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Comparability Between the Rates for All-listed Inpatient Procedures Using National Hospital Discharge Survey and Medicare Claims, 1999 and 2007

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Abstract

Objectives—This report examines the comparability between the rates of inpatient procedures for persons aged 65 and over using the National Hospital Discharge Survey (NHDS) and Medicare claims data.

Methods—The estimates in this report are based on data from NHDS and Medicare claims submitted by hospital providers for inpatient stays among Part A fee-for-service Medicare beneficiaries aged 65 and over. The discharge rates, selected procedures rates, and comparability ratios are reported for older men and women, by age and sex, for 1999 and 2007.

Results—Between 1999 and 2007, observed decreases in discharge rates and in all-listed procedure rates derived from NHDS were not significant, while Medicare discharge rates decreased and procedure rates increased significantly. In 1999 and 2007, no statistically significant differences were found between NHDS and Medicare estimates for discharge rates in the age-sex groups examined except for those aged 85 and over. In both years, the comparability ratios between Medicare and NHDS procedure rates were significantly different from one for about 50% of selected procedures, and ranged from 1.12 to 1.26 in 1999 and from 1.16 to 1.41 in 2007. This reflects more procedures recorded in 1999 and 2007 in Medicare data per discharge. The comparability ratio was higher for most of the cardiac procedures, and in general, was closer to one when fewer procedures were performed per discharge and for procedures with lower utilization rates.

Keywords: Centers for Medicare & Medicaid Services • administrative data

Introduction

The use of medical procedures among older Americans has changed markedly over the past decade. Advances in anesthesia, new developments in medical technologies, improvements in patient safety, and

changes in settings where procedures are performed, have contributed to increased use among older patients. These trends are evident in the rapidly increasing number of surgeries performed in ambulatory settings (1,2) with inpatient operations generally reserved for more complex procedures and for patients

with serious comorbid conditions who are more likely to require postoperative hospitalization (3–6).

Since 1965, the National Hospital Discharge Survey (NHDS) has provided data on trends in rates of major procedures (up to four procedures per discharge) performed in nonfederal short-term hospitals in the United States (7,8). In 2007, more than one-third of all procedures and one-half of operations on the cardiovascular and digestive systems in these hospitals were performed on inpatients aged 65 and over (9). Medicare Part A covers inpatient services for about 98% of the U.S. population aged 65 and over (10) and currently, researchers use Medicare claims data for analysis of selected procedures performed on Medicare beneficiaries (11–13).

The purpose of this report is to help researchers to compare long-term trends using NHDS and Medicare claims data. It reviews methods for calculating procedure rates using these two data sources and discusses benefits and limitations for both of these approaches. The report compares selected procedure rates in 1999 and 2007 and presents the comparability ratios for the 1999 and 2007 rates.



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for Health Statistics



Data Sources

National Hospital Discharge Survey

NHDS is a national probability survey designed to meet the need for information on characteristics of inpatients discharged from nonfederal short-stay hospitals in the United States. NHDS has been conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) annually since 1965 and collects medical and demographic information on a sample of discharges from about 500 sampled hospitals.

The current NHDS sampling frame covers hospitals with an average length of stay of less than 30 days for all patients, as well as general hospitals and children's general hospitals regardless of average length of stay. Federal, military, and U.S. Department of Veterans Affairs (VA) hospitals are excluded, as are hospital units of institutions, such as prison hospitals, and hospitals with fewer than six beds staffed for inpatient use. Hospitals specializing in psychiatric care or rehabilitation are included in the NHDS sample frame provided that their average length of stay is less than 30 days. State, local, county, and other nonfederal government hospitals are also included.

Data are collected either manually, by transcription from the face sheet of the medical record, or from electronic medical records transmitted directly to NCHS by commercial organizations, state data systems, or the hospitals themselves. Up to four procedures per sampled discharge are coded using the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM). Because NHDS is based on a sample, the survey data must be inflated or weighted to produce national estimates. The estimation procedure produces unbiased national estimates and has three basic components: inflation by reciprocals of the probabilities of sample selection, adjustment for nonresponse, and population weighting ratio adjustments (9). The survey samples discharges, not patients, thus it is possible for some

patients who have multiple hospitalizations in a given year to be sampled more than once; however, it is not possible to link these records because NHDS does not collect any personally identifying information. Estimates reported here are for all-listed procedure categories, which include all occurrences of the procedures recorded in NHDS regardless of the order in the medical record.

