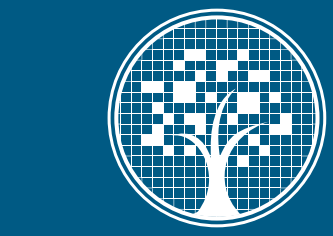

H·CUP

HEALTHCARE COST AND UTILIZATION PROJECT

HCUP Methods Series

Final 2000 NIS Comparison Report

Report # 2003-01

Agency for Healthcare Research and Quality

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

Overview and Purpose

This report compares statistics calculated from the 2000 Nationwide Inpatient Sample (NIS) with estimates from two comparable databases, with the objective of assessing potential biases. The two comparison databases consist of The National Hospital Discharge Survey (NHDS) and the Medicare Provider Analysis and Review (MedPAR). Comparison variables included total discharges, length of stay, and in-hospital mortality rates. Grouping variables used in these comparisons included patient age, gender, race, region, procedure, diagnosis category, payor, hospital ownership, and other hospital characteristics.

Major Findings

NIS estimates of essential healthcare policy variables (i.e., in-hospital mortality, inpatient population size, length of stay, and costs) are accurate and precise. Drawn from states that encompass 68 percent of all short-stay hospitals and 75 percent of all discharges, the NIS contains charges, a full range of payers, and a very large sample of discharges. The large NIS sample allows for the study of rare disorders, procedures, and hospital types: NIS estimates can be calculated for any number of special sub-populations.

Summary of Overall Comparisons:

- National and regional NIS estimates were statistically consistent with the NHDS estimates on discharge count and average length of stay (ALOS) measures.
- Overall, the NIS in-hospital mortality rate estimate was significantly higher than NHDS estimates, exceeding the NHDS estimate by slightly more than 6 percent. By region, all the NIS estimates were higher than the NHDS estimates, but only one significant difference was observed.
- The NIS overestimated discharges (by nearly 22 percent) and underestimated ALOS (by more than 3 percent) for Medicare patients when compared to MedPAR statistics. Both discrepancies are likely caused by the omission of managed care patients from the MedPAR file.
- NIS-MedPAR discharge differences were greatest in the Northeast and West, consistent with the hypothesis that MedPAR data underreports Medicare managed care discharges such as Medicare + Choice.

Comparison by Hospital Characteristics:

- NIS discharge estimates differ from NHDS estimates by reporting relatively more discharges from private non-profit hospitals and larger hospitals, and reporting relatively fewer discharges from smaller hospitals.
- NIS discharge estimates consistently exceed 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.

Comparison by Patient Characteristics:

- NIS and NHDS estimates were virtually identical across all patient categories (age group, gender, and race) for discharges and average length of stay, but in-hospital mortality rate estimates from the NIS tended to be slightly higher than NHDS estimates.
- All NIS and NHDS estimates by expected payer were consistent except for discharges where payer was missing or unknown.
- All NIS estimates of Medicare discharges and most NIS estimates of average length of stay for Medicare patients differed from corresponding MedPAR statistics. In general, NIS discharge estimates were larger than MedPAR counts and NIS average length of stay estimates were shorter than MedPAR averages.

Comparison by Diagnosis Category:

- NIS and NHDS estimates were generally consistent across diagnosis categories, and 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.
- The rank order of the most common diagnoses was nearly identical for the NIS and NHDS. Similarly, the NIS and MedPAR had almost identical rankings for the most common diagnoses within the Medicare population.
- Because of the omission of managed care patients in the MedPAR data, the NIS discharge estimates were higher for all diagnosis categories. There were few differences between the NIS and MedPAR in either total charges or inpatient mortality.
- The NIS estimates of Medicare average length of stay were significantly lower than MedPAR averages for nearly half of the diagnoses groups.

NIS Background

The 2000 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 28 states. Sampling probabilities were calculated to select 20 percent of the universe in each stratum. As a result, the NIS includes approximately 7.2 million discharges from 984 hospitals, with weights to make national estimates. It is important to note that NIS data differ in scope from the two other databases in that only 28 states agreed to make their data available for the NIS project, as compared with a sampling frame of all 50 states for the other sources.

NHDS Background

In 2000 the National Center for Health Statistics drew a sample of over 300,000 short-stay discharges from 434 hospitals, including both general-specialty and children's hospitals.

Statistics from the NHDS are thought to be geographically representative because the NHDS sampling frame was relatively unrestricted.

MedPAR Background

Obtained from the Health Care Financing Administration (HCFA), MedPAR data included all paid fee-for-service Medicare discharges from Medicare-certified, short-stay U.S. hospitals. A total of 11.5 million discharge records were included for calendar year 2000. Of special importance is the fact that MedPAR data underreport total Medicare discharges by omitting most discharges for managed care. This particular omission has significant implications for the various comparisons between the MedPAR and NIS data files.

Methods

Outcome variables compared in the NIS and NHDS databases included:

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

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 NDHDS are samples, and statistics derived from them are estimates. Comparisons between NIS and NHDS estimates utilized two-sample z-tests. MedPAR data, in contrast, are not a sample and the NIS-MedPAR comparisons employed oversample z-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 taken. 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, and the sheer volume of tests conducted – 330 in all. Considering all of these possible reasons for encountering significant differences among the samples, data analyses revealed remarkable similarity among the estimates.

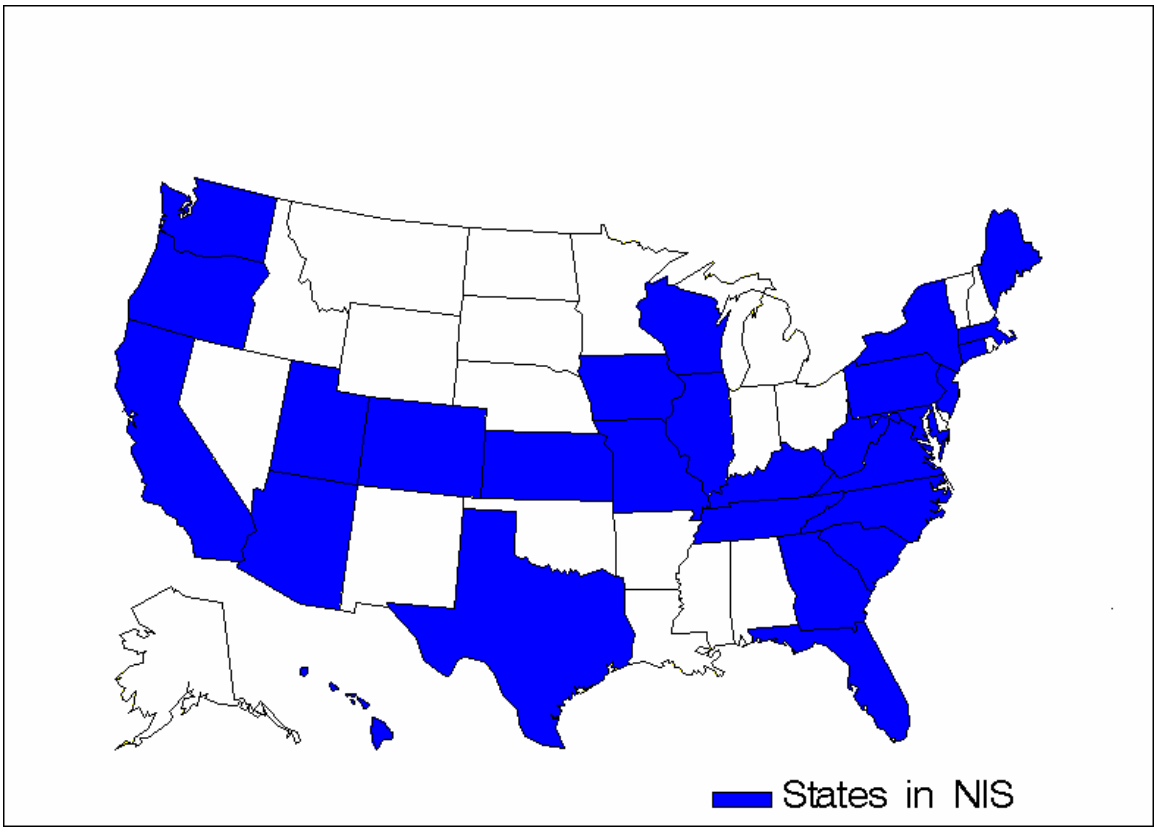
Conclusion

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 healthcare policy variables are accurate and precise. The NIS offers a large sample that allows for the study of rare disorders, procedures, and hospital types. NIS estimates can be calculated for thousands of special sub-populations that may be of interest to researchers. The NHDS sample and MedPAR data are drawn from all 50 states, while only 28 states are included in the NIS database. NIS states, however, encompass 68 percent of all short-stay hospitals and 75 percent of all discharges. The NIS contains charges for each case, a full range of payers, and a very 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, while the MedPAR database contains all Medicare patients covered by the fee-for-service program, but excludes Medicare patients enrolled in alternative plans.

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 2000, with estimates from two other data sources. These comparisons will interest researchers who intend to make inferences about hospital outcomes using the 2000 NIS. This is the sixth in a series of such reports. The five previous reports compared the NIS to other data sources for the years 1991, 1993, 1995, 1997, and 1999, respectively. These data years correspond to releases of the NIS 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 28 states shown in Figure 1:

Figure 1. States in the NIS, 2000



Although NIS coverage of U.S. discharges is impressive (these states include 76 percent of all discharges from community hospitals nationwide during 2000), the possibility remains that hospital outcomes from these states may differ from hospital outcomes in the states not covered by the NIS. For example, most of the largest states are sampled in the NIS, while most of the smaller states are not. Additionally, NIS states tend to be more urban than non-NIS states. As a result, the NIS may overemphasize larger hospitals and discharges with complex disease patterns – even taking into account stratification and weighting.

Created as a part of the Hospital Cost and Utilization Project (HCUP) under funding from 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 indicated in Figure 1. The final sample contained 7.2 million discharges from 984 hospitals. We compared outcomes from this sample to outcomes from two other hospital discharge databases: 1) the 2000 National Hospital Discharge Survey (NHDS), and 2) the 2000 Medicare Provider Analysis and Review (MedPAR) file.

The 2000 NHDS was created under the auspices of the National Center for Health Statistics (NCHS). Compared to the 2000 NIS, the 2000 NHDS was a much smaller sample, containing only 313,259 discharges from 434 hospitals. However, the sample was drawn from a frame that included nearly all hospitals in all 50 states. This survey 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 the NHDS estimates less precise than the NIS estimates, the complete coverage of states and the NHDS sampling design minimized the potential bias for national estimates of hospital outcomes, which was the reason it was used as a comparative database in this study.

The 2000 MedPAR, obtained from the Center for Medicare and Medicaid Services (CMS), included about 11.5 million fee-for-service Medicare discharges from over 5,000 Medicare-certified, short-stay United States hospitals. It 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 Medicare managed care enrollees; these individuals accounted for almost 12 percent of the Medicare inpatient experience in 2000.

We compared the estimates from the 2000 NIS with estimates from the 2000 NHDS and the 2000 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 outcomes. To the extent that the NIS generates reasonable estimates for these outcomes, researchers can feel more comfortable that estimates for other, similar outcomes will also be reasonable.

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

In addition, we compared weighted and unweighted frequencies between the 2000 NIS sample and the 2000 Hospital Survey of the American Hospital Association (AHA). These comparisons are purely descriptive because the NIS sample weights were derived from the AHA survey. Consequently, there was close agreement between the two sources by construction.

The results indicate that estimates from the 2000 NIS are generally in line with estimates from the 2000 NHDS and the 2000 MedPAR. Most NIS estimates are consistent with NHDS estimates for discharges, average length of stay, and in-hospital mortality rates. Overall, the NIS

estimate for in-hospital mortality is higher than the NHDS estimate, although most other estimates were consistent. Nearly all of the average length of stay estimates were consistent between the two samples. A critical difference between the 2000 NIS and 2000 NHDS data is the code changes applied to the NHDS data in an effort to achieve more consistency within the sample. As a result of these coding alterations, some significant differences appear in the findings related to Diagnosis Groupings.

While most NIS estimates were consistent with MedPAR statistics, NIS estimates of Medicare discharge counts were higher than MedPAR estimates, by 22 percent overall. The primary reason for this difference is the absence of most managed care discharges from the MedPAR data. This discrepancy is exaggerated because the NIS is drawn from states that have higher managed care penetration than the national average. Finally, NIS ALOS estimates for Medicare patients were shorter than MedPAR statistics, while most in-hospital mortality and average total charge estimates from the NIS were consistent with the corresponding MedPAR statistics.

This report is divided into four sections. The first section describes the NIS and recent changes in the sampling strategy. The second section provides a discussion of the NHDS, the MedPAR, and the methodology used in the analysis. The third section contains the results. The final section presents a discussion and offers some conclusions.

