore be the choice of researchers who wished to include all discharges, regardless of payment type. Inclusion of Medicare managed care discharges leads to discrepancies in estimated discharge counts, but most other NIS Medicare estimates were similar to MedPAR statistics, particularly with respect to comparisons by hospital characteristics.

NIS Weaknesses

NIS discharge estimates vary from NHDS estimates on the dimension of hospital size; the NIS includes more discharges from large hospitals than the NHDS. In contrast, NIS discharge estimates were similar to AHA survey results. Because the NHDS uses a more geographically complete sampling frame, however, that database might be preferable for researchers, in certain cases.

The NIS also contains significant numbers of discharges for which race was missing (27 percent). While the NHDS also suffers from this problem (23 percent of discharges without race), the MedPAR includes an insignificant number of discharges without race information.

Because of the limitations of the NIS sampling frame, the NIS exaggerates the discrepancy between total Medicare discharges and the MedPAR's primarily fee-for-service population. The MedPAR database provides no estimate for managed care participants, while the NIS database may over-estimate the number of discharges in managed care.

Contrasting Findings from the Previous NIS Comparisons

NIS-NHDS Evaluations

Estimates of most outcome measurements from the 2003 NIS and NHDS data were consistent, as were previous evaluations. Overall, the discharge and ALOS estimates from these two databases were similar for 2000, 2001, 2002, and 2003. NIS and NHDS estimates of ALOS were almost indistinguishable. Of more than 80 comparisons, few significant ALOS differences

were observed in any year: by year, there were four differences with the 2000 data, two with the 2001 data, one with the 2002 data, and two with the 2003 data. NIS and NHDS discharge estimates from 2000 through 2003 were also similar, although in all years, the data sources generated divergent statistics for large and small hospitals.

Similarly, in-hospital mortality rate estimates for 2003 data were consistent with previous data across hospital and patient categories. Of all hospital comparisons, four significant mortality differences were observed, and only one meaningful mortality rate differences was discovered for patient categories. These outcomes were similar to the 2001 and 2002 analysis and represented improvements over the 2000 assessments. For diagnosis and procedure comparisons, the 2003 in-hospital mortality rate evaluations were similar to comparisons for 2002 and 2000 (2001 now appears to be an aberration). No trend appears with these differences. The number of categories with lower NIS rates was about the same as the number of categories with higher NIS rates.

Discrepancies in in-hospital mortality rate comparisons may be related to differences in the hospitals included in the two samples. The NIS tends to have better representation from larger hospitals and better captures less common diagnoses, which tend to have higher mortality rates.[13] Furthermore, because the NIS retains all discharges from a hospital, it was not possible to exclude some of the higher mortality cases that might have been treated in skilled-nursing facilities and other long-term care units within the hospital. Differences may also be linked to a hospital's teaching status or location, although this cannot be verified because the NHDS does not report this information.

NIS-MedPAR Evaluations

As discussed previously, NIS Medicare discharge estimates were higher than MedPAR counts for almost all categories. Inconsistencies were noted for nearly all discharge counts; the overall discrepancy rate was 14 percent. This was also true for earlier years: the difference in 2002 was 20 percent, the difference in 2001 was 21 percent, the difference in 2000 was 22 percent, and in 1999, the figure was 12 percent. The growth from 1999 to 2000 may have been caused by increases in Medicare managed care market penetration, particularly within NIS states, while the slow decline after 2000 reflects a decrease in market penetration in later years.

While there were differences for discharge statistics, other estimates were similar between the two data sources. Most NIS estimates of discharge proportions, ALOS, in-hospital mortality rates, and average total hospital charge were comparable to MedPAR statistics. Mortality rates were quite similar to earlier years.

The overall ALOS statistics were consistent for the 2003 NIS and MedPAR data; ALOS comparisons were similar to the 2002 results, which demonstrated fewer differences than in previous reports. These findings for the latest three years demonstrate fewer differences when compared with the 2000 data. The overall NIS Medicare estimate of ALOS in 2000 was significantly shorter in duration than the MedPAR average. Finally, average hospital charge comparisons revealed few differences in any year.

[13]The average in-hospital mortality rate for discharges associated with the 50 most frequent diagnosis groups was 2.1 percent. This compares to an average of 3.9 percent for discharges associated with one of the 50 least frequent diagnosis groups.

Conclusion

Each of the data sources discussed has its strengths and weaknesses, and each may be the preferred choice for different research questions. The NIS offers a large sample that enables study of low incidence disorders and less common procedures; NIS estimates can be calculated for literally thousands of special sub-populations that may be of interest to researchers. In addition, NIS hospitals accurately reflect the universe of United States hospitals, particularly the relative mix of large and small hospitals. Therefore, the NIS may be more appropriate when hospital type and size are important considerations.

The NHDS and MedPAR, however, both offer data drawn from all 50 states, rather than the 37 states that make up the NIS. Where a comprehensive geographic representation is more important than a large sample size, and the question under study requires all age groups, the NHDS might be preferable. In the same situation, if only Medicare clients are of interest, the MedPAR data set might be preferable.

The NIS is not without bias: specifically, it over-represents large hospitals and urban states and under-represents smaller hospitals and rural/frontier states. It does, however, provide a useful data source for answering many research questions. The source of the few differences that do exist between the NIS and NHDS are areas that warrant further investigation. The relationship between hospital size and treatment patterns is an example.

As for which of the data sources discussed is preferable or better, the answer depends on the needs of the researcher. The intended use of the data is the most critical factor in determining which data source will be most valuable. In general, the NIS estimates of variables essential to health care policy – including in-hospital mortality, inpatient population size, length of stay, and costs – are accurate and precise. Statistics can be calculated for large groups ranging from the inpatient population of the United States, as well as for small subsets featuring specific conditions. The characteristics documented in this report suggest that the 2003 NIS is a valuable tool for researchers and policy makers alike.

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APPENDIX A: NIS-AHA TABLES

Table 7. Number of Hospitals in the NIS Frame and the AHA Universe, 2003

	Hospital Counts		
	2003 NIS Frame[1] (Weighted)	2003 NIS Frame[1] (Unweighted)	2003 AHA Universe
U.S.	4,836	994	4,891
Region			
Northeast	657	134	657
Midwest	1,404	286	1,404
South	1,878	385	1,878
West	897	189	897
Hospital Control			
Public	1,118	233	1,128
Private, Non-Profit	2,981	609	2,947
Proprietary	737	152	761
Location / Teaching Status			
Rural Hospitals	2,171	444	2,171
Small Hospitals	930	188	1,333
Medium Hospitals	560	115	469
Large Hospitals	681	141	369
Urban, Non-Teaching	1,858	384	1,858
Small Hospitals	673	139	685
Medium Hospitals	576	119	613
Large Hospitals	609	126	560
Urban, Teaching	807	166	807
Small Hospitals	249	52	232
Medium Hospitals	253	51	235
Large Hospitals	305	63	340

Note: All values are from the AHA Annual Survey of Hospitals, based on hospital self-report. Significance tests were not performed because AHA numbers were not sample statistics.

[1]The 2003 frame contains 35 states.