This report presents NHDS data for persons aged 65 and over at the time of the admission. According to NHDS, in 2007 this group accounted for 37% of the 34.4 million discharges (excluding newborns) from nonfederal short-stay hospitals (9).

NHDS rates are based on the U.S. civilian population (Table 1). Rates are computed for 1999 using civilian population intercensal estimates for July 1, 1999, based on 1990 and 2000 census data, and for 2007 using postcensal estimates for July 1, 2007, based on the 2000 census.

Researchers may refer to the NHDS website for more information on survey methods and access to data: <http://www.cdc.gov/nchs/nhds.htm>.

Medicare claims data

Medicare is the primary health insurance program covering persons aged 65 and over, persons under age 65 with certain disabilities, and persons of all ages with end-stage renal disease (ESRD). Nearly all Medicare beneficiaries receive Part A (hospital insurance) benefits, which helps cover the costs of inpatient hospital care, skilled nursing facility stays (not custodial), and home health and hospice care; however, the Centers for Medicare & Medicaid Services (CMS) receive and collect only claims submitted by health care providers for services rendered for fee-for-service (FFS) beneficiaries. Medicare Part A FFS beneficiaries aged 65 and over account for about 80% of the Medicare enrollment and U.S. population in this age group.

This report presents estimates derived from CMS' 5% sample of Medicare beneficiaries, which is a sample of beneficiaries with 05, 20, 45,

70, or 95 in a specific position of their unique Medicare identification number. Demographic and enrollment data from the Beneficiary Summary File (also called the Denominator File) and the core records for the inpatient claims in the Part A Inpatient Base Claim file were used. Both files are received annually from CMS' Research Data Assistance Center (ResDAC, <http://www.resdac.org>) as a part of the interagency agreement between NCHS and CMS.

The Beneficiary Summary File contains data for all beneficiaries in the 5% sample who are alive and eligible for Medicare for any part of a calendar year. The data include information on months with Medicare Part A coverage, whether the beneficiary was enrolled in a FFS Medicare or a Medicare Advantage plan, the beneficiary's age at the end of the calendar year, and the beneficiary's place of residence. In 2007, 36.6 million persons aged 65 and over were enrolled in Part A Medicare for at least 1 month in a year, a 9% increase from 33.5 million in 1999 (14).

The Part A inpatient file consists of claims submitted to CMS by Medicare-certified hospitals for costs incurred by beneficiaries enrolled in FFS Medicare. The data in the inpatient base file include the identifiers for the beneficiary and provider (hospital), dates of service, discharge date, ICD-9 diagnosis and procedure codes, Diagnosis Related Group (DRG) information, facility charges, and Medicare reimbursement amount. A system of payment for the inpatient stays under Medicare Part A is based on prospectively set rates with each case categorized into a DRG (15). Hospitals and other providers are required by law to file Medicare claims for covered services and supplies received by Medicare beneficiaries but may exclude procedures not covered by Medicare (e.g., bariatric surgery *prior to* 2006). Adjustments to the DRG classification are made annually and as Medicare expands its coverage to new inpatient procedures, these procedures must be mentioned on the claims (e.g., bariatric surgery *since* 2006). In both 1999 and 2007, up to six procedures can

be recorded on one claim; however, more than one claim can be submitted by the provider for an uninterrupted inpatient stay. Therefore, any number of procedures may be recorded for a single stay.

The hospital identification number on the Medicare inpatient claim includes a four-digit code for the type of facility. For consistency with the selection frame in NHDS, claims from short-term hospitals, rehabilitation hospitals, alcohol and drug treatment hospitals, psychiatric hospitals, rural primary care hospitals, and children's hospitals were identified and selected. The provider's state code was used to select claims submitted by the hospitals located in the 50 states and the District of Columbia (DC) (Table 2). Of all inpatient claims for Medicare FFS beneficiaries aged 65 and over, 97.4% (10.1 million claims) in 1999 and 98.5% (10.2 million claims) in 2007 were submitted from the selected hospitals. During both years, selected hospitals accounted for 98% of all procedures recorded on the claims for these beneficiaries. Claims data do not allow identification and exclude claims submitted by federal hospitals; that is, standalone hospitals funded by the U.S. government within the Department of Defense, VA, Public Health Services, and the Department of Justice, which are excluded from the NHDS sample frame (16). Only 0.6% of discharges (56,160) in 1999 and 0.1% (9,660) in 2007 had more than one claim submitted per discharge. A small number of claims (0.13% in 1999 and 0.03% in 2007) were submitted in the current year for patients not discharged by December 31.