HCUP AND NIS BACKGROUND

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

The 2000 NIS universe included all acute-care discharges from all community hospitals in the United States. The NIS 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 their discharge data for research use. AHRQ currently has agreements with 29 data sources that maintain statewide, all-payer discharge data files. The 2000 NIS contains data from 28 of these states; this reflects an increase of four more states than the previous release and 20 more states than in the first release.

Table 1 describes the growth of the NIS sampling frame. It lists the states included in each NIS release, for data years 1988 through 2000.

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	Add Arizona, Pennsylvania, and Wisconsin
1993	Add Connecticut, Kansas, Maryland, New York, Oregon, and South Carolina
1994	No new additions
1995	Add Missouri and Tennessee
1996	No new additions
1997	Add Georgia, Hawaii, and Utah
1998	No new additions
1999	Add Maine and Virginia
2000	Add Kentucky, North Carolina, Texas, and West Virginia

As with previous releases of the NIS, the 2000 NIS sampling frame was subject to further restrictions.

- The Illinois Health Care Cost Containment Council stipulated that no more than 40 percent of Illinois discharge data could be included in the database for any calendar quarter. Consequently, it was necessary to reduce the number of Illinois hospitals in the NIS sampling frame. To this end, a sample of 67 percent of Illinois hospitals yielded just less than 40 percent of the discharges supplied by Illinois in each calendar quarter of the 2000 NIS.

- Hospitals in Missouri had the option to withhold their data from the 2000 NIS. Excluding rehabilitation facilities, there were a total of 119 community hospitals in Missouri, of which 105 supplied data to the HCUP project. However, 32 of those 105 hospitals decided to withhold their data from the 2000 NIS.
- Georgia, Hawaii, South Carolina, and Tennessee all imposed "small cell" restrictions, which forced us to exclude hospitals from the 2000 NIS when a sampling stratum contained a single hospital. This restriction eliminated from the NIS sampling frame two Georgia hospitals, five Hawaii hospitals, seven South Carolina hospitals, and one Tennessee hospital. Two additional South Carolina hospitals were removed from the sampling frame due to unique characteristics that would make them identifiable, even though they were not isolated in their sampling strata.
- Texas did not supply data for most small rural hospitals. Only 287 of the 408 Texas community hospitals (excluding rehabilitation facilities) supplied data to the HCUP project for the 2000 NIS.

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. The 1999 and 2000 NIS differ 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 changes in the sampling design:

1. The previous sampling 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. 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 reduced the number of NIS strata from 108 to 60.

3. We discovered that patients treated in rehabilitation hospitals tend to have lower mortality rates and longer lengths of stay than patients in other community hospitals. Similarly, the completeness of reporting for rehabilitation hospitals is very uneven across the states. Therefore, we decided to eliminate rehabilitation hospitals from the NIS (and from the target universe).

4. In the previous NIS, bed size categories were defined only within location/teaching status. However, even within these location/teaching categories, 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 category such that approximately one-third of the hospitals would be allocated to each category.

5. Previously, 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 it was either a member of the Council of Teaching Hospitals or it had an AMA-approved residency program. The new definition still defines those same hospitals as teaching hospitals. However, it also includes all hospitals with a ratio of interns and residents to beds of 0.25 or higher. This intern-to-bed ratio is similar to a component of the Centers for Medicare & Medicaid Services' (CMS, formerly the Health Care Financing Administration) definition of teaching hospitals for Medicare payments.

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.
5. Bed Size - Previously, we stratified all hospitals into one of three ownership categories: public, voluntary, and proprietary. In several geographic regions, however, some ownership categories rarely occurred, so the new stratification sometimes collapses categories. Where possible, we used all three ownership categories (public, voluntary, and proprietary). However, we collapsed the proprietary and voluntary hospitals into a new "private" ownership category in the West and Midwest regions.

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+
Northcentral			
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+

To further improve proportional geographic representation, hospitals were sorted by state and the first three digits of their zip code prior to systematic sampling. See *Design Report: HCUP Nationwide Inpatient Sample 2000* for more details on the sampling design.

NIS Weights

Sample weights were developed for the NIS to obtain national estimates of the hospital and inpatient parameters. Within each stratum, the discharge weight was set at the ratio of discharges in the universe to discharges in the sample. The number of discharges in the universe was estimated from the 2000 AHA hospital survey. With these weights it should be possible to estimate, for example, diagnosis-specific average lengths of stay over all U.S. hospitals using weighted average lengths of stay from the NIS.

METHODS

Comparison Data Sources

NIS statistics were compared with those calculated from two other sources, each of which is described below.

National Hospital Discharge Survey (NHDS)

Conducted by the National Center for Health Statistics (NCHS), the 2000 NHDS included 313,259 discharges from 434 hospitals. The NHDS covered discharges from U.S. hospitals categorized as short-stay (hospitals with an average length of stay under 30 days), including both general-specialty (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. The remaining sample of hospitals was based on a stratified, three-stage design. The first stage consisted of selecting 112 primary sampling units (PSU's) that comprised a probability subsample of PSU's used in the 1985-94 National Health Interview Survey. The second stage consisted of selecting non-certainty hospitals from the sampled PSU's. At the third stage, a sample of discharges was selected by a systematic random sampling technique. Sixty-one percent of NHDS records were manually sampled directly from hospitals, while automated methods were employed to sample the remaining 39 percent from purchased data.

Medical Coding and Edits. The medical information that was recoded manually on the sample patient abstracts was coded centrally by NCHS staff. A maximum of seven diagnostic codes was assigned for each sample abstract. In addition, if the medical information included surgical or non-surgical procedures, a maximum of four codes for these procedures was assigned. 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.

NHDS usually presents diagnoses and procedures in the order they are listed on the abstract form or obtained from abstract services; however, there are exceptions. For women discharged after a delivery, a code of V27 from the supplemental classification is 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 is listed with other circulatory diagnoses and is other than the first entry, it is reordered to the first position. If a symptom appears as a first-listed code and a diagnosis appears as a secondary code, the diagnosis replaces the symptom which is moved back.

Following conversion of the data on the medical abstract to a computer file and combining it with the automated data files, a final medical edit was accomplished by computer inspection and by a manual review of rejected records. Priority was given to medical information in the editing decision. (Refer to the *NHDS Public Use Data File Documentation, 2000,* for additional details about NHDS Medical Coding and Data File Documentation.)

Table 3. Comparison of 2000 NIS and NHDS Data Files

Characteristics	2000 NIS	2000 NHDS
Number of Hospitals	**984**	**434**
Number of discharges	**7,450,992**	**300,460**
Intended universe	Discharges from community hospitals as defined by AHA – non-federal, short-term general or other specialty hospitals that are not a hospital unit of an institution.	SAME
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	28 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 PSU's was selected. These PSU's were a probability sample of the counties or metropolitan areas used in the 1985-1994 National Health Interview Survey. A sample of hospitals was selected within these PSU's.
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 is entered as the first-listed code. If a symptom appears as a first-listed code and a diagnosis is listed as a secondary code, the diagnosis replaces the symptom. If acute myocardial infarction is listed with other circulatory conditions, it is 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. The NIS includes nearly 25 times the number of NHDS discharges and more than double the number of hospitals. Further, the NIS contains all discharges from sampled hospitals, whereas the NHDS

contains a sample of discharges from sampled hospitals. As a result of these sampling differences, statistics calculated from the NIS usually have much smaller standard errors than those calculated from the NHDS. In addition, the NHDS does not provide valid estimates of standard errors for statistics calculated from rare sub-populations. 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 sub-populations could contain hundreds of discharges in the NIS. Statistics from the NHDS are assumed to be representative geographically, because the sampling frame is relatively unrestricted, encompassing all federal, acute-care general U.S. hospitals with six or more beds. In contrast, the NIS sampling frame is limited to the 28 states that made their data available for research purposes.

Medicare Provider Analysis and Review (MedPAR)

The MedPAR data obtained from the Center for Medicare and Medicaid Services (CMS, formerly HCFA) include all records for each fee-for-service Medicare discharge from a Medicare-certified, short-stay U.S. hospital. Federal fiscal year records for 2000 and 2001 were used to create a calendar year 2000 MedPAR file with nearly 11.5 million discharge records. To ensure that the hospital make-up of the MedPAR file was consistent with the NIS universe, community hospitals as defined by the American Hospital Association (AHA) were identified and selected. Only AHA-defined community hospitals were kept in the MedPAR-derived file for this study. In the MedPAR data, same-day stays (admission and discharge on the same day) are 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 2000 fee-for-service Medicare discharges. Analyses, however, suggest that the MedPAR data underreport total Medicare discharges by omitting most discharges for managed care. In 2000, 17.3 percent of Medicare enrollees were in managed care, including HMOs (HCFA, 2000). However, only 0.8 percent of calendar year 2000 MedPAR discharges were identified as managed care enrollees, suggesting that over 16 percent of the Medicare population may have been excluded (17.3 percent in the population - 0.8 percent in the MEDPAR file = 16.5 percent). 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 2000 NIS Medicare Discharges and MedPAR Data Files

Characteristic	2000 NIS (Medicare Only)	MedPAR
Number of Hospitals	**979 (with Medicare discharges)**	**5,020[1]**
Number of discharges	**2,642,150**	**11,470,080[2]**
Intended universe	Discharges from community hospitals as defined by AHA – non-federal, short-term general, or other specialty hospitals that are not a hospital unit of an institution.	All Medicare discharges. *Only discharges from community hospitals are 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	28 states	50 states and the District of Columbia
Sample design – hospitals	By geographic region, control/ownership, location, teaching status, and bed size.	All hospitals included.
Sample design – discharges	All discharges from sampled hospitals were included.	All fee-for-service discharges were included.
Reassignment of diagnosis codes	None	None

Variables Compared

The following measures were chosen to compare the NIS and NHDS 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 above. When comparing NIS records to MedPAR, only the NIS discharges for which Medicare was the expected primary or secondary payer were used.

[1] Short-term general and specialty community hospitals

[2] Discharges from short-term general and specialty community hospitals

Statistical Testing

Estimates derived from both the NIS and NHDS are 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* 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 given in Appendix C.

NIS-NHDS Comparisons

For each NIS-NHDS comparison, a test was performed to determine whether the NIS and NHDS estimates differed significantly. Because the NIS and NHDS estimates were both based on samples, two-sample z-tests were used where valid estimates of the NHDS standard error could be made. Due to the limited sample size, valid estimates were not available for all breakdowns of the NHDS data. Please see Appendix C for a description of comparison tests and an explanation of restrictions on calculating NHDS sample errors. Differences were reported at the .01 and .05 significance levels.

Tables comparing NIS and NHDS statistics (Table 9 – Table 14) are found in Appendix A.

NIS-MedPAR Comparisons

Because the MedPAR data are the population, and not a sample, a z-statistic was computed for these comparisons. The standard error used in these calculations was generated by the PROC SURVEYMEANS procedure for the subset of NIS discharges with Medicare identified as the principal payer or secondary payer.

Tables comparing NIS and MedPAR statistics (Table 15 – Table 21) are found in Appendix B.

NIS-AHA Comparisons

No significance tests were performed for the NIS-AHA comparisons because the NIS sample weights were derived from AHA survey discharge counts.

Comparisons by Diagnosis and Procedure Categories

NIS data was compared to both NHDS and MedPAR data across selected diagnoses and procedure groups. For NHDS comparisons, the 25 diagnosis and procedure groups most frequently found on the NIS were selected. For MedPAR comparisons, the 25 diagnosis and procedure groups selected were those most frequently found for NIS discharges where Medicare was the expected payer.

Grouping of diagnosis and procedures was done with Clinical Classification 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 are assigned based on the principal, or first-listed, diagnosis and procedure for each discharge.

RESULTS

Whenever two different samples are taken, sample estimates will not be identical, because of sampling variation. Statistically significant differences between the NIS and NHDS can be expected for a variety of reasons. First, some differences exist in the sampling strategies used. Second, the NHDS recoding of certain conditions may lead to significant differences on these comparisons. Finally, the sheer number of tests (about 330), will produce, purely by chance, some statistically significant results.[3]

NIS-AHA Comparisons

This section refers to tables in Appendix A (Table 7 and Table 8) comparing NIS estimates with AHA annual survey data. These tables show that NIS discharge estimates consistently align with the discharge counts from the AHA survey. This is not surprising since the definition of geographic location used as a NIS sampling stratum is based on AHA annual survey results, and NIS discharge weights are derived from the AHA survey discharge counts. As with the regional comparisons, the AHA-derived sampling weights in the NIS yield hospital counts consistent with AHA universe counts for various categories of hospital types.

NIS-NHDS Comparisons

Appendix B includes Table 9 through Table 14, comparing NIS estimates with NHDS estimates. The following sections refer to these tables.