Table 8. AHA Universe and NIS Hospital Comparisons, 2003

AHA Survey Data Element, 2003	Mean Hospital Values		Median Hospital Values	
	NIS Hospitals	Universe	NIS Hospitals	Universe
Hospital Discharges[1]	8,317.34	7,800.89	4,362.00	4,138.00
Average Length of Stay[2]	4.75	5.18	3.91	4.05
Births	869.42	796.86	331.00	303.00
Percent Medicare Days	54.04	54.06	54.90	54.97
Percent Medicare Discharges[1]	44.53	44.55	42.98	43.27
Percent Medicaid Days	14.75	14.55	12.56	12.32
Percent Medicaid Discharges[1]	14.25	14.25	13.46	13.43
Hospital Beds	157.03	150.92	90.00	92.00
Occupancy Rate	52.17	51.80	53.40	53.01
Inpatient Surgeries	2,132.09	2,039.54	1,010.50	998.00
FTE[3]	865.96	839.91	429.50	410.50
FTE[3] per Bed	5.32	5.23	5.01	4.80
RN FTE[3] per 1000 Patient Days	3.12	3.06	2.92	2.89
Intern-Resident FTE[3] per 100 Beds (Acute Units)	5.78	5.70	0.00	0.00
Total Hosp. Expenses [dollars]	95,188,680	91,152,562	44,027,639	39,101,030
Hosp. Expenses/Bed [dollars]	539,806	520,966	500,859	479,156
Total Hospital Payroll [dollars]	38,773,096	37,568,156	18,080,889	16,141,261
Hosp. Payroll per Bed [dollars]	222,281	213,653	203,746	193,794

Note: All values are from the AHA Annual Survey of Hospitals, based on hospital self-report. Significance tests were not performed because AHA numbers were not sample statistics.

[1]Reported discharges adjusted to include "well newborns."

[2]Reported Inpatient Days divided by discharges adjusted to include "well newborns."

[3]Full-time equivalents.

Table 9. NIS and AHA Comparisons Overall and by Region, 2003

	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)	
	NIS	**AHA**	**NIS**	**AHA**
Overall	38,220 (700)	38,667	4.62 (0.03)	4.51**
Region				
Northeast	7,561 (346)	7,560	5.17 (0.09)	5.12
Midwest	8,823 (346)	8,823	4.35 (0.06)	4.29
South	14,549 (412)	14,549	4.64 (0.05)	4.52*
West	7,286 (284)	7,286	4.33 (0.08)	4.09**

Note: All values are from the AHA Annual Survey of Hospitals, based on hospital self-report. AHA discharges and lengths of stay were adjusted to include well newborns.

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 10. NIS and AHA Comparisons by Hospital Control, 2003

Hospital Control	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)	
	NIS	AHA	NIS	AHA
Public				
Total	5,331 (556)	5,139	4.67 (0.12)	4.70
1-99 Beds	1,162 (77)	1,113	3.73 (0.09)	3.75
100-199 Beds	794 (116)	882	4.05 (0.12)	4.22
200-299 Beds	411 (170)	591	4.66 (0.40)	4.44
300-499 Beds	1,183 (249)	1,193	4.93 (0.14)	5.02
500+ Beds	1,778 (306)	1,357	5.39 (0.27)	5.63
Private Non-Profit				
Total	27,806 (858)	28,184	4.63 (0.04)	4.47**
1-99 Beds	2,828 (136)	2,695	3.70 (0.06)	3.76
100-199 Beds	5,249 (298)	5,264	4.30 (0.07)	4.10*
200-299 Beds	5,077 (492)	5,568	4.50 (0.08)	4.42
300-499 Beds	8,583 (683)	7,769	4.68 (0.06)	4.47**
500+ Beds	6,067 (745)	6,886	5.39 (0.10)	5.09**

Hospital Control	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)	
	NIS	AHA	NIS	AHA
Proprietary				
Total	5,082 (367)	4,895	4.50 (0.08)	4.46
1-99 Beds	722 (89)	768	4.21 (0.21)	4.27
100-199 Beds	1,738 (147)	1,679	4.29 (0.13)	4.26
200-299 Beds	1,280 (195)	1,140	4.51 (0.20)	4.46
300-499 Beds	1,031 (174)	833	4.79 (0.08)	4.74
500+ Beds	310 (11)	474**	5.39 (0.13)	4.98**

Note: All values are from the AHA Annual Survey of Hospitals, based on hospital self-report. AHA discharges and lengths of stay were adjusted to include well newborns.

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 11. NIS and AHA Comparisons by Hospital Characteristics, 2003

	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)	
	NIS	**AHA**	**NIS**	**AHA**
Location / Teaching Status				
Rural – Total	5,803 (234)	5,803	3.93 (0.04)	4.00
1-49 beds	1,323 (61)	1,348	3.42 (0.05)	3.62**
50-99 beds	1,719 (140)	1,476	3.77 (0.06)	3.74
100+ beds	2,760 (277)	2,978	4.27 (0.07)	4.30
Urban, Non-Teaching – Total	15,979 (402)	15,978	4.44 (0.04)	4.36
1-99 beds	1,615 (114)	1,661	4.13 (0.14)	4.07
100-199 beds	4,776 (234)	4,737	4.25 (0.07)	4.14
200+ beds	9,588 (405)	9,580	4.59 (0.06)	4.51
Urban, Teaching – Total	16,437 (523)	16,437	5.03 (0.06)	4.82**
1-299 beds	2,478 (315)	2,353	4.47 (0.13)	4.45
300-499 beds	4,796 (534)	4,268	4.85 (0.10)	4.63*
500+ beds	9,162 (777)	9,815	5.28 (0.09)	5.00**

Note: All values are from the AHA Annual Survey of Hospitals, based on hospital self-report. AHA discharges and lengths of stay were adjusted to include well newborns.

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 12. Specialty Services at NIS and Non-NIS Hospitals, 2003

	NIS Hospitals	Non-NIS Hospitals
Technology and Resource Intensive Units or Services		
High Tech Index (mean)	3.11	2.91
High Tech Index (median)	2.00	2.00
Percent with Unit or Service		
Neonatal ICU[1]	18.31	18.91
Cardiac Catheterization Unit[1]	36.32	34.18
CT Scanner[1]	81.29	75.65
MRI[1]	54.63	51.83
Open Heart Surgery Unit[1]	22.23	19.68
Transplant Service[1]	7.44	7.13
X-Ray Radiation Therapy Unit[1]	25.25	24.04
Extracorporeal Shock Wave Lithotripsy[1]	22.33	20.48
Coronary Angioplasty Unit[1]	27.67	25.07
PET Scanner[1]	15.39	13.96
Pediatric Specialty Hospital	1.11	1.77
Rehabilitation Unit	24.85	25.66
Alcohol/Chemical Dependency Services	8.65	9.42
Trauma Center	30.78	29.64
Emergency Department	84.10	79.93

Note: All values are from the AHA Annual Survey of Hospitals, based on hospital self-report. Significance tests were not performed because AHA numbers were not sample statistics.

[1]High technology service – used in the High Tech Index.

APPENDIX B: NIS-NHDS TABLES

Table 13. NIS and NHDS Comparisons Overall and by Region, 2003

	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	**NHDS**	**NIS**	**NHDS**	**NIS**	**NHDS**
United States	38,220 (700)	38,613 (1,731)	4.60 (0.03)	4.64 (0.32)	2.22 (0.03)	2.13 (0.13)
Region						
Northeast	7,561 (346)	7,978 (676)	5.15 (0.09)	5.29[1] (c)	2.55 (0.12)	2.40 (0.28)
Midwest	8,823 (346)	8,534 (978)	4.33 (0.05)	4.21[1] (c)	1.97 (0.05)	2.01[1] (c)
South	14,549 (412)	14,464 (921)	4.62 (0.05)	4.69 (0.48)	2.28 (0.05)	2.10 (0.19)
West	7,286 (284)	7,636 (611)	4.31 (0.08)	4.33 (0.55)	2.07 (0.06)	2.01 (0.22)

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

[1]A significance test was not performed because a valid standard error was not available for one of the following reasons:

(a) Because of a limited sample, the NHDS estimate and standard error were unreliable and not reported.