Choice of the denominator for rates calculation

Because enrollment characteristics for Medicare beneficiaries may change on a monthly basis [e.g., a person may switch from an FFS Medicare plan to a Medicare health maintenance organization (HMO) plan during one month and back to FFS in the next month], some researchers use person-years of enrollment as a denominator for calculation of rates. To be consistent

with NHDS methodology, which uses a midyear civilian population as a denominator for rate calculation, midyear (July) enrollment in Part A FFS Medicare among beneficiaries aged 65 and over who resided in the 50 states and DC, was selected (Table 1).

The Medicare 5% sample data and more information on the Medicare claims and beneficiary summary data are available from the Research Data Assistance Center (ResDAC) at <http://www.resdac.org>.

Methods

Discharge rates using NHDS data (subsequently called NHDS rates) were calculated by dividing the number of discharges by the U.S. civilian population and then multiplying by 10,000. Procedure rates were calculated by dividing the number of all-listed procedures by the U.S. civilian population and then multiplying by 10,000. "All-listed" procedure estimates included all mentions of procedures, regardless of the order of listing in the medical record. Rates for 2007 were computed using adjustments made after the 2000 census (postcensal estimates) of the U.S. civilian population aged 65 and over as of July 1, 2007. Rates for 1999 were computed using intercensal estimates of July 1, 1999 civilian population. The population data were from the tabulations provided by the U.S. Census Bureau (Table 1).

NHDS estimates are based on a sample survey and therefore the standard error is primarily a measure of sampling variability that occurs by chance because only a sample rather than an entire universe is surveyed. Standard errors for the estimates from NHDS were calculated with SAS-callable SUDAAN 10.0.1 software, which takes into account the complex sample design.

Discharge rates using the Medicare data (subsequently called Medicare rates) were calculated by dividing the number of claims with discharge date mentioned and appropriate patient discharge status code by the number of U.S. Medicare beneficiaries aged 65 and over enrolled in FFS Medicare Part A in

July of 1999 and 2007. Procedure rates were calculated by dividing the number of all-listed procedures mentioned on the claims by the number of U.S. Medicare beneficiaries aged 65 and over enrolled in FFS Medicare Part A in July of 1999 and 2007. "All-listed" procedure estimates include all mentions of procedures, regardless of the order of listing on the Medicare claim (or multiple claims) submitted per discharge. Nonsampling standard errors for the Medicare rates were calculated using the properties of the Poisson distribution.

This report compares the rates for selected all-listed procedures that were performed most often on older persons. The ICD-9 CM code for the list of selected procedures is presented in Table 3. Changes in the ICD-9 CM codes for angioplasty and pacemaker-related procedures between 1999 and 2007 reflect improvements in technology and changes in medical practice.

To compare numbers of procedures listed per discharge, the percentage of discharges with none, one to three, four and more, and five and more (for CMS data only) procedures mentioned per discharge were calculated. A two-tailed Z test ($p = 0.05$) was used to assess whether the difference between NHDS and Medicare rates was statistically significant. When multiple comparisons were required, the Bonferroni test was used. To assess how Medicare rates differ from NHDS estimates, comparability ratios were calculated by dividing the Medicare rate by the NHDS rate. Standard error for the ratio was approximated using the following formula (17,18):

$$SE_{\text{RATIO}} = \text{RATIO} * RSE_{\text{RATIO}} = \text{RATIO} * \sqrt{SE_{\text{CMS}}^2 / \text{Rate}_{\text{CMS}}^2 + SE_{\text{NHDS}}^2 / \text{Rate}_{\text{NHDS}}^2}$$

with the condition that

$$RSE_{\text{NHDS}} < 0.05 \text{ or}$$

$$\max(RSE_{\text{NHDS}}, RSE_{\text{CMS}}) < 0.10,$$

where $\text{RATIO} = \text{Rate}_{\text{CMS}} / \text{Rate}_{\text{NHDS}}$ —comparability ratio,