Overall and Regional Comparisons

Overall and by region, no statistically significant differences were found between the NIS and NHDS data with either discharges or average length of stay (ALOS). However, we found a small but significant difference for in-hospital mortality estimates: 2.37 percent for the NIS and 2.24 percent for the NHDS, which is not completely explained. It appears to particularly reflect a difference in results for the Midwest states where NIS representation is relatively weaker. It does not appear to be related to differences in ownership or size of hospitals, but may be related to the hospital's teaching status.[4] The NIS includes many teaching hospitals, which often treat significant numbers of severely ill patients, and based on common diagnoses and procedures, it appears that the NIS contains a larger proportion of severely ill patients (who might have higher mortality rates) than does the NHDS data. Finally, since the NIS retains all discharges at a hospital, it was not possible to exclude some of the cases that might have been discharged from Skilled Nursing Facilities and other Long Term Care units with higher mortality rates.

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[3] While some type of correction for the number of tests could be applied, given the number of tests, this would greatly increase the risk of a Type II error. For example, if a Bonferroni correction was used for the total number of tests, the applied alpha level would be about 0.05/330 or 0.00015.

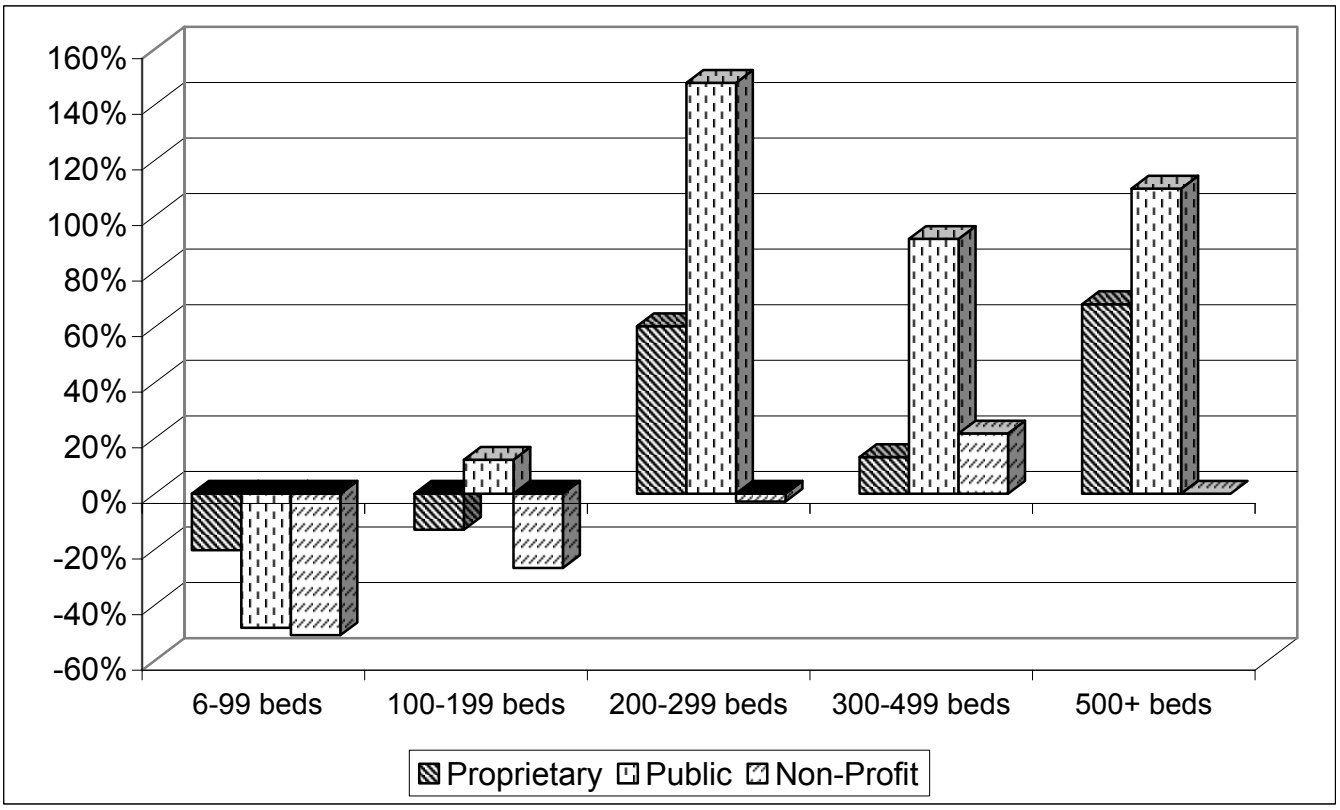
[4] A test of this teaching status hypothesis is not possible because hospital teaching status information is not available for NHDS data.

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 are small and appear consistent with the non-significant differences shown in other regions.

Comparisons by Hospital Characteristics

Generally, NIS and NHDS estimates were similar for each of the three hospital ownership categories, although the NIS discharge estimate was significantly larger than the NHDS estimate for public hospitals. Significant differences also appear with comparisons for some bed size categories within each level of hospital ownership.[5] Where ALOS differences were found, the NIS estimates were shorter than the NHDS estimates, and where in-hospital mortality differences were found, the NIS estimates were higher than the NHDS estimates. These differences may be caused by the make-up of the two samples – the NIS has a greater proportion of its discharges from larger hospitals while the NHDS has a greater proportion of its discharges from smaller hospitals. It can be seen in Figure 1 that the NIS tends to underemphasize discharges relative to the NHDS for smaller hospitals and overemphasize discharges represented by the largest hospitals.

Figure 2. NIS and NHDS Discharge Difference by Ownership and Bed Size



[5] The NHDS does not include any discharges from public hospitals with 500+ beds, so no comparison was possible for that category.

The NIS and NHDS discharge estimates were significantly different for six bed size categories.

- For proprietary hospitals, the NIS estimate was 20 percent lower for hospitals with 6-99 beds.
- For private non-profit hospitals, the NIS estimate was
  48 percent lower for hospitals with 6-99 beds,
  27 percent lower for hospitals with 100-199 beds, and
  52 percent higher for hospitals with 500 or more beds.
- For public hospitals, the NIS estimate was
  51 percent lower for hospitals with 6-99 beds, and
  48 percent higher for hospitals with 500 or more beds.

There were far fewer differences in estimates of ALOS, where only two significant differences were found. Both instances were bed size categories for public hospitals:

- For hospitals with 6-99 beds, the NIS estimate was 24 percent shorter than the NHDS estimate.
- For hospitals with 200-299 beds, the NIS estimate was 18 percent shorter than the NHDS estimate.

Four significant differences were found with NIS in-hospital mortality estimates.

- For proprietary hospitals with 100-199 beds, the NIS estimate was 34 percent higher than the NHDS estimate.
- For private non-profit hospitals, the NIS estimate was
  13 percent higher for hospitals with 6-99 beds,
  19 percent higher for hospitals with 100-199 beds, and
  11 percent higher for hospitals with 300-499 beds.

Comparisons by Patient Characteristics

Nearly all estimates by expected payer were consistent between the NIS and NHDS. Only in the payer category of "missing," where the NIS estimates fewer than 500 discharges,[6] were significant differences found for discharges and in-hospital mortality. No significant differences were found for any ALOS and most discharge category of patient characteristics – age group, gender, and race. Several significant differences were found, however, for in-hospital mortality estimates.

- By age group, only one significant difference was found: the NIS in-hospital mortality rate estimate for patients 65 years and older was 6 percent higher than the NHDS estimate.
- One significant difference was found by gender with the in-hospital mortality rate for males. The NIS estimate was 9 percent higher than the NHDS estimate.

Most of the significant differences in patient categories occurred with race groupings.

[6] The NHDS estimate for "missing" payer is 351,000 discharges.

- For discharges, the NIS estimate for “other” was two and one-half times larger than the NHDS estimate.
- The NIS in-hospital mortality estimate, compared to the NHDS, was
  11 percent higher for whites,
  23 percent lower for “other,” and
  12 percent higher where race was missing.

The racial make-up of the two samples is very different. The NHDS contains proportionately more discharges for white patients and the NIS contains proportionately more discharges for “other” race patients. Both samples include large numbers of discharges without race information: 24 percent of NIS discharges and 25 percent of NHDS discharges are missing race information. Looking only at discharges with race information, however, the NIS is more reflective 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

Race	U.S. Population[7]	NIS Discharges with Race Information	NHDS Discharges with Race Information
White	71%	70%	80%
Black	13%	13%	15%
Other	16%	17%	5%

Comparisons by Diagnosis Category

NIS estimates differ significantly from NHDS estimates for nine of the 25 diagnosis categories – with larger NIS estimates in five categories and larger NHDS estimates in the remaining four categories.

Of the nine significant differences, four can be attributed to code reordering in the NHDS (“nonspecific chest pain,” and three pregnancy/delivery categories). In contrast to the NHDS, there was no reordering of diagnoses with NIS data: the first diagnosis listed for each discharge was assigned as the principal diagnosis.

Diagnoses were reordered in the NHDS, however, under certain conditions. For example, when a symptom appeared as the first-listed code, it was reassigned as a secondary diagnosis. This explains the dramatically lower figure for non-specific chest pain in the NHDS sample compared to the NIS (91 percent lower than the NIS estimate).

There are four diagnoses in the top 25 relating to pregnancy and delivery, including the category "normal pregnancy." Significant differences were found with 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.) Again, this can be

[7] SOURCE: U.S. Census Bureau, Current Population Survey, March 2000, Racial Statistics Branch, Population Division. February 22, 2001

attributed to reordering of diagnosis codes in the NHDS data: regardless of the original principal diagnosis, the NHDS gives a code of V27 from the supplemental classification as the principal diagnosis for all women discharged after delivery. As a result, the NHDS estimates 3.7 million "normal deliveries" – significantly higher than the NIS estimate. However, the NHDS estimates for the other three pregnancy/delivery categories were much lower than the NIS estimates.

In five areas, the difference in number of discharges could not be attributed to coding differences. In three categories, the NIS estimates were lower than NHDS estimates (“affective disorders,” “fluid and electrolyte disorders,” and “asthma”). In two other categories (“complications of device implants” and “complications of surgical procedures”), the NIS estimate was significantly higher than the NHDS estimate.

There are only two diagnosis categories with significant ALOS differences, and three categories that differ significantly on in-hospital mortality estimates. Both ALOS differences occur with categories subject to code reordering in the NHDS. In the NIS, the "normal delivery" category is listed as the principal diagnosis only when coded by the hospital. The "normal delivery" population in the NIS represents cases where the delivery code was listed as the principal diagnosis. In contrast, deliveries in the NHDS "normal delivery" category include women who had episiotomies as well as a variety of minor birth complications. It is not surprising, then, that both the average length of stay and mortality would be higher for the NHDS "normal" category, as it represents a somewhat higher risk population.

Of the three significant differences found with in-hospital mortality measures, the NIS estimate was larger in two categories (“pneumonia” and “cardiac dysrhythmias”) and smaller in the third category (“acute myocardial infraction”).

Comparisons by Procedure Category

By procedure category, NIS discharge estimates differ significantly from the NHDS estimates for five of the 25 categories ("other procedures to assist delivery,” “diagnostic cardiac catheterization,” “percutaneous coronary angioplasty,” “coronary artery bypass graft,” and “other vascular catheterization”). In each case, the NIS estimate was significantly higher than the NHDS estimate. Comparisons of average length of stay, however, estimated by procedure category, showed no significant differences between the NIS and NHDS.

Valid standard errors for in-hospital mortality rates could only be calculated for nine of the procedure categories because of a combination of low mortality and the smaller sample size of the NHDS, yielding insufficient sample sizes to produce valid estimates. (See Appendix D for validity criteria.) In three of those nine categories, significant differences were found. The NIS estimate was larger than the NHDS estimate in two of these instances (“respiratory intubation” and “coronary artery bypass graft”) and smaller than the NHDS estimate in the third category (“diagnostic cardiac catheterization”).

NIS-MedPAR Comparisons

Tables in Appendix C (Table 15 through Table 21) compare NIS Medicare estimates with MedPAR statistics. The following sections refer to these tables.

Overall and Regional Comparisons

Overall, the NIS estimate of total discharges is 22 percent higher than the total number of MedPAR discharges. Higher NIS discharge estimates may be attributed to the omission of most managed care clients from the MedPAR, given that Medicare managed care patients, approximately 16 percent of Medicare patients, were excluded from the MEDPAR. An important difference between the NIS-Medicare sample and MedPAR data is that MedPAR represents actual fee-for-service claims paid by Medicare, while the NIS-Medicare sample consists of discharges (both fee-for-service and managed care) where Medicare was the *expected* payer. This may be another explanation of the higher NIS counts, since the expected payer is not always the actual payer.

By Census region, the NIS estimates 38 percent more Medicare discharges in the Northeast, 15 percent more in the Midwest, 14 percent more in the South, and 48 percent more in the West. The magnitude of differences in the regional discharge estimates appears greatest in the regions with the largest Medicare managed care penetration, such as the Northeast and West.