(b) A valid standard error could not be calculated. Refer to Appendix D for details.

Table 14. NIS and NHDS Comparisons by Hospital Control and Size, 2003

Hospital Control/Size	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
Total Public	5,331 (556)	5,009 (229)	4.65 (0.12)	4.67 (0.33)	2.16 (0.07)	2.01 (0.13)
1-99 Beds	1,162 (77)	1,410* (67)	3.70 (0.09)	3.45 (0.25)	2.43 (0.09)	2.20 (0.15)
100-199 Beds	794 (116)	909 (45)	4.03 (0.12)	4.22 (0.32)	2.11 (0.09)	1.94 (0.13)
200-299 Beds	411 (170)	663 (34)	4.65 (0.40)	4.74 (0.37)	2.00 (0.32)	2.37 (0.17)
300-499 Beds	1,183 (249)	1,294 (62)	4.91 (0.14)	5.43 (0.40)	2.25 (0.20)	1.99 (0.13)
500+ Beds	1,778 (306)	730** (37)	5.37 (0.27)	6.22 (0.47)	1.99 (0.08)	1.42** (0.10)
Total Private Non-Profit	27,806 (858)	28,630 (1,285)	4.61 (0.04)	4.62 (0.32)	2.25 (0.04)	2.16 (0.13)
1-99 Beds	2,828 (136)	5,575** (254)	3.68 (0.06)	3.98 (0.28)	2.08 (0.06)	1.99 (0.12)
100-199 Beds	5,249 (298)	7,117** (323)	4.28 (0.07)	4.58 (0.32)	2.21 (0.07)	2.02 (0.13)
200-299 Beds	5,077 (492)	6,042 (275)	4.48 (0.08)	4.74 (0.33)	2.33 (0.18)	2.19 (0.14)
300-499 Beds	8,583 (683)	6,362** (289)	4.66 (0.06)	4.70 (0.33)	2.18 (0.07)	2.28 (0.14)
500+ Beds	6,067 (745)	3,532** (162)	5.37 (0.11)	5.35 (0.38)	2.39 (0.09)	2.46 (0.16)

Hospital Control/Size	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
Total Proprietary	5,082 (367)	4,974 (227)	4.48 (0.08)	4.71 (0.33)	2.14 (0.06)	2.04 (0.13)
1-99 Beds	722 (89)	1,376** (66)	4.18 (0.21)	4.67 (0.34)	2.09 (0.15)	2.08 (0.14)
100-199 Beds	1,738 (147)	1,856 (87)	4.27 (0.13)	4.43 (0.32)	2.22 (0.11)	1.47** (0.09)
200-299 Beds	1,280 (195)	1,143 (55)	4.49 (0.20)	5.19 (0.38)	2.10 (0.14)	2.66* (0.18)
300-499 Beds	1,031 (174)	598* (31)	4.78 (0.08)	4.74 (0.37)	2.02 (0.10)	2.50* (0.18)
500+ Beds	310 (11)	0[1] (a)	5.38 (0.13)	0.00[1] (a)	2.38 (0.25)	0.00[1] (a)

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

[1]A significance test was not performed because a valid standard error was not available for one of the following reasons:

(a) Because of a limited sample, the NHDS estimate and standard error were unreliable and not reported.

(b) A valid standard error could not be calculated. Refer to Appendix D for details.

Table 15. NIS and NHDS Comparisons by Patient Characteristics, 2003

	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
Age Group						
0-15 Years	6,123 (199)	6,613 (300)	3.51 (0.07)	3.77 (0.26)	0.37 (0.02)	0.46* (0.02)
16-44 Years	10,469 (236)	10,664 (481)	3.60 (0.04)	3.71 (0.26)	0.43 (0.01)	0.43 (0.02)
45-64 Years	8,339 (185)	8,119 (368)	4.92 (0.04)	4.90 (0.34)	1.94 (0.04)	1.88 (0.12)
65+ Years	13,232 (276)	13,216 (596)	5.69 (0.04)	5.66 (0.39)	4.70 (0.06)	4.48 (0.28)
Gender						
Female	22,533 (420)	22,721 (1,021)	4.40 (0.03)	4.43 (0.31)	1.92 (0.03)	1.87 (0.11)
Male	15,534 (295)	15,892 (715)	4.90 (0.04)	4.93 (0.34)	2.69 (0.04)	2.49 (0.15)
Race						
White	18,418 (647)	23,384** (1,549)	4.73 (0.04)	4.62 (0.47)	2.55 (0.04)	2.26 (0.21)
Black	3,932 (281)	4,528 (321)	5.31 (0.07)	5.38 (0.62)	2.20 (0.07)	1.96 (0.19)
Other	5,533 (361)	1,649** (227)	4.33 (0.07)	4.62[1] (c)	1.64 (0.06)	1.64[1] (c)
Unknown	10,337 (702)	9,051 (1,162)	4.24 (0.05)	4.32[1] (c)	1.96 (0.04)	1.94[1] (c)

	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
Principal Payer						
Medicare	14,204 (294)	13,674 (672)	5.76 (0.04)	5.72 (0.44)	4.21 (0.05)	4.03 (0.28)
Medicaid	7,035 (276)	6,967 (585)	4.23 (0.06)	4.40[1] (c)	0.93 (0.03)	0.98 (0.11)
Private Insurance	13,968 (399)	13,876 (917)	3.72 (0.03)	3.80 (0.40)	1.00 (0.03)	1.06 (0.09)
Self Pay	1,615 (72)	1,649 (115)	3.71 (0.05)	3.88 (0.46)	1.37 (0.05)	1.23 (0.12)
No Charge	141 (55)	121 (22)	4.96 (0.13)	5.52[1] (c)	0.92 (0.11)	1.03[1] (c)
Other	1,179 (76)	2,323** (427)	4.41 (0.11)	4.46[1] (c)	2.01 (0.20)	1.46[1] (c)

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

[1]A significance test was not performed because a valid standard error was not available for one of the following reasons:

(a) Because of a limited sample, the NHDS estimate and standard error were unreliable and not reported.

(b) A valid standard error could not be calculated. Refer to Appendix D for details.