Because the overall NIS estimate of Medicare discharges exceeds the actual number in the MedPAR data by over 20 percent, it is not surprising to find that nearly all the NIS discharge estimates that follow are also significantly larger than the corresponding MedPAR totals. This suggests the need for a more useful comparison of discharges. We have included a second method of comparing discharges on all the NIS-MedPAR tables: a test between proportions of patients in the various categories. Although significant differences in proportions were found in three of the four regional comparisons (northeast, south, and west), tests of other categories reveal fewer meaningful differences.

NIS average length of stay estimates were significantly lower than MedPAR statistics, nationwide as well as in the Northeast and South. All of the ALOS differences by region show NIS estimates lower than MedPAR averages, suggesting that the missing managed care discharges have significantly shorter stays than fee-for-service (FFS) Medicare admissions. It is not possible to compare ALOS for FFS and Managed Care Medicare enrollees within the NIS because not all states make this distinction.

No significant NIS-MedPAR differences, either nationally or regionally, exist for in-hospital mortality or in total charge measures. Although the NIS and MedPAR yield different estimates of ALOS, the similarity of their mortality and charge estimates suggest that the two databases do not have fundamental differences in their description of patient outcomes.

Comparisons by Hospital Characteristics

NIS estimated discharge counts are larger than those reported in MedPAR data – reflecting the exclusion of Medicare managed care discharges from MedPAR data. Differences were significant for all three ownership categories and eight of the 15 bed size categories. However, few differences in proportion were meaningful – significant proportion differences were found for only one ownership category and one bed size category. Results should be interpreted

cautiously, as many MedPAR records did not clearly identify hospital ownership (1.1 percent) or bed size (10.8 percent).[8]

For public hospitals, the NIS discharge estimate was 19 percent larger than the MedPAR statistic, but no meaningful difference was found in comparing the proportion of discharges. Significant differences were found with discharge counts for two of the five bed size categories (100-199 beds and 200-299 beds), but only for the 100-199-bed hospitals was a meaningful difference found in comparing the proportion of discharges.

With private non-profit hospitals, the NIS estimate was 26 percent higher than the MedPAR count and the difference in discharge proportions was also significant. Significant differences were found for all five bed size categories by count only, while no meaningful differences were found with any proportional comparisons by bed size for private non-profit hospitals.

For investor-owned hospitals, the NIS estimate was 23 percent higher than the MedPAR count, although the proportion of discharges was not significantly different. Significant discharge differences were found with only one of the five bed size categories (1-99 beds). In proportional comparisons, no meaningful differences were found.

Most NIS estimates of ALOS were consistent with MedPAR averages. In only one ownership category (public hospitals) and three bed size categories were significant ALOS differences found. In all four instances, the NIS estimate was shorter than the MedPAR average. Meaningful differences by bed size were found with public hospitals with 1-99 beds and private non-profit hospitals with 1-99 beds and 100-199 beds.

NIS estimates of in-hospital mortality and total charges were consistent with MedPAR averages for all ownership categories. Two in-hospital mortality rate differences by bed size were found; the NIS estimate for public hospitals with 1-99 beds was higher than the MedPAR average, while the estimate for investor-owned hospitals with 500+ beds was lower than the MedPAR average. Only one meaningful difference in total charge statistics by bed size was found. The NIS average total charge estimate for public hospitals with 1-99 beds was significantly lower than the MedPAR average.

A second comparison by hospital type examines NIS and MedPAR statistics by hospital location, teaching status, and bed size within each of the three location/teaching status categories. NIS discharges are significantly higher than MedPAR for all these categories except for urban teaching hospitals with 1-299 beds and for rural hospitals with over 100 beds. Again, these discrepancies probably reflect the omission of managed care patients from the MedPAR data. In measures of proportions, meaningful differences were found only for rural hospitals – overall, and for rural hospitals with 1-49 beds.

NIS estimates of ALOS were significantly shorter for two of the three location/teaching status categories (both urban hospital categories: teaching and non-teaching). Significant ALOS differences were also found for two of the nine bed size categories (urban teaching hospitals with 1-299 beds and urban non-teaching hospitals with 1-99 beds).

[8] MedPAR data does not include hospital identifiers, so it is not possible to augment it with AHA information.

All NIS estimates of in-hospital mortality rates were consistent with MedPAR averages, in the three location/teaching status categories and in all nine bed size categories. Most total charge estimates from the NIS were also consistent with MedPAR averages. Significant differences were found only for rural hospitals (overall) and urban non-teaching hospitals with 1-99 beds. In both cases, the NIS estimate was lower than the MedPAR average.

Comparisons by Patient Characteristics

Comparisons by patient characteristics found significant differences for all discharge count comparisons and most discharge proportions and ALOS comparisons. Most NIS estimates of in-hospital mortality and average total charge were consistent with MedPAR averages.

While all the NIS discharge estimates differed significantly from the MedPAR totals, for three measures the NIS estimate was actually lower than the MedPAR count. The NIS estimate for patients 85 years and older was 6 percent lower than the MedPAR statistic, and the NIS estimates for the racial categories of White and Black were lower than the MedPAR count by 9 percent and 17 percent, respectively. A contributing cause of the race differences was the sizeable number of discharges without race information on the NIS – race was missing on more than 21 percent of NIS Medicare discharges, compared with a missing rate of less than 0.5 percent on the MedPAR data.

The NIS also shows more records in the “other” category, a likely result of the NIS’ geographic make-up: the NIS includes the most racially diverse states in the nation (New York and California) and excludes many of the least racially and ethnically diverse states (e.g., North Dakota).

Significant differences were also found for eight of the ten proportionality tests. Only with the age groups 0-64 years and 75-84 years were the NIS and MedPAR proportions consistent.

Average length of stay estimates from the NIS were significantly shorter than MedPAR averages on all four age group and both gender categories, as well as two of the race categories (White and Missing).

NIS estimates of in-hospital mortality rates were consistent for two age groups (0-64 years and 65-74 years), as well as both gender and two of the race categories. In the age groups 75-84 and 85+, the NIS estimate of in-hospital mortality was higher than the MedPAR average. For “other” race, the NIS estimate was higher than the MedPAR average, while for “missing” race, the NIS estimate was lower than the MedPAR average.

NIS estimates of average total charge were consistent with MedPAR statistics for all four age groups and both gender categories, as well as the race groups White and Black. Compared with the MedPAR averages, the NIS charge estimate for “other” race was high and the estimate for “missing” race was low.

Comparisons by Diagnosis Category

Significant differences were found between NIS estimates of Medicare discharges and MedPAR discharges, both by count and by proportion for all 25 diagnosis groups, ranging from 12 percent higher (“affective disorders”) to 29 percent higher (“nonspecific chest pain”).

For 12 of the 25 diagnoses, the NIS estimate for ALOS was significantly lower than the MedPAR average. Although significant, the difference is not substantial: the average discrepancy was 0.18 days, or less than 3 percent of the overall mean length of stay of 6.14 days found for the MedPAR data file as a whole. And even this relatively small figure is likely an overestimate of the difference between the NIS estimate and the Medicare population, as the MedPAR file excludes most managed care discharges which tend to have shorter lengths of stay.

Most NIS estimates of in-hospital mortality and average total charge were consistent with the MedPAR averages. For 20 of the 25 diagnoses, there were no significant differences in mortality estimates; four NIS estimates were significantly lower than the MedPAR average ("acute myocardial infraction," "nonspecific chest pain," "gastrointestinal hemorrhage," and "biliary tract disease"); and one NIS estimate was significantly higher than the MedPAR average ("rehabilitation care"). For average total charge, the NIS estimates were consistent with the MedPAR averages on 21 of the 25 diagnosis groupings. Of the four significant total charge differences, the NIS estimate was larger in three instances ("osteoarthritis," "biliary tract disease," and "transient cerebral ischemia") and smaller in one instance ("rehabilitation care").

Comparisons by DRG

By diagnosis related group (DRG), NIS estimates of discharge counts were significantly higher than the MedPAR counts for all DRGs, ranging from 12 percent higher ("psychosis") to 30 percent higher ("chest pain"). Most comparisons of discharge proportion, however, showed consistency between the NIS estimates and the MedPAR sums – only five significant differences were found in proportion of discharges, with the NIS proportion smaller than the MedPAR proportion for three DRGs ("specific cerebrovascular disorders," "psychosis," and "nutritional & miscellaneous metabolic disorders") and larger than the MedPAR proportion for two DRGs ("chest pain" and "circulatory disorders").

Most NIS estimates of ALOS were consistent with MedPAR averages; significant differences were detected for only seven DRGs. The NIS estimates were shorter than the MedPAR average for each of the seven differences.

NIS estimates of in-hospital mortality and average length of stay were consistent with the MedPAR averages for nearly all DRGs. Only two meaningful mortality differences were found, with the NIS estimate higher than the MedPAR statistic in one measure and lower in the other ("rehabilitation" and "G.I. hemorrhage," respectively). Only two significant differences in total hospital charge were identified – the NIS estimate of total charge for "major joint & limb reattachment procedures of the lower extremity" was higher than the MedPAR average, while the estimate for "rehabilitation" was lower than the MedPAR average.

Comparisons by Procedure Category

Most, but not all, of the NIS discharge estimates by procedure category were significantly larger than the MedPAR counts. However, in three procedure groups there was no meaningful difference ("diagnostic ultrasound of the heart," "other therapeutic procedures," and "computerized axial tomography"). Where significant differences were found, the NIS estimate exceeded the MedPAR number, ranging from 15 percent higher ("laminectomy") to 45 percent higher ("physical therapy"). Nearly all comparisons of discharge proportions showed significant

differences between NIS estimates and MedPAR statistics. The NIS and MedPAR proportions were consistent with only one procedure group (“other therapeutic procedures”); in the other 24 groups, the NIS estimate was higher than the MedPAR proportion.

Most NIS estimates of ALOS were consistent with MedPAR averages, with only six significant differences noted. In each of those six groups, the NIS estimate was shorter than the MedPAR average.

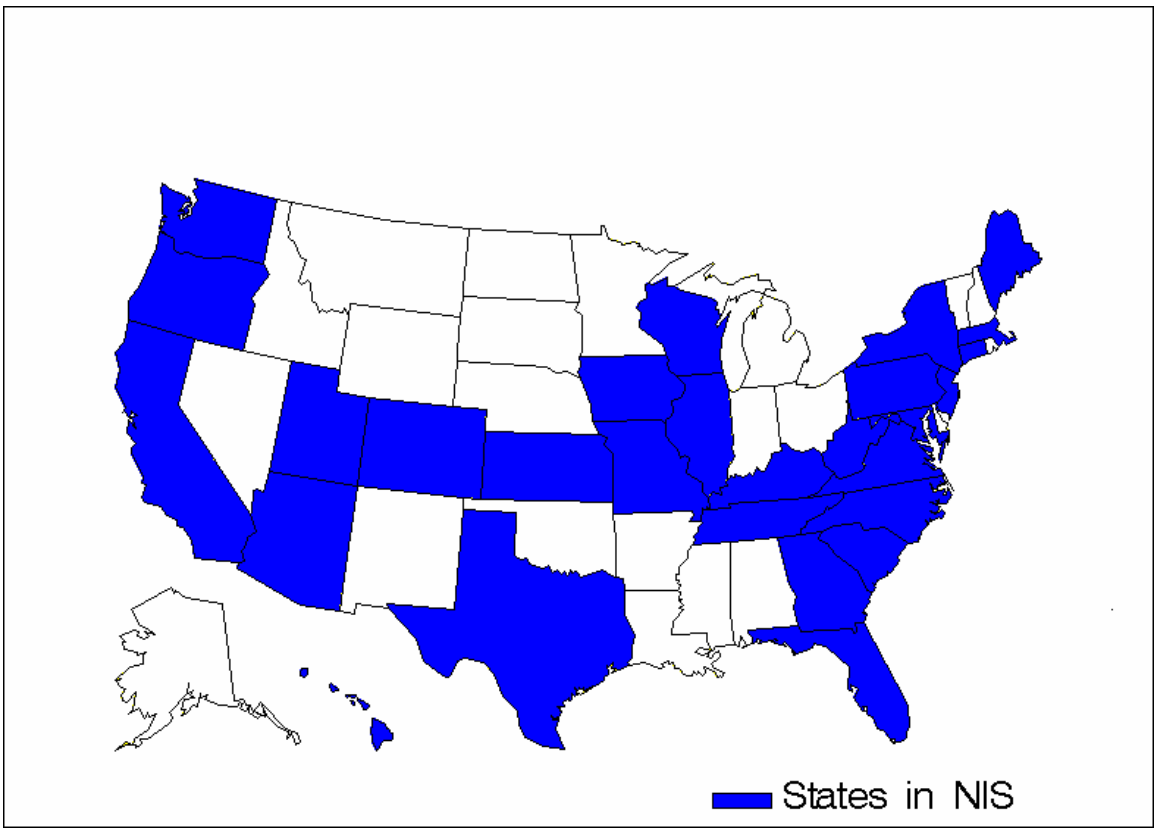
The majority of NIS estimates for in-hospital mortality and average length of stay were consistent with MedPAR averages: there were three meaningful mortality differences and one meaningful total charge difference. Of the three mortality differences, one NIS estimate was higher, while two were lower than the corresponding MedPAR statistic: the NIS in-hospital mortality estimate for “physical therapy” was significantly higher than the MedPAR average and the NIS estimates for “colorectal resection” and “diagnostic ultrasound of the heart” were lower than MedPAR. For the one significant difference detected for average total charge (“hip replacement”), the NIS estimate was larger than the MedPAR average.