Table 16. NIS and NHDS Comparisons by Principal Diagnosis Category, 2003

Principal Diagnosis	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
218: Liveborn	4,089 (132)	3,885 (178)	3.20 (0.06)	3.26 (0.23)	0.33 (0.01)	0.38 (0.02)
122: Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	1,314 (22)	1,413 (68)	5.65 (0.04)	5.59 (0.41)	5.09 (0.08)	4.51 (0.30)
101: Coronary atherosclerosis and other heart disease	1,256 (50)	1,208 (58)	3.54 (0.04)	3.35 (0.25)	0.68 (0.02)	0.73 (0.05)
108: Congestive heart failure, nonhypertensive	1,119 (25)	1,123 (55)	5.53 (0.04)	5.30 (0.39)	4.17 (0.06)	4.44 (0.30)
102: Nonspecific chest pain	862 (24)	59** (5)	1.84 (0.01)	1.46[1] (c)	0.06 (0.00)	0.00** (0.00)
100: Acute myocardial infarction	750 (24)	766 (39)	5.38 (0.05)	5.50 (0.42)	7.51 (0.12)	7.44 (0.53)
193: Trauma to perineum and vulva	748 (28)	--[1] (a)	1.99 (0.01)	--[1] (a)	0.00 (0.00)	--[1] (a)
69: Affective disorders	713 (40)	881** (44)	7.27 (0.16)	7.40 (0.55)	0.04 (0.00)	0.14** (0.01)
195: Other complications of birth, puerperium affecting management of mother	712 (25)	73** (6)	2.68 (0.03)	5.09** (0.63)	0.03 (0.00)	0.00** (0.00)
106: Cardiac dysrhythmias	708 (17)	782 (39)	3.54 (0.03)	3.58 (0.27)	1.19 (0.03)	0.87** (0.06)
205: Spondylosis, intervertebral disc disorders, other back problems	658 (28)	643 (33)	3.05 (0.04)	3.16 (0.25)	0.16 (0.01)	0.47** (0.03)
127: Chronic obstructive pulmonary disease and bronchiectasis	621 (12)	692 (35)	4.95 (0.03)	4.80 (0.37)	2.38 (0.06)	2.60 (0.18)
237: Complication of device, implant or graft	597 (22)	550 (29)	5.90 (0.08)	5.83 (0.46)	1.94 (0.06)	1.57** (0.11)
203: Osteoarthritis	584 (20)	622 (32)	3.96 (0.04)	4.01 (0.31)	0.16 (0.01)	0.56** (0.04)
55: Fluid and electrolyte disorders	580 (12)	800** (40)	3.77 (0.03)	3.80 (0.29)	2.30 (0.06)	1.58** (0.11)
109: Acute cerebrovascular disease	559 (12)	577 (30)	6.44 (0.07)	6.15 (0.48)	10.88 (0.18)	8.21** (0.61)
159: Urinary tract infections	488	589**	4.50	4.55	1.55	1.87*

Principal Diagnosis	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
	(9)	(31)	(0.03)	(0.36)	(0.05)	(0.13)
50: Diabetes mellitus with complications	481 (12)	491 (26)	5.40 (0.05)	5.05 (0.40)	1.21 (0.04)	1.04 (0.07)
181: Other complications of pregnancy	476 (15)	224** (14)	2.45 (0.02)	3.05* (0.29)	0.02 (0.00)	0.00** (0.00)
128: Asthma	469 (19)	574** (30)	3.35 (0.03)	3.24 (0.26)	0.35 (0.02)	0.21** (0.01)
197: Skin and subcutaneous tissue infections	466 (11)	490 (26)	4.79 (0.04)	4.68 (0.38)	0.49 (0.02)	0.28** (0.02)
149: Biliary tract disease	458 (9)	469 (25)	4.25 (0.03)	4.30 (0.35)	0.82 (0.03)	0.80 (0.06)
254: Rehabilitation care, fitting of prostheses, and adjustment of devices	458 (33)	507 (27)	11.99 (0.24)	11.44 (0.89)	0.57 (0.06)	0.66 (0.05)
238: Complications of surgical procedures or medical care	452 (12)	457 (25)	6.29 (0.07)	6.21 (0.50)	1.64 (0.04)	1.38* (0.10)
189: Previous C-section	422 (15)	--[1] (a)	2.84 (0.02)	--[1] (a)	0.00 (0.00)	--[1] (a)

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

[1]A significance test was not performed because a valid standard error was not available for one of the following reasons:

(a) Because of a limited sample, the NHDS estimate and standard error were unreliable and not reported.

(b) A valid standard error could not be calculated. Refer to Appendix D for details.

Table 17. NIS and NHDS Comparisons by Principal Procedure Category, 2003

Principal Procedure	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
137: Other procedures to assist delivery	1,333 (53)	969** (48)	2.10 (0.01)	2.13 (0.16)	0.00 (0.00)	0.00** (0.00)
134: Cesarean section	1,168 (41)	1,122 (55)	3.68 (0.03)	3.65 (0.27)	0.01 (0.00)	0.00** (0.00)
115: Circumcision	1,093 (43)	1,067 (52)	2.59 (0.03)	2.67 (0.20)	0.00 (0.00)	0.00 (0.00)
70: Upper gastrointestinal endoscopy, biopsy	712 (17)	700 (36)	5.38 (0.06)	5.65 (0.43)	1.60 (0.04)	1.28** (0.09)
47: Diagnostic cardiac catheterization, coronary arteriography	707 (26)	542** (28)	3.67 (0.04)	3.73 (0.30)	0.97 (0.03)	1.40** (0.10)
140: Repair of current obstetric laceration	694 (35)	769 (39)	2.09 (0.01)	2.11 (0.17)	0.00 (0.00)	0.00 (0.00)
45: Percutaneous transluminal coronary angioplasty (PTCA)	675 (40)	548* (29)	2.85 (0.04)	2.80 (0.23)	0.74 (0.02)	0.52** (0.03)
216: Respiratory intubation and mechanical ventilation	616 (15)	592 (31)	11.06 (0.22)	11.16 (0.86)	28.43 (0.46)	26.96 (2.00)
124: Hysterectomy, abdominal and vaginal	588 (18)	591 (31)	2.72 (0.02)	2.66 (0.21)	0.06 (0.00)	0.02** (0.00)
228: Prophylactic vaccinations and inoculations	555 (59)	531 (28)	2.49 (0.06)	2.47 (0.20)	0.00 (0.00)	0.01** (0.00)
231: Other therapeutic procedures	540 (57)	549 (29)	4.94 (0.13)	5.09 (0.40)	2.15 (0.17)	2.60 (0.19)
222: Blood transfusion	500 (19)	486 (26)	5.64 (0.05)	6.36 (0.50)	5.64 (0.11)	6.34 (0.48)
54: Other vascular catheterization, not heart	447 (19)	441 (24)	9.15 (0.20)	9.31 (0.74)	8.70 (0.29)	10.26 (0.79)
152: Arthroplasty knee	427 (15)	449 (24)	3.98 (0.04)	3.96 (0.32)	0.16 (0.01)	0.49** (0.03)
84: Cholecystectomy and common duct exploration	395 (8)	373 (21)	4.67 (0.04)	4.66 (0.39)	0.78 (0.03)	0.96* (0.07)
133: Episiotomy	389 (20)	433 (23)	2.16 (0.01)	2.20 (0.19)	0.00 (0.00)	0.00 (0.00)

Principal Procedure	Number of Discharges in Thousands (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)	
	NIS	NHDS	NIS	NHDS	NIS	NHDS
153: Hip replacement, total and partial	340 (11)	354 (20)	5.16 (0.05)	5.15 (0.43)	1.15 (0.04)	0.77** (0.06)
219: Alcohol and drug rehabilitation/detoxification	308 (13)	275 (16)	5.11 (0.07)	5.27 (0.46)	1.32 (0.06)	0.84** (0.07)
44: Coronary artery bypass graft (CABG)	297 (16)	261 (15)	3.87 (0.07)	3.96 (0.36)	0.23 (0.01)	0.32* (0.02)
48: Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator	296 (7)	301 (17)	2.97 (0.03)	2.96 (0.27)	0.10 (0.01)	0.00** (0.00)
80: Appendectomy	291 (11)	265 (16)	5.40 (0.16)	5.56 (0.49)	1.05 (0.05)	0.84* (0.07)
78: Colorectal resection	291 (17)	223** (14)	8.89 (0.10)	9.00 (0.79)	2.22 (0.09)	2.25 (0.20)
3: Laminectomy, excision intervertebral disc	285 (15)	272 (16)	2.68 (0.05)	2.67 (0.25)	0.14 (0.01)	0.21** (0.01)
76: Colonoscopy and biopsy	283 (33)	338 (19)	4.85 (0.18)	5.53 (0.46)	0.11 (0.01)	0.24** (0.01)
158: Spinal fusion	277 (7)	262 (16)	9.90 (0.06)	9.70 (0.82)	4.04 (0.10)	4.20 (0.36)

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

APPENDIX C: NIS-MEDPAR TABLES

Table 18. NIS and MedPAR Comparisons Overall and by Region, 2003

	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
U.S.	14,204 (294)	12,416**	--	--	5.78 (0.04)	5.83	4.21 (0.05)	4.06**	$24,587 (620)	$24,391
Northeast	2,969 (167)	2,418**	20.90 (0.99)	19.47	6.36 (0.11)	6.56	4.70 (0.18)	4.53	$29,059 (2,217)	$29,146
Midwest	3,514 (145)	3,317	24.74 (0.88)	26.71*	5.42 (0.07)	5.48	3.63 (0.07)	3.67	$19,187 (624)	$19,824
South	5,513 (171)	5,030**	38.81 (0.98)	40.51	5.76 (0.06)	5.80	4.20 (0.06)	4.09	$22,535 (642)	$22,151
West	2,206 (88)	1,649**	15.53 (0.60)	13.28**	5.59 (0.10)	5.55	4.48 (0.11)	4.10**	$33,113 (1,794)	$33,434

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 19. NIS and MedPAR Comparisons by Control and Bed Size, 2003

Control / Bed Size	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
Total Public	1,786 (139)	1,437*	12.57 (1.02)	11.57	5.45 (0.10)	5.74**	4.06 (0.09)	4.13	$18,712 (940)	$19,478
1-99 Beds	572 (36)	374**	32.03 (2.33)	26.08*	4.56 (0.10)	4.55	4.11 (0.12)	3.93	$9,414 (372)	$9,859
100-199 Beds	278 (47)	293	15.58 (2.54)	20.42	5.16 (0.17)	5.59*	4.19 (0.21)	4.15	$14,981 (947)	$16,665
200-299 Beds	154 (62)	190	8.62 (3.48)	13.29	5.79 (0.31)	5.99	3.95 (0.33)	4.25	$19,825 (3,175)	$18,374
300-499 Beds	358 (92)	282	20.05 (5.01)	19.64	5.92 (0.12)	6.38**	4.13 (0.27)	4.19	$24,684 (2,556)	$26,963
500+ Beds	423 (83)	295	23.69 (4.38)	20.54	6.31 (0.34)	6.65	3.90 (0.24)	4.23	$28,201 (1,753)	$28,043
Total Private Non-Profit	10,514 (328)	9,328**	74.02 (1.31)	75.13	5.80 (0.05)	5.84	4.26 (0.06)	4.10*	$24,069 (773)	$23,862
1-99 Beds	1,266 (61)	978**	12.04 (0.64)	10.49*	4.69 (0.08)	4.70	3.80 (0.08)	3.75	$12,891 (496)	$13,461
100-199 Beds	2,104 (126)	1,886	20.01 (1.21)	20.22	5.48 (0.07)	5.53	4.18 (0.12)	4.11	$18,898 (937)	$18,665
200-299 Beds	1,910 (190)	1,899	18.17 (1.84)	20.35	5.76 (0.11)	5.84	4.49 (0.23)	4.16	$24,345 (1,465)	$23,474
300-499 Beds	3,099 (258)	2,483*	29.47 (2.44)	26.62	5.94 (0.09)	6.02	4.22 (0.11)	4.08	$25,783 (1,206)	$25,964
500+ Beds	2,133 (285)	2,080	20.28 (2.41)	22.30	6.62 (0.13)	6.45	4.45 (0.19)	4.21	$33,102 (2,874)	$31,314

Control / Bed Size	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
Total Proprietary	1,903 (131)	1,650	13.40 (0.92)	13.29	5.93 (0.12)	5.83	4.06 (0.10)	3.82*	$32,881 (1,662)	$31,657
1-99 Beds	294 (34)	288	15.45 (1.76)	17.45	5.73 (0.38)	4.65**	3.98 (0.24)	3.31**	$23,044 (1,758)	$20,199
100-199 Beds	664 (53)	583	34.89 (2.59)	35.36	5.78 (0.16)	5.83	4.18 (0.14)	3.85*	$28,068 (2,097)	$28,625
200-299 Beds	452 (75)	376	23.79 (3.90)	22.82	6.07 (0.28)	6.13	4.09 (0.23)	4.07	$39,750 (4,920)	$36,223
300-499 Beds	384 (76)	255	20.18 (3.86)	15.44	5.81 (0.17)	6.19*	3.67 (0.21)	3.79	$38,317 (2,357)	$42,079
500+ Beds	107 (7)	147**	5.67 (0.42)	8.90**	7.31 (0.47)	6.69	4.78 (0.20)	4.04**	$41,152 (2,830)	$36,375

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 20. NIS and MedPAR Comparisons by Location, Teaching Status, and Size, 2003

Hospital Type / Size	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
Rural	2,719 (106)	2,302**	19.14 (0.71)	18.54	4.87 (0.05)	5.01*	3.97 (0.08)	3.96	$12,632 (338)	$13,559**
1-49 beds	675 (27)	399**	24.82 (1.35)	17.33**	4.07 (0.06)	4.15	3.63 (0.09)	3.57	$8,709 (259)	$9,275*
50-99 beds	788 (65)	630*	28.98 (2.68)	27.37	4.76 (0.08)	4.66	4.04 (0.12)	3.86	$12,618 (626)	$11,901
100+ beds	1,255 (123)	1,273	46.18 (3.15)	55.29**	5.37 (0.08)	5.45	4.10 (0.16)	4.14	$14,784 (543)	$15,723
Urban, Non-Teaching	6,145 (166)	5,428**	43.26 (0.99)	43.72	5.79 (0.06)	5.80	4.33 (0.09)	4.06**	$25,357 (730)	$25,401
1-99 beds	657 (45)	593	10.70 (0.74)	10.92	5.59 (0.23)	4.97**	4.03 (0.14)	3.70*	$18,849 (1,089)	$18,766
100-199 beds	1,812 (90)	1,605*	29.48 (1.46)	29.57	5.59 (0.09)	5.75	4.19 (0.10)	4.13	$22,937 (1,104)	$22,854
200+ beds	3,675 (159)	3,230**	59.80 (1.52)	59.49	5.92 (0.08)	5.98	4.44 (0.14)	4.10*	$27,708 (1,100)	$27,886