DISCUSSION

Comparisons with NHDS and MedPAR Data

The key difference between the NIS and the databases to which it was compared is geographic. Both the NHDS and the MedPAR are national in coverage; MedPAR data includes all Medicare paid, fee-for-service discharges in the U.S., while NHDS data are gathered from a sampling frame of all 50 states plus the District of Columbia. In contrast, the 2000 NIS is limited to the 28 states shown in Figure 3. These states contain over 75 percent of all U.S. community hospital discharges. There are some significant differences between the states excluded and included in the NIS that offer likely explanations for some of the differences observed.

Figure 3. States in the NIS, 2000



The NIS states are disproportionately the more populated ones. NIS states had an average population density of 128.2 persons per square mile in 2000, compared to a national average of 79.8 persons per square mile. Of the ten states with the highest population density, all but three are included in the NIS. These states, and their rank in terms of population density order, are: New Jersey (1), Massachusetts (3), Connecticut (4), Maryland (5), New York (6), Florida (8), and Pennsylvania (10). At the other end of the spectrum, only one of the ten least populous states is included in the NIS: Utah (41).[9] Given this difference in geographic sampling, the NIS sampling frame starts with few hospitals in sparsely populated areas. While discharges are weighted by rural versus urban, the most rural state included in the sample, Utah, has a

[9] Source of state rankings: State and Metropolitan Area Data Book - 5th Edition and 2000 U.S. Census.

population density of 27.2 persons per square mile, compared with population densities of 1.1 for Alaska, 5.0 for Wyoming and 6.2 for Montana.[10] 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 NIS is preferable to the MedPAR file for estimating the total Medicare discharges, as it includes the Medicare managed care patients and not just the fee-for-service discharges. The exclusion by MedPAR is inconsequential in those areas where managed care providers have minimal market penetration, but greater in the regions, particularly the West, where managed care participation by Medicare patients is higher.

One impact of the specific subset of states selected for the NIS is an overrepresentation of Medicare patients in managed care. In the 28 states included in the 2000 NIS, the market penetration of managed care providers for Medicare enrollees averages 19.6 percent. In contrast, for the 22 states not included in the NIS, the mean market penetration of managed care providers is 10.2 percent. Table 6 breaks down managed care penetration by region of NIS and non-NIS states. In the Northeast, South, and West, Medicare managed care penetration is higher in NIS states than in non-NIS states and the MedPAR substantially under-represents total discharges. In contrast, the Midwest has a low proportion of managed care enrollees and the NIS estimates more closely align with MedPAR numbers. This is consistent with the hypothesis that the MedPAR under-represents total discharges by omitting most managed care discharges.

Table 6. Medicare Managed Care Market Penetration by Region

	States Not in the NIS		NIS States		All States in Region	
	Mean	N	Mean	N	Mean	N
Northeast	13.67%	3	20.55%	6	20.19%	9
Midwest	9.78%	7	9.71%	5	9.75%	12
South	8.72%	6	13.01%	10	12.13%	16
West	15.82	6	35.53%	7	33.24%	13

NIS Strengths

While the above discussion focused on the 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 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 smaller sample such as the NHDS. Without a sample of several million, such as in the NIS, estimates for less common procedures and diagnoses are unreliable. While the NIS may overemphasize urbanized areas, this emphasis on higher density states makes available data on less common conditions that might rarely find inclusion in a smaller sample such as the NHDS.

[10] None of these three states have all-payer hospital discharge data, so are not eligible for HCUP inclusion.

In estimating mortality for the nation or within any major category of age, gender, region, procedure or diagnosis, the NIS rates are equivalent to the data sets to which it was compared. Because NIS estimates have greater precision rooted in a 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 type of payment. For researchers interested in discharges for which Medicare is a secondary payer, the NIS is the only one of the data sources discussed that provides a large sample of this population.

NIS Weaknesses

NIS estimates of mortality and length of stay are not significantly different from NHDS estimates. However, the latter would be preferred by researchers in those cases where total discharge estimates are of interest and it is important to the research hypothesis that representation of hospitals by size in the sample is proportional to the national distribution.

Because of the states available for the sample, the NIS exaggerates the discrepancy between total Medicare discharges and the MedPAR's primarily fee-for-service population. The MedPAR database gives no estimate for managed care participants, while the NIS database may overestimate the number in managed care.

Comparing the 2000 NIS to Previous Releases

In contrasting NIS and NHDS comparisons for 2000 and 1999, the 2000 data showed fewer significant differences for discharge estimates but more differences for in-hospital mortality estimates, although most estimates of in-hospital mortality are consistent between the two samples. The average length of stay comparisons for the two years were very similar, with nearly all estimates consistent.

NIS and NHDS discharge estimates for 2000 were more closely aligned than in 1999, with fewer differences found in nearly every comparison grouping – from hospital characteristics and patient characteristics to diagnosis and procedure categories. Of 88 discharge comparisons for the 2000 data, 20 significant differences were observed. For the 1999 data, there were 29 significant differences for 89 comparisons.

In contrast to discharge estimates, NIS and NHDS in-hospital mortality estimates were less similar for 2000 than in 1999. This was true for nearly every comparison grouping. The overall NIS estimate for in-hospital mortality was significantly higher than the NHDS estimate, as well. There were 64 comparisons possible with the 2000 data and 18 significant differences were found, compared with only seven such differences in 67 comparisons for the 1999 data.

As was true for 1999, the NIS estimate of Medicare discharges was greater than the MedPAR count for calendar year 2000. And as was the case in previous years, a major cause of the difference was the exclusion of most Medicare managed care records from MedPAR data (the

NIS estimates were based on a population that included both fee-for-service and managed care discharges). The overall discrepancy between the NIS estimate and the MedPAR count increased between 1999 and 2000: the NIS estimate was 12 percent larger than the MedPAR count in 1999 and 22 percent larger in 2000, due largely to an increase in Medicare managed care, particularly within NIS states, as noted previously in the report. While most NIS estimates of Medicare discharge were significantly larger than similar MedPAR counts, most NIS estimates of average length of stay were consistent with MedPAR averages, as were nearly all in-hospital mortality and average total charge estimates.

In terms of meaningful differences, the 2000 NIS is comparable to the 1999 NIS with regard to discharge and total charge tests, and showed improvement from the 1999 NIS with regard to average length of stay and in-hospital mortality tests. Significant differences were noted on nearly all discharge tests in both years. The number of differences was up slightly in 2000, from 100 to 103, an increase that may have occurred by chance because of the sheer number of tests (115). The minor increase in differences for total charge tests – 12 significant differences, up from 10 – may also have occurred by chance.

Overall, the NIS estimate for average length of stay was significantly shorter than the MedPAR average, as was true with the 1999 data, but the difference was smaller in 2000 (3.4 percent, as compared with 7.1 percent in 1999). This improvement is also observed as a decrease in the number of differences on individual comparison tests – there were 65 significant differences with the 1999 data, compared with only 44 with the 2000 data. The number of significant differences observed for in-hospital mortality estimates also declined from 1999 to 2000 by nearly one-third, from 27 down to 16.

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. In addition, NIS estimates may be calculated for literally thousands of special sub-populations that may be of interest to researchers.

The NHDS and MedPAR both offer data drawn from all 50 states, rather than the 28 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, but it does provide a useful data source for answering many research questions. The source of the few differences that do exist between the NIS and NHDS is one area that warrants further investigation. It is possible, for example, that the lower prevalence of chronic obstructive pulmonary disease, dysrythmias, fluid and electrolyte disorders, and osteoarthritis, in the face of higher numbers of surgical complications, could reflect a relationship between hospital size and intense treatment patterns.

As for which of the data sources discussed is preferable or better, the answer, as with so much of research, is “It depends.” It depends on the use for which the data are intended. In general, the NIS estimates of such essential variables to healthcare policy as in-hospital mortality, inpatient population size, length of stay, and costs are accurate, precise and can be calculated

for both large groups ranging from the inpatient population of the United States, and small subsets with specific conditions. The characteristics documented herein ensure that the NIS will be a valuable tool for researchers and policymakers alike.

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APPENDIX A – NIS-AHA TABLES

Table 7. Number of Hospitals in NIS Frame and AHA Universe by Census Region, 2000

	2000 AHA Universe (thousands)	2000 NIS Frame[11] Weighted (thousands)	2000 NIS Frame[1] Unweighted (thousands)
U.S.	36,418	36,417	7,451
Census Region			
Northeast	7,350	7,350	1,446
Midwest	8,426	8,426	1,707
South	13,715	13,715	2,857
West	6,927	6,927	1,440

[11] The 2000 frame contains 28 states.

Table 8. Hospitals in NIS Frame and AHA Universe by Hospital Characteristics, 2000

	2000 AHA Universe (thousands)	2000 Frame[12] Weighted (thousands)	2000 Frame[2] Unweighted (thousands)
Total	36,418	36,417	7,451
Control / Ownership			
Private/Investor-Owned	4,530	4,763	1,003
Private/Non-Profit	26,899	27,295	5,587
Government/Non-Federal	4,989	4,360	861
Location / Teaching Status / Bedsize			
Rural			
Total	5,740	5,740	1,147
1 – 49 Beds (small)	559	559	115
50 – 99 Beds (medium)	1,187	1,187	234
100+ Beds (large)	3,994	3,994	798
Urban			
Total	30,677	30,678	6,305
Urban Teaching			
Total	11,771	15,635	3,161
1 – 299 Beds (small)	1,174	2,008	436
300 – 499 Beds (medium)	3,157	4,590	950
500+ Beds (large)	7,440	9,037	1,775
Urban Non-Teaching			
Total	18,907	15,043	3,144
1 – 99 Beds (small)	2,416	1,582	322
100 – 199 Beds (medium)	5,533	4,100	867
200+ Beds (large)	10,958	9,361	1,955

[12] The 2000 frame contains 28 states.

APPENDIX B – NIS-NHDS TABLES

Table 9. NIS and NHDS Estimates by Region, 2000

	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**
U.S.	36,417 (674)	35,348 (1,694)	4.60 (0.04)	4.72 (0.35)	2.37** (0.04)	2.23 (0.04)
Census Region						
Northeast	7,350 (295)	7,857 (914)	5.21[a] (0.11)	5.45 (b)	2.78 (0.13)	2.52 (0.07)
Midwest	8,426 (318)	8,000 (783)	4.48[a] (0.05)	4.35 (b)	2.25** (0.06)	2.04 (0.07)
South	13,715 (427)	13,359 (799)	4.54 (0.05)	4.70 (0.38)	2.36 (0.07)	2.27 (0.08)
West	6,927 (289)	6,132 (456)	4.22 (0.10)	4.31 (0.40)	2.07 (0.07)	2.05 (0.11)

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[b] A reliable standard error could not be calculated.

Table 10. NIS and NHDS Comparisons by Hospital Ownership and Size, 2000

Control/ Bed 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	4,763 (461)	4,417 (214)	4.60 (0.09)	4.58 (0.35)	2.21 (0.07)	2.04 (0.07)
6-99 beds	1,130** (78)	1,418 (71)	3.75 (0.08)	3.61 (0.29)	2.36 (0.10)	2.12 (0.10)
100-199	867 (111)	996 (51)	4.04 (0.14)	4.33 (0.32)	2.35** (0.16)	1.56 (0.16)
200-299	691 (184)	431 (24)	4.87 (0.28)	5.54 (0.40)	2.09 (0.21)	2.53 (0.21)
300-499	1,174 (292)	1,037 (53)	5.30 (0.22)	5.23 (0.42)	2.17 (0.16)	2.21 (0.16)
500+ beds	900 (356)	535 (29)	5.12 (0.10)	5.56 (0.42)	2.05 (0.18)	2.02 (0.18)
Total Private Non-Profit	27,295 (837)	27,286 (1,308)	4.62 (0.04)	4.72 (0.35)	2.40 (0.05)	2.29 (0.05)
6-99 beds	2,784** (146)	5,377 (260)	3.72 (0.08)	4.12 (0.29)	2.34* (0.07)	2.03 (0.11)
100-199 beds	5,254** (303)	7,167 (346_	4.25 (0.07)	4.58 0.33)	2.45* (0.16)	1.99 (0.09)
200-299 beds	5,068 (480)	5,214 (253)	4.46 (0.10)	4.86 (0.34)	2.34 (0.09)	2.28 (0.11)
300-499 beds	8,018 (739)	6,587 (318)	4.90 (0.09)	4.96 (0.38)	2.53* (0.09)	2.25 (0.10)
500+ beds	6,172** (827)	2,941 (144)	5.08 (0.12)	5.35 (0.39	2.28 (0.12)	2.44 (0.16)

Table 10. NIS and NHDS Comparisons by Hospital Ownership and Size, 2000

Control/ Bed 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	4,360* (283)	3,645 (178)	4.50 (0.12)	4.91 (0.35)	2.30 (0.10)	2.61 (0.15)
6-99 beds	613** (74)	1,248 (63)	4.04** (0.23)	5.29 (0.32)	2.19 (.19)	1.82 (0.21)
100-199	1,648 (154)	1,468 (73)	4.27 (.17)	4.46 (.33)	2.13 (.14)	2.02 (0.20)
200-299	952 (166)	384 (21)	4.76* (0.21)	5.81 (0.40)	2.56 (0.20)	2.78 (0.47)
300-499	1,045** (286)	545 (29)	4.90 (0.27)	4.63 (0.40)	2.34 (0.23)	2.03 (0.34)
500+ beds	100[a] (b)	0 (b)	4.24[a] (b)	0 (b)	2.92[a] (b)	0 (b)

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[b] A reliable standard error could not be calculated.