Hospital Type / Size	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
Urban, Teaching	5,339 (217)	4,685**	37.59 (1.09)	37.73	6.22 (0.07)	6.26	4.19 (0.08)	4.11	$29,930 (1,378)	$28,543
1-299 beds	838 (111)	611*	15.70 (2.04)	13.05	5.82 (0.18)	6.02	4.51 (0.20)	4.10*	$26,876 (2,647)	$25,750
300-499 beds	1,547 (190)	1,192	28.97 (3.79)	25.45	6.00 (0.13)	6.09	4.03 (0.13)	4.00	$27,081 (1,954)	$26,254
500+ beds	2,953 (279)	2,881	55.31 (3.94)	61.49	6.45 (0.11)	6.39	4.19 (0.12)	4.16	$32,110 (2,141)	$30,083

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 21. NIS and MedPAR Comparisons by Patient Characteristics, 2003

	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
Race										
White	8,099 (296)	10,321**	57.02 (1.62)	83.12**	5.75 (0.04)	5.69	4.35 (0.06)	4.10**	$24,881 (743)	$23,792
Black	1,191 (91)	1,495**	8.39 (0.60)	12.04**	6.72 (0.10)	6.63	4.31 (0.13)	3.99*	$29,367 (2,009)	$26,021
Other	1,166 (94)	552**	8.21 (0.66)	4.44**	6.34 (0.10)	6.21	4.38 (0.11)	3.71**	$34,336 (1,630)	$31,223
Unknown	3,746 (261)	47**	26.37 (1.78)	0.38**	5.35 (0.06)	5.66**	3.81 (0.06)	3.34**	$19,531 (645)	$23,763**
Age Group										
0-64 Years	2,168 (52)	2,083	15.26 (0.27)	16.78**	6.11 (0.06)	6.14	2.22 (0.04)	2.07**	$24,961 (832)	$24,157
65-74 Years	4,312 (97)	3,720**	30.36 (0.17)	29.96*	5.51 (0.04)	5.55	3.16 (0.05)	3.21	$26,693 (702)	$26,279
75-84 Years	5,125 (114)	4,287**	36.08 (0.18)	34.52**	5.83 (0.04)	5.86	4.56 (0.06)	4.34**	$24,870 (616)	$24,804
85+ Years	2,593 (57)	2,325**	18.25 (0.19)	18.72*	5.83 (0.04)	5.92	6.93 (0.09)	6.71*	$20,246 (481)	$20,819

	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
Gender										
Female	8,115 (166)	7,029**	57.13 (0.16)	56.60**	5.76 (0.04)	5.82	3.92 (0.05)	3.79*	$23,011 (560)	$22,925
Male	6,077 (131)	5,387**	42.78 (0.16)	43.39**	5.79 (0.04)	5.84	4.60 (0.05)	4.43**	$26,699 (717)	$26,303

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 22. NIS and MedPAR Comparisons by DRG, 2003

DRG	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
127: Heart Failure & Shock	799 (17)	678**	5.62 (0.06)	5.46**	5.08 (0.03)	5.16*	4.14 (0.06)	4.22	$17,226 (478)	$17,109
89: Simple Pneumonia & Pleurisy Age >17 w/cc	632 (12)	535**	4.45 (0.06)	4.31*	5.55 (0.03)	5.64*	5.31 (0.09)	5.25	$16,611 (376)	$16,792
88: Chronic Obstructive Pulmonary Disease	474 (9)	400**	3.34 (0.05)	3.22	4.85 (0.03)	4.90	1.71 (0.05)	1.64	$14,512 (374)	$14,625
209: Major Joint & Limb Reattachment Procedures Of Lower Extremity	460 (15)	428*	3.24 (0.07)	3.45**	4.75 (0.04)	4.71	0.83 (0.03)	0.78	$33,084 (866)	$32,229
430: Psychoses	323 (17)	330	2.27 (0.12)	2.66**	10.56 (0.22)	10.70	0.13 (0.01)	0.11	$17,278 (758)	$16,715
462: Rehabilitation	322 (24)	307	2.26 (0.16)	2.47	11.36 (0.16)	11.66	0.65 (0.07)	0.23**	$21,703 (1,028)	$22,498
182: Esophagitis	318 (6)	279**	2.24 (0.02)	2.25	4.37 (0.03)	4.40	1.32 (0.04)	1.33	$13,856 (346)	$13,726
174: G.I. Hemorrhage w/cc	299 (6)	255**	2.10 (0.01)	2.05**	4.65 (0.03)	4.73*	3.29 (0.08)	3.26	$16,868 (398)	$16,761
143: Chest Pain	288 (8)	241**	2.02 (0.04)	1.94	2.05 (0.02)	2.10*	0.11 (0.01)	0.11	$9,719 (283)	$9,414
296: Nutritional & Misc Metabolic Disorders Age >17 w/cc	286 (5)	253**	2.01 (0.02)	2.03	4.76 (0.04)	4.82	3.84 (0.10)	3.95	$13,869 (364)	$13,774

DRG	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
14: Specific Cerebrovascular Disorders Except Tia	273 (6)	235**	1.92 (0.02)	1.89	5.76 (0.06)	5.81	11.99 (0.21)	11.72	$21,638 (696)	$20,914
416: Septicemia Age >17	247 (7)	209**	1.74 (0.03)	1.68	7.23 (0.07)	7.29	19.75 (0.36)	19.76	$26,704 (756)	$26,853
320: Kidney & Urinary Tract Infections Age >17 w/cc	242 (5)	207**	1.71 (0.02)	1.66	5.05 (0.04)	5.13	2.47 (0.08)	2.44	$14,486 (426)	$14,433
138: Cardiac Arrhythmia & Conduction Disorders w/cc	235 (5)	200**	1.65 (0.01)	1.61*	3.92 (0.03)	3.95	2.78 (0.09)	2.82	$14,046 (351)	$13,847
79: Respiratory Infections & Inflammations Age >17 w/cc	202 (5)	171**	1.42 (0.02)	1.38	8.16 (0.08)	8.25	14.18 (0.23)	13.96	$25,995 (704)	$26,220
121: Circulatory Disorders W Ami & Major Comp	191 (5)	160**	1.34 (0.02)	1.29*	6.12 (0.05)	6.23*	0.00 (0.00)	0.00[1]	$25,643 (711)	$25,362
316: Renal Failure	184 (5)	156**	1.30 (0.02)	1.26	6.54 (0.19)	6.40	9.12 (0.21)	8.85	$21,580 (632)	$21,580
517: Percutaneous CV Procedures, with Stent, without AMI	165 (11)	143	1.16 (0.06)	1.15	2.54 (0.05)	2.52	0.39 (0.03)	0.43	$35,799 (1,254)	$34,205
148: Major Small & Large Bowel Procedures w/cc	150 (3)	133**	1.05 (0.01)	1.07	12.01 (0.08)	12.20*	7.80 (0.17)	7.89	$56,782 (1,390)	$56,016
124: Circulatory Disorders Except Ami	150 (6)	131**	1.05 (0.03)	1.05	4.45 (0.06)	4.42	0.95 (0.06)	1.01	$25,535 (1,061)	$24,190
132: Atherosclerosis w/cc	144 (4)	119**	1.01 (0.02)	0.96	2.81 (0.03)	2.81	0.76 (0.05)	0.74	$10,748 (326)	$10,576