Table 11. NIS and NHDS Comparisons by Age, Gender, and Race, 2000

	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	5,975 (208)	6,025 (681)	3.31 (0.06)	3.71 (0.79)	0.37 (0.02)	0.45 (0.05)
16-44 years	10,317 (255)	9,969 (482)	3.54 (0.04)	3.64 (0.28)	0.46 (0.02)	0.44 (0.04)
45-64 years	7,388 (139)	6,958 (350)	4.93 (0.05)	4.93 (0.40)	2.06 (0.04)	1.90 (0.09)
65+ years	12,737 (266)	12,396 (713)	5.89 (0.05)	5.96 (0.49)	5.02* (0.06)	4.70 (0.11)
Gender						
Male	14,830 (258)	14,383 (721)	4.90 (0.04)	5.04 (0.40)	2.86** (0.04)	2.60 (0.08)
Female	21,580 (429)	20,965 (1,008)	4.39 (0.04)	4.50 (0.35)	2.03 (0.04)	2.00 (0.05)
Race						
White	19,538 (674)	21,134 (1,369)	4.69 (0.04)	4.71 (0.48)	2.66** (0.05)	2.39 (0.06)
Black	3,639 (692)	3,980 (296)	5.22 (0.08)	5.23 (0.62)	2.21 (0.07)	2.12 (0.11)
Other	4,605** (235)	1,297 (190)	4.19 (0.08)	4.68 (1.15)	1.56* (0.07)	2.03 (0.18)
Missing	8,636 (297)	8,937 (1,225)	4.34 (0.07)	4.52 (0.88)	2.20** (0.06)	1.94 (0.08)

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[b] A reliable standard error could not be calculated.

Table 12. NIS and NHDS Comparisons by Primary Payer, 2000

	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**
Medicare	13,164 (271)	12,329 (756)	5.92 (0.05)	6.04 (0.54)	4.57 (0.06)	4.42 (0.10)
Medicaid	6,010 (224)	5,592 (447)	4.25 (0.06)	4.48 (0.57)	0.99 (0.04)	0.90 (0.08)
Private Insurance	14,220 (458)	13,813 (979)	3.65 (0.03)	3.79 (0.63)	1.09 (0.03)	1.03 (0.04)
Self-Pay	1,658 (154)	1,725 (122)	3.79 (0.10)	3.83 (0.43)	1.53 (0.06)	1.46 (0.13)
No Charge	119 (43)	183 (36)	4.75 (0.20)	4.70 1.41)	1.87 (0.3)	1.10 (0.30)
Other	1,101 (75)	1,355 (265)	4.23 (0.09)	4.36 (1.30)	1.4 (0.11)	1.32 (0.11)
Missing	0** (0)	351 (69)	4.59 (0.04)	4.38 (1.31)	2.36* (0.04)	1.75 (0.31)

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[b] A reliable standard error could not be calculated.

Table 13. NIS and NHDS Comparisons by Top 25 Principal Diagnoses, 2000

	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	4,104 (156)	3,651 (178)	3.00 (0.05)	3.24 (0.25)	0.32 (0.02)	0.37 (0.06)
101: Coronary atherosclerosis	1,361 (52)	1,349 (68)	3.77 (0.05)	3.59 (0.28)	0.81 (0.03)	0.85 (0.14)
122: Pneumonia (except that caused by tuberculosis and STD)	1,250 (21)	1,297 (65)	6.02 (0.05)	5.9 (0.46)	6.03** (0.10)	5.00 (0.34)
108: Congestive heart failure, non-hypertensive	1,025 (21)	1,036 (53)	5.61 (0.06)	5.46 (0.44)	4.71 (0.07)	4.10 (0.34)
193: Trauma to perineum and vulva	820[a] (37)	3 (b)	1.99 (0.01)	2.36 (1.27)	0.00[a] (0.00)	0.00 (b)
102: Non-specific chest pain	794** (21)	73 (6)	1.83** (0.02)	1.30 (0.14)	0.06 (0.01)	0.00 (b)
100: Acute myocardial infarction	768 (24)	781 (40)	5.49 (0.06)	5.61 (0.45)	8.42** (0.13)	9.90 (0.59)
195: Other complications of birth, puerpepium	682** (31)	51 (5)	2.54 (0.03)	2.74 (0.32)	0.02[a] (0.00)	0.00 (b)
69: Affective disorders	664* (35)	784 (41)	7.29 (0.15)	7.81 (0.63)	0.04[a] (0.01)	0.04 (b)
106: Cardiac dysrhythmias	652 (16)	700 (37)	3.60 (0.03)	3.57 (0.29)	1.33** (0.04)	0.71 (0.18)
127: Chronic obstructive pulmonary diseases	619 (13)	660 (35)	5.31 (0.05)	5.16 (0.42)	2.75 (0.07)	2.20 (0.32)
205: Spondylosis, intervertebral disc disorders, other back problems	588 (21)	553 (29)	3.15 (0.04)	3.18 (0.26)	0.17[a] (0.01)	0.04 (b)
109: Acute cerebrovascular disease	580 (12)	571 (30)	6.68 (0.09)	6.6 (0.53)	10.99 (0.16)	10.00 (0.70)
237: Complication of device, implant, or graft	527* (18)	451 (25)	5.71 (0.07)	6.1 (0.51)	2.06 (0.06)	1.50 (0.32)
55: Fluid and electrolyte disorders	512** (10)	646 (34)	4.17 (0.05)	4.05 (0.33)	2.98 (0.08)	2.40 (0.33)
196: Normal pregnancy and/or delivery	500** (20)	3,749 (182)	1.93** (0.02)	2.47 (0.19)	0.00[a] (0.00)	0.03 (b)
149: Biliary tract disease	465 (10)	443 (24)	4.07 (0.04)	3.95 (0.33)	0.76 (0.03)	0.87 (0.24)
50: Diabetes mellitus with complications	455 (10)	449 (24)	5.63 (0.07)	5.68 (0.46)	1.45 (0.05)	1.20 (0.29)

Table 13. NIS and NHDS Comparisons by Top 25 Principal Diagnoses, 2000

	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**
254: Rehabilitation care, fitting of prostheses	448 (31)	514 (28)	13.06 (0.30)	13.2 (1.08)	0.83 (0.08)	0.67 (0.20)
203: Osteoarthritis	443 (17)	441 (24)	4.27 (0.04)	4.51 (0.37)	0.16[a] (0.01)	0.12 (b)
159: Urinary tract infections	437 (8)	489 (26)	4.64 (0.05)	4.64 (0.39)	1.78 (0.07)	2.10 (0.36)
181: Other complications of pregnancy	422** (16)	181 (11)	2.43 (0.03)	2.35 (0.22)	0.03[a] (0.01)	0.00 (0)
128: Asthma	392* (15)	465 (25)	3.22 (0.04)	3.02 (0.25)	0.28[a] (0.02)	0.38 (b)
238: Complications of surgical procedures	387* (10)	337 (19)	6.13 (0.06)	6.25 (0.53)	1.68 (0.06)	1.50 (0.37)
197: Skin and subcutaneous tissue infections	378 (8)	365 (20)	4.94 (0.05)	5.2 (0.44)	0.56[a] (0.03)	0.72 (b)

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[b] A reliable standard error could not be calculated.

Table 14. NIS and NHDS Comparisons by Top 25 Principal Procedures, 2000

	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	1,350** (73)	876 (45)	2.07 (0.02)	2.15 (0.17)	0.00[a] (0.00)	0.05 (b)
115: Circumcision	1,211 (54)	1,122 (57)	2.49 (0.02)	2.57 (0.20)	0.00[a] (0.00)	0.00 (b)
134: Cesarean section	927 (36)	845 (43)	3.77 (0.04)	3.68 (0.29)	0.02[a] (0.00)	0.06 (b)
140: Repair of current obstetric laceration	701 (37)	740 (38)	2.09 (0.02)	2.02 (0.17)	0.00[a] (0.00)	0.02 (b)
47: Diagnostic cardiac catheterization, coronary ateriography	693* (27)	597 (31)	3.64 (0.05)	3.76 (0.31)	0.98** (0.04)	2.80 (0.37)
70: Upper gastrointestinal endoscopy, biopsy	662 (17)	613 (32)	5.42 (0.10)	5.66 (0.46)	1.92 (0.06)	2.00 (0.31)
45: Percutaneous transluminal coronary angioplasty	601* (40)	500 (26)	2.90 (0.06)	3.10 (0.26)	0.89 (0.04)	0.55 (0.18)
124: Hysterectomy, abdominal and vaginal	596 (18)	608 (32)	2.84 (0.02)	2.82 (0.23)	0.09[a] (0.01)	0.03 (b)
133: Episiotomy	533 (28)	556 (29)	2.14 (0.01)	2.13 (0.18)	0.00[a] (0.00)	0.00 (a)
216: Respiratory intubation and mechanical ventilation	528 (13)	493 (26)	10.95 (0.23)	11.60 (0.94)	30.17** (0.46)	27.00 (1.11)
84: Cholecystectomy and common duct exploration	400 (9)	367 (20)	4.44 (0.05)	4.31 (0.36)	0.80[a] (0.04)	0.72 (b)
228: Prophylactic vaccinations and inoculations	380 (56)	320 (18)	2.29 (0.05)	2.27 (0.20)	0.01[a] (0.00)	0.00 (b)
231: Other therapeutic procedures	369 (36)	423 (23)	5.28 (0.14)	4.89 (0.41)	2.57 (0.17)	2.10 (0.39)
222: Blood transfusion	358 (14)	341 (19)	5.83 (0.08)	5.91 (0.50)	6.33 (0.15)	6.00 (0.71)
219: Alcohol and drug rehabilitation/detox	351 (34)	304 (17)	5.35 (0.26)	5.7 (0.49)	0.09[a] (0.02)	0.01 (b)
44: Coronary artery bypass graft (CABG)	349* (22)	280 (16)	8.84 (0.10)	9.11 (0.77)	2.70* (0.11)	1.60 (0.42)
152: Arthroplasty knee	328 (12)	339 (19)	4.17 (0.04)	4.45 (0.38)	0.17[a] (0.02)	0.11 (b)
54: Other vascular catheterization, not heart	306* (10)	260 (15)	10.07 (0.14)	10.4 (0.89)	10.94 (0.28)	11.00 (1.08)

Table 14. NIS and NHDS Comparisons by Top 25 Principal Procedures, 2000

	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	304 (10)	284 (16)	5.44 (0.05)	5.91 (0.51)	1.28[a] (0.06)	0.73 (b)
135: Forceps, vacuum, and breech delivery	302 (14)	303 (17)	2.28 (0.02)	2.27 (0.20)	0.00[a] (0.00)	0.00 (b)
3: Laminectomy, excision intervertebral disc	294 (13)	260 (15)	2.82 (0.05)	2.76 (0.25)	0.15[a] (0.02)	0.01 (b)
80: Appendectomy	277 (7)	280 (16)	3.12 (0.03)	3.16 (0.28)	0.14[a] (0.02)	0.00 (b)
76: Colonoscopy and biopsy	276 (13)	256 (15)	5.41 (0.23)	5.65 (0.49)	0.07[a] (1.21)	1.40 (b)
146: Treatment, fracture or dislocation of hip and femur	265 (6)	271 (15)	6.18 (0.06)	6.24 (0.54)	0.06[a] (2.08)	1.30 (b)
78: Colorectal resection	261 (6)	247 (14)	10.06 (0.08)	9.94 (0.85)	0.11 (4.20)	4.60 (0.74)

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[b] A reliable standard error could not be calculated.

APPENDIX C – NIS-MEDPAR TABLES

Table 15. NIS and MedPAR Comparisons by Region, 2000

	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)		TOTAL CHARGES (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
U.S.	13,474** (275)	11,051	100.0	100.0	5.93** (0.05)	6.14	4.55 (0.06)	4.52	17,306 (496)	16,718
Census Region										
Northeast	2,931** (137)	2,121	21.8** (0.9)	19.2	6.66** (0.15)	7.15	5.15 (0.19)	5.00	18,823 (1,385)	18,622
Midwest	3,254** (147)	2,821	24.2 (0.9)	25.5	5.65 (0.07)	5.69	4.26 (0.08)	4.13	15,067 (383)	14,611
South	5217** (150)	4,589	38.7** (1.0)	41.5	5.84** (0.06)	6.09	4.45 (0.07)	4.56	15,293 (464)	15,781
West	2,071** (112)	1,399	15.4** (0.8)	12.7	5.55 (0.16)	5.59	4.42 (0.12)	4.31	24,561 (2,250)	22,038

* $p < 0.05$ ** $p < 0.01$

Table 16. NIS and MedPAR Comparisons by Hospital Ownership and Size, 2000

	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)		TOTAL CHARGES (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
Total Public[c]	1,703** (108)	1,426	12.6 (0.8)	12.9	5.96** (0.15)	6.56	4.30 (0.14)	4.18	22,074 (2,141)	21,818
1-99 beds[d]	251 (32)	217	14.7 (2.0)	15.2	5.44** (0.35)	7.73	4.31** (0.29)	3.37	13,264* (1,192)	16,066
100-199 beds[d]	642** (61)	415	37.7* (3.5)	29.1	5.96 (0.26)	5.88	4.12 (0.22)	4.21	24,883 (5,786)	18,787
200-299 beds[d]	389** (68)	281	22.9 (4.1)	19.7	6.06 (0.31)	6.32	4.37 (0.24)	4.50	22,795 (2,843)	23,188
300-499 beds[d]	375 (104)	185	22.0 (5.3)	13.0	6.26 (0.28)	6.38	4.41 (0.34)	4.57	22,986 (2,512)	27,779
500+ beds[d]	46 (46)	64	2.7 (2.6)	4.5	5.48[a] (0.00)	6.60	5.07[a] (0.00)	4.68	20,359[a] (0)	26,885
Private, Non-Profit[c]	10,262** (308)	8,120	76.2* (1.2)	73.5	5.96 (0.6)	6.11	4.60 (0.07)	4.56	16,984 (537)	16,476
1-99 beds[d]	1,252** (61)	928	12.2 (0.7)	11.4	4.75** (0.08)	5.00	4.29 (0.09)	4.21	9,208 (263)	9,508
100-199 beds[d]	2,023** (120)	1,569	19.7 (1.2)	19.3	5.60** (0.09)	5.85	4.77 (0.23)	4.56	13,515 (530)	13,008
200-299 beds[d]	1,912* (188)	1,520	18.6 (1.9)	18.7	5.89 (0.14)	6.07	4.54 (0.11)	4.57	17,115 (700)	16,517
300-499 beds[d]	3,021** (284)	1,983	29.4 (2.6)	24.4	6.37 (0.11)	6.28	4.77 (0.12)	4.64	18,195 (1,106)	18,307
500+ beds[d]	2,054* (287)	1,418	20.0 (2.5)	17.5	6.53 (0.19)	6.79	4.45 (0.17)	4.68	23,296 (1,796)	21,711

Table 16. NIS and MedPAR Comparisons by Hospital Ownership and Size, 2000

	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)		TOTAL CHARGES (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
Private, Investor-Owned[c]	1,510** (124)	1,383	11.2 (0.9)	12.5	5.64 (0.12)	5.78	4.49 (0.11)	4.49	13,820 (673)	13,774
1-99 beds[d]	540** (31)	418	35.8 (3.3)	30.2	4.65 (0.11)	4.63	4.13 (0.13)	4.13	7,516 (302)	7,515
100-199 beds[d]	298 (39)	259	19.7 (2.8)	18.7	5.67 (0.19)	5.75	4.95 (0.24)	4.73	13,006 (1,112)	12,303
200-299 beds[d]	152 (50)	186	10.1 (3.4)	13.4	6.59 (0.38)	6.36	5.24 (0.37)	4.81	16,790 (2,591)	15,208
300-499 beds[d]	291 (83)	198	19.3 (4.9)	14.3	6.49 (0.31)	6.73	4.68 (0.22)	4.54	20,459 (1,392)	19,674
500+ beds[d]	229 (100)	190	15.1 (5.9)	13.7	6.21 (0.39)	6.62	4.01** (0.23)	4.63	19,353 (2,009)	20,097

* $p < 0.05$ ** $p < 0.01$

[a] A significance test was not performed because a valid standard error was not available.

[c] Caution should be taken in interpreting of the total discharge estimates for MedPAR by ownership type, as 1.1% of the records (N=121,909) had missing data for type of hospital ownership.

[d] Caution should be taken in interpreting of the total discharge estimates for MedPAR by bed size, as 10.8% of the records (N=1,193,410) had missing data for bed size.

Table 17. NIS and MedPAR Comparisons by Hospital Type, 2000

	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)		TOTAL CHARGES (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
Total Rural[c]	2,643** (95)	2,357	19.6* (0.7)	21.3	5.04 (0.06)	5.14	4.37 (0.07)	4.25	9,405** (213)	9,984
1-49 beds	310** (14)	231	11.7** (0.6)	9.8	3.93 (0.6)	4.11	4.07 (0.14)	3.90	6,156 (173)	6,209
50-99 beds	579* (28)	512	21.9 (1.1)	21.7	4.64 (0.11)	4.79	4.26 (0.13)	4.06	7,704 (272)	8,224
100+ beds	1,754 (89)	1,614	66.4 (1.4)	68.5	5.37 (0.08)	5.40	4.46 (0.10)	4.36	10,548 (279)	11,083
Total Urban, Teaching[c]	5,053** (197)	3,978	37.5 (1.1)	36.0	6.40* (0.10)	6.61	4.47 (0.09)	4.64	20,488 (828)	20,223
1-299 beds	628 (65)	527	12.4 (1.2)	13.2	5.69** (0.22)	6.27	4.17 (0.20)	4.33	15,622 (1,200)	15,665
300-499 beds	1,571** (90)	1,253	31.1 (1.6)	31.5	6.32 (0.18)	6.45	4.61 (0.13)	4.77	17,999 (1,066)	19,009
500+ beds	2,854** (163)	2,198	56.5 (1.9)	55.3	6.60 (0.15)	6.78	4.46 (0.13)	4.64	22,726 (1,246)	22,008

Table 17. NIS and MedPAR Comparisons by Hospital Type, 2000

	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)		TOTAL CHARGES (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
Total Urban, Non-Teaching[c]	5,778** (168)	4,593	42.9 (1.0)	41.6	5.92** (0.07)	6.22	4.71 (0.10)	4.52	18,128 (859)	17,407
1-99 beds	678* (43)	574	11.7 (0.7)	12.5	5.53** (0.16)	7.04	4.62** (0.14)	4.15	12,329** (608)	14,146
100-199 beds	1,520** (56)	1,281	26.3 (1.0)	27.9	5.83 (0.13)	6.00	4.80 (0.30)	4.60	15,704 (693)	15,507
200+ beds	3,581** (153)	2,739	62.0 (1.3)	59.6	6.03 (0.09)	6.15	4.69 (0.10)	4.56	20,357 (1,363)	18,980

* $p < 0.05$ ** $p < 0.01$

[c] Caution is advised in interpreting the total discharge estimates for MedPAR by ownership type, as 1.1% of the records (N=121,909) had missing data for type of hospital location and teaching status.

Table 18. NIS and MedPAR Comparisons by Age, Gender, and Race, 2000

	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)		TOTAL CHARGES (Standard Error)	
	NIS	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
Age Group										
0 to 64 years	2,003** (47)	1,587	14.9 (0.3)	14.4	6.07** (0.07)	6.37	2.26 (0.05)	2.27	17,764 (1,260)	16,650
65 to 74 years	4,276** (95)	3,342	31.7** (0.2)	30.2	5.62** (0.05)	5.83	3.58 (0.06)	3.60	18,435 (446)	17,926
75 to 84 years	4,796** (110)	3,972	35.6 (0.2)	35.9	6.02** (0.05)	6.20	4.93** (0.07)	4.70	17,347 (472)	16,993
85+ years	2,018** (48)	2,150	17.8** (0.2)	19.5	6.17* (0.06)	6.32	7.69** (0.10)	7.28	14,830 (521)	14,380
Gender										
Male	5,826** (123)	4,717	43.2** (0.1)	42.7	5.92** (0.05)	6.13	4.98 (0.06)	4.93	18,536 (498)	17,946
Female	7,646** (156)	6,333	56.8** (0.1)	57.3	5.93** (0.05)	6.14	4.23 (0.05)	4.22	16,369 (503)	15,803
Race										
White	8,409** (301)	9,263	63.8** (1.6)	83.8	5.87* (0.06)	6.00	4.64 (0.07)	4.54	17,594 (674)	16,402
Black	1,025** (67)	1,237	7.8** (0.5)	11.2	6.93 (0.12)	7.02	4.58 (0.12)	4.55	19,119 (862)	17,966
Other	839** (66)	497	6.3** (0.5)	4.5	6.44 (0.15)	6.51	4.43* (0.13)	4.10	22,093** (871)	19,545
Missing	2,892** (223)	53	22.1** (1.7)	0.5	5.56** (0.08)	6.12	4.41** (0.07)	4.67	15,059* (494)	16,188

* $p < 0.05$ ** $p < 0.01$

Table 19. NIS and MedPAR Comparisons by Top 25 Principal Diagnoses, 2000

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)		TOTAL CHARGES (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
108: Congestive heart failure, non-hypertensive	788** (17)	647	8.3** (0.1)	5.9	5.68 (0.05)	5.75	5.17 (0.08)	5.27	14,428 (502)	14,024
122: Pneumonia (except that caused by tuberculosis and sexually transmitted diseases)	759** (14)	624	8.0** (0.1)	5.6	6.74 (0.06)	6.78	8.11 (0.13)	8.14	15,942 (471)	15,245
101: Coronary atherosclerosis	755** (30)	605	8.0** (2.3)	5.5	4.10 (0.06)	4.21	1.13 (0.04)	1.17	24,007 (859)	23,216
100: Acute myocardial infarction	459** (14)	359	4.8** (0.1)	3.2	6.08* (0.07)	6.25	11.36** (0.16)	11.87	27,354 (873)	26,695
127: Chronic obstructive pulmonary disease	438** (9)	363	4.6** (0.1)	3.3	5.54* (0.05)	5.64	3.15 (0.08)	3.10	12,643 (388)	12,105
106: Cardiac dysrhythmias	437** (11)	354	4.6** (0.1)	3.2	3.94 (0.04)	3.98	1.63 (0.05)	1.59	14,748 (403)	14,202
109: Acute cerebrovascular disease	406** (9)	343	4.3** (0.0)	3.1	6.47** (0.07)	7.13	11.15 (0.17)	11.08	17,338 (521)	17,036

Table 19. NIS and MedPAR Comparisons by Top 25 Principal Diagnoses, 2000

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)		TOTAL CHARGES (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
254: Rehabilitation care, fitting of prostheses, and adjustment of devices	330** (23)	271	3.5** (0.2)	2.5	12.55** (0.25)	13.23	0.92** (0.09)	0.38	17,538* (767)	19,232
237: Complication of device, implant or graft	318** (11)	256	3.4** (0.1)	2.3	5.81* (0.07)	5.95	2.53 (0.07)	2.44	24,128 (674)	23,713
102: Non-specific chest pain	306** (8)	237	3.2** (0.1)	2.1	2.14** (0.03)	2.22	0.11** (0.01)	0.14	7,904 (492)	7,111
55: Fluid and electrolyte disorders	300** (6)	253	3.2** (0.0)	2.3	4.95 (0.05)	5.00	4.11 (0.11)	4.19	9,959 (308)	9,630
203: Osteoarthritis	282** (11)	242	3.0** (0.1)	2.2	4.36** (0.04)	4.85	0.21 (0.02)	0.21	22,445* (458)	21,518
226: Fracture of neck of femur (hip)	265** (6)	222	2.8** (0.0)	2.0	6.59** (0.07)	6.96	3.22 (0.09)	3.24	20,335 (448)	19,945
159: Urinary tract infections	257** (5)	217	2.7** (0.0)	2.0	5.35 (0.06)	5.38	2.67 (0.09)	2.70	10,867 (337)	10,272
2: Septicemia (except in labor)	232** (7)	188	2.5** (0.1)	1.7	8.45 (0.11)	8.55	19.07 (0.28)	19.28	23,398 (1,189)	22,423
153: Gastrointestinal hemorrhage	217** (4)	177	2.3** (0.0)	1.6	5.06* (0.05)	5.16	4.74* (0.12)	5.03	13,841 (396)	13,250