DRG	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
210: Hip & Femur Procedures Except Major Joint Age >17 w/cc	141 (3)	125**	0.99 (0.01)	1.00	6.72 (0.05)	6.79	2.84 (0.10)	2.91	$30,061 (679)	$29,793
524: Transient Ischemia	140 (3)	117**	0.98 (0.02)	0.94	3.19 (0.03)	3.24	0.22 (0.02)	0.22	$12,414 (363)	$12,257
141: Syncope & Collapse w/cc	135 (3)	114**	0.95 (0.01)	0.92	3.42 (0.04)	3.49	0.46 (0.03)	0.47	$12,899 (436)	$12,787
475: Respiratory System Diagnosis With Ventilator Support	133 (3)	112**	0.93 (0.01)	0.90*	11.15 (0.14)	10.95	36.51 (0.43)	35.98	$62,530 (1,774)	$60,826

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 23. NIS and MedPAR Comparisons by Principal Diagnosis, 2003

Principal Diagnosis	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
108: Congestive heart failure, nonhypertensive	861 (19)	727**	6.06 (0.06)	5.85**	5.58 (0.04)	5.66	4.49 (0.06)	4.58	$22,944 (666)	$22,861
122: Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	797 (15)	673**	5.61 (0.07)	5.42*	6.26 (0.04)	6.38*	6.91 (0.10)	6.91	$20,929 (491)	$21,418
101: Coronary atherosclerosis and other heart disease	696 (29)	607**	4.90 (0.14)	4.89	3.88 (0.05)	3.86	0.95 (0.03)	0.94	$35,386 (1,190)	$34,838
106: Cardiac dysrhythmias	472 (12)	406**	3.32 (0.03)	3.27	3.88 (0.03)	3.92	1.47 (0.05)	1.48	$23,806 (689)	$23,520
100: Acute myocardial infarction	445 (14)	381**	3.13 (0.06)	3.07	5.98 (0.06)	6.05	10.30 (0.15)	10.26	$40,497 (1,298)	$39,883
127: Chronic obstructive pulmonary disease and bronchiectasis	440 (9)	373**	3.10 (0.05)	3.00	5.15 (0.04)	5.21	2.66 (0.07)	2.60	$16,693 (437)	$16,853
109: Acute cerebrovascular disease	382 (8)	326**	2.69 (0.02)	2.62*	6.18 (0.06)	6.23	11.06 (0.18)	10.85	$25,307 (862)	$24,467
203: Osteoarthritis	352 (12)	326*	2.48 (0.06)	2.63*	4.10 (0.04)	4.07	0.20 (0.01)	0.19	$30,364 (774)	$30,032
237: Complication of device, implant or graft	343 (12)	319	2.41 (0.06)	2.57**	6.07 (0.07)	5.93	2.37 (0.06)	2.27	$37,219 (1,322)	$35,512
102: Nonspecific chest pain	335 (9)	286**	2.36 (0.04)	2.30	2.15 (0.02)	2.21*	0.11 (0.01)	0.12	$11,043 (295)	$10,824

Principal Diagnosis	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
254: Rehabilitation care, fitting of prostheses, and adjustment of devices	326 (24)	311	2.29 (0.16)	2.50	11.46 (0.17)	11.75	0.66 (0.07)	0.23**	$22,082 (1,060)	$22,825
55: Fluid and electrolyte disorders	319 (6)	280**	2.25 (0.03)	2.25	4.53 (0.04)	4.65*	3.33 (0.09)	3.45	$13,565 (361)	$13,691
159: Urinary tract infections	292 (6)	248**	2.06 (0.03)	2.00	5.09 (0.05)	5.16	2.27 (0.07)	2.26	$15,039 (432)	$15,026
2: Septicemia (except in labor)	270 (8)	229**	1.90 (0.04)	1.84	8.37 (0.10)	8.43	19.04 (0.33)	18.94	$32,815 (948)	$33,387
226: Fracture of neck of femur (hip)	262 (6)	225**	1.85 (0.02)	1.81	6.49 (0.05)	6.46	3.31 (0.09)	3.35	$28,979 (596)	$29,065
153: Gastrointestinal hemorrhage	224 (4)	189**	1.58 (0.01)	1.52**	4.87 (0.04)	5.01**	4.42 (0.11)	4.46	$19,105 (454)	$19,332
205: Spondylosis, intervertebral disc disorders, other back problems	220 (8)	203	1.55 (0.04)	1.64*	4.01 (0.05)	3.97	0.37 (0.02)	0.39	$24,267 (890)	$23,634
50: Diabetes mellitus with complications	213 (5)	186**	1.50 (0.02)	1.50	6.27 (0.07)	6.39	1.92 (0.07)	1.94	$23,368 (778)	$23,589
238: Complications of surgical procedures or medical care	196 (5)	172**	1.38 (0.02)	1.38	7.10 (0.08)	6.91*	2.73 (0.09)	2.59	$28,167 (893)	$27,283
69: Affective disorders	179 (9)	177	1.26 (0.06)	1.42**	9.84 (0.20)	9.91	0.11 (0.02)	0.10	$16,531 (714)	$15,803
197: Skin and subcutaneous tissue infections	178 (3)	155**	1.25 (0.01)	1.24	5.72 (0.05)	5.70	1.01 (0.05)	0.97	$15,791 (414)	$15,857

Principal Diagnosis	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
245: Syncope	173 (5)	143**	1.21 (0.02)	1.15*	3.12 (0.04)	3.20*	0.35 (0.03)	0.37	$13,545 (468)	$13,596
149: Biliary tract disease	171 (3)	148**	1.20 (0.01)	1.19	5.47 (0.05)	5.52	1.76 (0.07)	1.74	$26,767 (586)	$26,188
145: Intestinal obstruction without hernia	171 (3)	149**	1.20 (0.01)	1.20	6.80 (0.06)	6.90	4.43 (0.12)	4.49	$24,713 (609)	$24,825
146: Diverticulosis and diverticulitis	168 (3)	142**	1.18 (0.01)	1.14*	5.63 (0.05)	5.80**	1.90 (0.07)	1.83	$21,849 (531)	$22,263

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

Table 24. NIS and MedPAR Comparisons by Principal Procedure, 2003

Principal Procedure	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
70: Upper gastrointestinal endoscopy, biopsy	408 (10)	358**	2.87 (0.04)	2.88	5.90 (0.05)	6.02*	2.06 (0.06)	2.08	$21,114 (565)	$21,130
47: Diagnostic cardiac catheterization, coronary arteriography	356 (14)	313**	2.50 (0.07)	2.52	4.23 (0.05)	4.25	1.46 (0.05)	1.41	$25,939 (818)	$24,826
45: Percutaneous transluminal coronary angioplasty (PTCA)	344 (21)	317	2.42 (0.12)	2.55	3.15 (0.05)	3.11	1.10 (0.04)	1.18	$40,117 (1,307)	$38,594
222: Blood transfusion	325 (13)	265**	2.28 (0.08)	2.14	5.81 (0.05)	5.99**	6.38 (0.14)	6.41	$19,978 (637)	$20,573
216: Respiratory intubation and mechanical ventilation	288 (7)	247**	2.02 (0.03)	1.99	9.16 (0.10)	9.04	39.77 (0.44)	39.72	$51,465 (1,511)	$49,574
152: Arthroplasty knee	249 (9)	235	1.75 (0.04)	1.89**	4.15 (0.04)	4.12	0.21 (0.02)	0.18	$31,820 (892)	$31,200
48: Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator	239 (10)	213**	1.68 (0.05)	1.71	5.15 (0.07)	5.18	1.44 (0.07)	1.46	$58,754 (1,931)	$56,009
153: Hip replacement, total and partial	230 (7)	212*	1.62 (0.03)	1.70**	5.52 (0.05)	5.51	1.57 (0.06)	1.50	$35,833 (904)	$34,907
54: Other vascular catheterization, not heart	224 (10)	196**	1.57 (0.06)	1.58	9.08 (0.17)	9.12	12.71 (0.42)	12.84	$32,558 (1,178)	$33,156
58: Hemodialysis	207 (7)	189*	1.45 (0.04)	1.52	5.61 (0.18)	5.36	4.01 (0.12)	3.78	$21,475 (740)	$20,244