Table 19. NIS and MedPAR Comparisons by Top 25 Principal Diagnoses, 2000

	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)		TOTAL CHARGES (Standard Error)	
Diagnosis	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
50: Diabetes mellitus with complications	209** (4)	170	2.2** (0.0)	1.5	6.69 (0.09)	6.69	2.33 (0.08)	2.39	16,665 (549)	15,875
205: Spondylosis, intervertebral disc disorders, other back problems	191** (6)	165	2.0** (0.1)	1.5	4.17** (0.07)	4.40	0.36 (0.03)	0.40	15,389 (498)	15,106
149: Biliary tract disease	176** (4)	145	1.9** (0.0)	1.3	5.24 (0.06)	5.33	1.63* (0.07)	1.78	18,726* (538)	17,566
69: Affective disorders	175** (8)	156	1.8** (0.1)	1.4	9.96** (0.20)	10.59	0.13 (0.02)	0.16	12,552 (498)	12,763
238: Complications of surgical procedures	171** (4)	141	1.8** (0.0)	1.3	7.04 (0.09)	7.02	2.76 (0.10)	2.87	19,514 (544)	18,955
145: Intestinal obstruction without hernia	166** (3)	137	1.8** (0.0)	1.2	6.78* (0.06)	6.91	4.78 (0.13)	4.88	17,218 (446)	16,971
99: Hypertension with complications	156** (4)	132	1.6** (0.0)	1.2	5.97 (0.08)	6.00	3.64 (0.13)	3.73	18,095 (707)	17,373
146: Diverticulosis and diverticulitis	156** (4)	127	1.6** (0.0)	1.1	5.69 (0.10)	5.87	1.85 (0.08)	1.98	15,661 (466)	15,192
112: Transient cerebral ischemia	155** (4)	126	1.6** (0.0)	1.1	3.52 (0.05)	3.57	0.31 (0.03)	0.32	9,230* (348)	8,543

* $p < 0.05$ ** $p < 0.01$

Table 20. NIS and MedPAR Comparisons by Top 20 DRGs, 2000

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)		TOTAL CHARGES (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
127: Heart failure & shock	777** (16)	641	5.8 (0.1)	5.8	5.23 (0.04)	5.30	4.71 (0.08)	4.81	11,935 (438)	11,443
89: Simple pneumonia & pleurisy age >17 w cc	585** (11)	482	4.4 (0.1)	4.4	5.97 (0.05)	6.00	6.19 (0.12)	6.28	12,375 (388)	11,824
88: Chronic obstructive pulmonary disease	440** (9)	366	3.3 (0.1)	3.3	5.15* (0.05)	5.25	2.15 (0.06)	2.07	10,739 (330)	10,269
209: Major joint & limb reattachment procedures of lower extremity	398** (13)	328	3.0 (0.1)	3.0	4.99 (0.05)	5.08	0.90 (0.04)	0.95	24,074* (498)	23,075
116: Other perm card pacemaker, implant or ptca w/ coronary artery stent implnt	381** (22)	316	2.8 (0.1)	2.9	3.54 (0.07)	3.60	0.94 (0.05)	0.97	28,022 (925)	26,756
14: Specific cerebrovascular disorders except tia	373** (8)	315	2.8** (0.0)	2.9	5.91** (0.07)	6.60	10.93 (0.17)	10.80	14,392 (446)	14,236
462: Rehabilitation	325* (23)	267	2.4 (0.2)	2.4	12.42** (0.25)	13.11	0.91** (0.09)	0.38	17,219* (754)	18,928
430: Psychoses	316* (16)	283	2.4* (0.1)	2.6	10.54* (0.24)	11.13	0.13 (0.02)	0.15	12,844 (499)	12,968

Table 20. NIS and MedPAR Comparisons by Top 20 DRGs, 2000

	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)		TOTAL CHARGES (Standard Error)	
DRG	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
174: G.I. hemorrhage w/cc	280** (6)	229	2.1 (0.0)	2.1	4.76 (0.04)	4.82	3.51* (0.09)	3.73	11,772 (324)	11,282
182: Esophagitis, gastroent & misc digest disorders age >17 w/cc	276** (6)	233	2.1 (0.0)	2.1	4.30 (0.04)	4.36	1.36 (0.06)	1.34	9,542 (338)	8,890
296: Nutritional & misc metabolic disorders age >17 w/cc	269** (5)	228	2.0** (0.0)	2.1	5.17 (0.05)	5.18	4.64 (0.12)	4.75	10,160 (312)	9,801
143: Chest pain	263** (7)	202	2.0** (0.0)	1.8	2.03** (0.03)	2.11	0.11 (0.02)	0.13	7,037 (531)	6,170
138: Cardiac arrhythmia & conduction disorders w/cc	228** (5)	184	1.7 (0.0)	1.7	3.99 (0.04)	4.03	3.09 (0.10)	2.99	9,904 (326)	9,434
416: Septicemia age >17	210** (6)	171	1.6 (0.0)	1.6	7.32 (0.09)	7.44	19.42 (0.29)	19.74	18,902 (1,057)	18,104
320: Kidney & urinary tract infections age >17 w/cc	210** (4)	178	1.6 (0.0)	1.6	5.32 (0.06)	5.33	2.92 (0.10)	2.99	10,359 (290)	9,856
121: Circulatory disorders w AMI & major comp, discharged alive	195** (5)	153	1.5** (0.0)	1.4	6.25 (0.06)	6.48	0.00 (0.00)	0.00	18,251 (645)	17,788

Table 20. NIS and MedPAR Comparisons by Top 20 DRGs, 2000

	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)		TOTAL CHARGES (Standard Error)	
DRG	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
79: Respiratory infect & inflammations age >17 w/cc	193** (5)	158	1.4 (0.0)	1.4	8.51 (0.10)	8.54	15.64 (0.24)	15.70	19,273 (687)	18,772
132: Athero-sclerosis w cc	176** (5)	140	1.3 (0.0)	1.3	2.96** (0.04)	3.14	0.79 (0.05)	0.84	7,815 (313)	7,575
15: Transient ischemic attack & precerebral occlusions	173** (4)	141	1.3 (0.0)	1.3	3.53** (0.04)	3.65	0.50 (0.04)	0.50	9,144 (370)	8,513
124: Circulatory disorders except AMI, w/ card cath & complex diag	151** (6)	124	1.1 (0.0)	1.1	4.35 (0.07)	4.38	0.98 (0.07)	1.06	16,930 (578)	16,424

* $p < 0.05$ ** $p < 0.01$

Table 21. NIS and MedPAR Comparisons by Top 25 Principal Procedures, 2000

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)		TOTAL CHARGES (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
70: Upper gastrointestinal endoscopy, biopsy	386** (10)	323	4.1** (0.1)	2.9	6.05* (0.08)	6.24	2.47 (0.07)	2.59	14,985 (452)	14,535
47: Diagnostic cardiac catheterization, coronary arteriography	347** (15)	280	3.7** (0.1)	2.5	4.15* (0.05)	4.25	1.41 (0.06)	1.50	17,631 (528)	16,847
45: Percutaneous coronary angioplasty (PTCA)	302** (22)	245	3.2** (0.2)	2.2	3.21 (0.07)	3.29	1.35 (0.07)	1.31	28,251 (1,154)	26,969
216: Respiratory intubation and mechanical ventilation	249** (6)	203	2.6** (0.0)	1.8	9.40 (0.17)	9.46	41.97 (0.39)	42.29	37,814 (1,210)	35,923
222: Blood transfusion	230** (10)	184	2.4** (0.1)	1.7	6.08 (0.09)	6.16	7.21 (0.17)	7.51	14,619 (629)	13,836
153: Hip replacement, total and partial	214** (7)	178	2.3** (0.1)	1.6	5.72 (0.06)	5.81	1.64 (0.07)	1.69	25,412* (528)	24,298
152: Arthroplasty knee	201** (8)	164	2.1** (0.1)	1.5	4.38* (0.04)	4.46	0.22 (0.02)	0.24	23,744 (528)	22,862

Table 21. NIS and MedPAR Comparisons by Top 25 Principal Procedures, 2000

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)		TOTAL CHARGES (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
146: Treatment, fracture or dislocation of hip and femur	188** (5)	156	2.0** (0.0)	1.4	6.28* (0.06)	6.40	2.57 (0.08)	2.56	19,686 (471)	18,971
44: Coronary artery bypass graft (CABG)	185** (12)	145	2.0** (0.1)	1.3	9.69 (0.11)	9.66	3.78 (0.17)	3.72	59,495 (2,247)	58,694
48: Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/ defibrillator	183** (7)	152	1.9** (0.0)	1.4	5.43 (0.08)	5.44	2.08 (0.09)	2.09	33,993 (886)	32,714
76: Colonoscopy and biopsy	168** (5)	137	1.8** (0.0)	1.2	5.99 (0.13)	6.21	1.64 (0.08)	1.70	14,192 (624)	13,626
54: Hemodialysis	167** (6)	139	1.8** (0.1)	1.3	5.49 (0.08)	5.56	4.45 (0.16)	4.33	14,531 (485)	13,986
58: Other vascular catheterization, not heart	147** (5)	123	1.6** (0.0)	1.1	9.82 (0.13)	9.70	16.26 (0.34)	16.48	25,225 (785)	24,520
78: Colorectal resection	144** (4)	118	1.5** (0.0)	1.1	10.95* (0.09)	11.15	6.19* (0.17)	6.62	37,078 (918)	35,747

Table 21. NIS and MedPAR Comparisons by Top 25 Principal Procedures, 2000

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)		TOTAL CHARGES (Standard Error)	
	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR	NIS	MedPAR
84: Cholecystectmy and common duct exploration	143** (4)	119	1.5** (0.0)	1.1	5.88 (0.06)	5.99	1.82 (0.09)	1.92	22,027 (667)	20,766
213: Physical therapy exercises, manipulation, and other procedures	135** (15)	93	1.4** (0.2)	0.8	11.79 (0.44)	11.53	1.16** (0.15)	0.59	17,466 (1,168)	17,747
61: Other O.R. procedures on vessels other than head and neck	135** (6)	114	1.4** (0.0)	1.0	6.91 (0.14)	7.07	4.82 (0.17)	4.88	31,008 (996)	30,044
193: Diagnostic ultrasound of heart (echocardiogram)	124 (10)	105	1.3** (0.1)	1.0	5.66 (0.10)	5.73	2.37* (0.14)	2.72	14,246 (554)	13,312
231: Other therapeutic procedures	117 (14)	104	1.2 (0.2)	0.9	5.51 (0.22)	5.75	6.01 (0.29)	5.91	13,754 (582)	13,011
177: Computerized axial tomography (CT) scan head	106 (11)	85	1.1** (0.1)	0.8	5.27 (0.15)	5.54	5.23 (0.24)	5.18	11,231 (640)	12,020

Table 21. NIS and MedPAR Comparisons by Top 25 Principal Procedures, 2000

	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)		TOTAL CHARGES (Standard Error)	
Procedure	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**	**NIS**	**MedPAR**
51: Endarterectomy, vessel of head and neck	102** (5)	84	1.1** (0.0)	0.8	3.10 (0.06)	3.21	0.58 (0.05)	0.59	15,997 (471)	15,797
39: Incision of pleura, thoracentesis, chest drainage	100** (3)	81	1.1** (0.0)	0.7	8.37 (0.09)	8.46	9.23 (0.22)	9.55	20,054 (678)	19,492
169: Debridement of wound, infection or burn	98** (3)	83	1.0** (0.0)	0.7	11.65 (0.20)	11.54	4.82 (0.18)	4.93	28,175 (940)	26,928
113: Transurethral prostatectomy (TURP)	89** (3)	74	0.9** (0.0)	0.7	3.41* (0.06)	3.56	0.30 (0.04)	0.33	10,589 (316)	10,065
3: Laminectomy, excision intervertebral disc	86** (4)	75	0.9** (0.0)	0.7	3.76 (0.08)	3.77	0.35 (0.04)	0.39	15,962 (589)	14,900

* $p < 0.05$ ** $p < 0.01$

APPENDIX D – 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, and
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, 2002), constants *a* and *b* were obtained for 2000. The relative standard error for the estimate of total discharges is approximated by:

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

where W_{TD} is the weighted sum of total discharges (i.e., the estimate of total discharges). The standard error is 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 is the denominator). The relative standard error of this proportion expressed as a percent is approximated by:

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

The standard error is then calculated as:

$$SE = RSE \times p$$

Where *b* is 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 is 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 is valid only if:

1. the relative standard error of the denominator (estimated discharges) is less than five percent, or

2. both the relative standard error of the numerator (estimated total stay days) and the denominator (estimated discharges) are less than ten 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 ownership 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 an NIS estimate, *X*, and an NHDS estimate, *Y*, the following procedure was used. The difference is significant if

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

where SE_x is the estimated standard error for the NIS estimate and SE_Y is the estimated standard error of the NHDS estimate.