Principal Procedure	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
146: Treatment, fracture or dislocation of hip and femur	186 (4)	164**	1.31 (0.01)	1.32	6.24 (0.05)	6.35*	2.33 (0.08)	2.46	$27,871 (608)	$27,742
76: Colonoscopy and biopsy	172 (5)	143**	1.21 (0.02)	1.15*	5.91 (0.08)	6.10*	1.37 (0.06)	1.41	$19,665 (511)	$20,030
231: Other therapeutic procedures	171 (19)	135	1.20 (0.14)	1.09	5.37 (0.13)	5.51	4.93 (0.31)	5.55	$18,633 (935)	$19,128
61: Other OR procedures on vessels other than head and neck	154 (5)	142*	1.08 (0.02)	1.14*	7.40 (0.14)	7.22	4.74 (0.14)	4.63	$46,089 (1,482)	$44,081
44: Coronary artery bypass graft (CABG)	152 (9)	133	1.07 (0.05)	1.07	9.75 (0.11)	9.70	3.22 (0.14)	3.19	$87,927 (3,367)	$82,899
78: Colorectal resection	145 (3)	128**	1.02 (0.01)	1.03	10.83 (0.07)	11.03**	6.38 (0.17)	6.26	$51,166 (1,233)	$50,560
193: Diagnostic ultrasound of heart (echocardiogram)	137 (13)	103*	0.96 (0.09)	0.83	5.38 (0.08)	5.49	2.70 (0.14)	2.57	$20,884 (1,436)	$19,434
84: Cholecystectomy and common duct exploration	136 (3)	122**	0.96 (0.01)	0.98	6.31 (0.06)	6.35	1.83 (0.08)	1.81	$32,284 (713)	$31,313
213: Physical therapy exercises, manipulation, and other procedures	116 (14)	101	0.82 (0.10)	0.81	10.98 (0.35)	10.85	1.01 (0.13)	0.45**	$24,967 (2,036)	$23,219
169: Debridement of wound, infection or burn	114 (3)	96**	0.80 (0.01)	0.78	11.55 (0.24)	10.90**	4.61 (0.21)	4.41	$39,999 (1,402)	$38,699
39: Incision of pleura, thoracentesis, chest drainage	104 (2)	91**	0.73 (0.01)	0.74	8.10 (0.07)	8.23	8.18 (0.21)	8.30	$27,758 (730)	$27,659

Principal Procedure	Number of Discharges in Thousands (Standard Error)		Percentage of Discharges (Standard Error)		Average Length of Stay in Days (Standard Error)		In-Hospital Mortality Rate Percent (Standard Error)		Average Total Hospital Charge (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
51: Endarterectomy, vessel of head and neck	99 (4)	88**	0.70 (0.02)	0.71	2.94 (0.07)	2.88	0.50 (0.05)	0.45	$21,804 (639)	$21,090
3: Laminectomy, excision intervertebral disc	90 (5)	84	0.63 (0.03)	0.68	3.53 (0.06)	3.48	0.33 (0.04)	0.32	$22,028 (896)	$20,161*
37: Diagnostic bronchoscopy and biopsy of bronchus	86 (2)	81*	0.61 (0.01)	0.65**	9.39 (0.10)	9.39	6.64 (0.22)	6.59	$37,137 (1,107)	$36,197
177: Computerized axial tomography (CT) scan head	83 (10)	62	0.58 (0.07)	0.50	4.80 (0.14)	5.02	4.55 (0.25)	4.42	$19,347 (2,686)	$18,264

**Significant at a 5 percent level.*

***Significant at a 1 percent level.*

APPENDIX D: ESTIMATES OF STANDARD ERROR FOR NHDS STATISTICS

Estimates of Standard Error for NHDS Statistics

A variety of statistics were estimated based on these NHDS data:

1. Total number of discharges
2. In-Hospital mortality
3. Average length of stay (calculated as the difference between discharge and admission dates).

The standard errors were calculated as follows:

Total Numbers of Discharges

From the NHDS Documentation (National Center for Health Statistics, 2004), constants *a* and *b* were obtained for 2003. The relative standard error for the estimate of total discharges was approximated by:

$$RSE(W_{TD}) = \sqrt{a + b/W_{TD}}$$

where W_{TD} was the weighted sum of total discharges (i.e., the estimate of total discharges).

The standard error was then calculated as:

$$SE = RSE \times W_{TD}$$

Percent Mortality

Let *p* be the estimated proportion of in-hospital deaths (with the number of deaths estimated as the numerator and the discharge estimate as the denominator). The relative standard error of this proportion expressed as a percent was approximated by:

$$RSE(p) = \sqrt{b(1-p)/(p \times W_{TD})}$$

The standard error was then calculated as:

$$SE = RSE \times p$$

Where *b* was the parameter in the formula for approximated $RSE(W_{TD})$ given by the NHDS documentation (i.e., the same used in the formula for calculating the standard error for number of discharges).

Average Length of Stay

Let average length of stay be the estimated average length of stay based on a weighted number of discharges equal to TD. If the weighted sum of patient length of stay was TLOS, and

$$ALOS = \frac{W_{TLOS}}{W_{TD}}$$

then the relative standard error is:

$$RSE(ALOS) = RSE(W_{TLOS} \Big/ W_{TD}) = \sqrt{[RSE(W_{TLOS})^2] + [RSE(W_{TD})^2]}$$

The estimate of the relative standard error was valid only if:

1. The relative standard error of the denominator (estimated discharges) was smaller than five percent.

   - or -

2. Both the relative standard error of the numerator (estimated total stay days) and the denominator (estimated discharges) were smaller than 10 percent.

For all parameter estimates, when values of *a* and *b* were available in the NHDS documentation (i.e., for procedures, gender, region, race, and diagnoses), the appropriate values for *a* and *b* were used. When a variable represented the sum of more than one NHDS category, as recommended by Korn and Graubard (1999, p.224), the standard error for each category was calculated, and the largest of these standard errors was reported and used in significance testing. For example, the NIS category of "private insurance" includes three NHDS categories: 1) Blue Cross/Blue Shield; 2) HMO/PPO; and 3) other private insurance. The standard error was calculated for all three categories, using the values of *a* and *b* provided in the NHDS documentation, and the largest value was used in computing the t-value to test for significant difference.

When no parameter estimates were available, the values of *a* and *b* for the total sample were used in calculating the standard errors. For example, in the hospital control X bed size comparisons, the values for the total sample were used in calculating standard errors, because the NHDS documentation provides parameter estimates by neither ownership nor bed size.

Tests of Statistical Significance

To test for a statistically significant difference between a NIS estimate, *X*, and a NHDS estimate, *Y*, the following procedure was used. The difference was significant if

$$\left| \frac{(X - Y)}{\sqrt{SE_X^2 + SE_Y^2}} \right| \geq S$$

where SE_X was the estimated standard error for the NIS estimate and SE_Y was the estimated standard error of the NHDS estimate.