SE_{RATIO} is standard error for the ratio,

RSE_{RATIO} is relative standard error for the ratio,

$RATE_{CMS}$ is Medicare rate,

SE_{CMS} is standard error for Medicare rate,

RSE_{CMS} is relative standard error for Medicare rate,

$Rate_{NHDS}$ is NHDS rate,

SE_{NHDS} is standard error for NHDS rate,

RSE_{NHDS} is relative standard error for NHDS rate.

Results

Number of discharges and procedures

Medicare estimates for the number of discharges aged 65 and over increased 2.9% from 9.7 million in 1999 to 10.0 million in 2007, and the number of procedures increased 13% from 13.4 million to 15.1 million, respectively (Table 4). The observed increase in NHDS estimates between 1999 and 2007 for the number of discharges and number of procedures in this age group was not significant possibly due to the larger NHDS standard errors. Total number of inpatient discharges and procedures derived from the Medicare data represent hospital utilization by about 80% of the persons aged 65 and over and are lower than national estimates derived from NHDS in each age and sex group.

In both data systems, similar distributions of the number of discharges by age group were observed (35% for ages 65–74, 40% for ages 75–84, and 25% for ages 85 and over). About 55% of discharges had at least one procedure recorded, and of those, women accounted for about 55%.

Discharge rates

Among inpatients aged 65 and over, the observed decrease by 8% in the NHDS discharge rates between 1999 and 2007 was not significant possibly due to the larger NHDS standard errors. The Medicare discharge rates during this time decreased for beneficiaries aged 65 and over by 4%, from 3,683 to 3,554 discharges per 10,000 beneficiaries (Table 5).

No statistically significant differences between NHDS and

Medicare estimates for discharge rates were observed in age-sex groups younger than age 85 in 1999 and 2007, for men aged 85 and over in 1999, and for women aged 85 and over in 2007. Among women aged 85 and over in 1999, the NHDS discharge rate was higher than the Medicare rate. Among men aged 85 and over in 2007, the NHDS discharge rate was lower than the Medicare rate.

The NHDS discharge rate for women aged 85 and over decreased 14% from 6,217 in 1999 to 5,320 discharges per 10,000 women in 2007. The observed decrease in NHDS discharge rates by about 10% for those aged 65–74, 8% for those aged 75–84, and 12% for men aged 85 and over between the two years was not significant possibly due to the larger NHDS standard errors. For men, Medicare discharge rates decreased 10% among those aged 65–74, and 5% for those aged 75–84 and 85 and over. For women, Medicare discharge rates decreased 7% for those aged 65–74, and slightly increased (about 1%) for those aged 75–84 and 85 and over.

Procedure rates

The observed decrease in the NHDS all-listed procedure rate between 1999 and 2007 was not significant, whereas the Medicare all-listed procedure rate increased 6% between those years (Table 6).

In 1999, the Medicare all-listed procedure rate was 12% higher than the NHDS all-listed procedure rate (comparability ratio of 1.12). In 2007, the Medicare rate was 27% higher than the NHDS rate (comparability ratio of 1.27).

In 2007, the comparability ratio for all-listed procedures was 1.23 for those aged 65–74, 1.29 for those aged 75–84, 1.30 for those aged 85 and over (Table 7), 1.28 for men aged 65 and over, and 1.25 for women aged 65 and over (Table 8).

Individual comparisons for each procedure in 2007 showed that Medicare rates differed significantly from NHDS rates in each age group for all-listed angioplasty, cardiac catheterization, and

pacemaker-related procedures. Individual comparisons of NHDS rates with Medicare rates for all-listed operations on the nose, mouth, and pharynx; endarterectomy of vessels of head and neck, except intracranial; shunt or vascular bypass; hemodialysis; gastrostomy; prostatectomy; endoscopy; and continuous mechanical ventilation, differed for some age groups but not for others, but no consistent pattern was observed (Table 7). No significant difference in any age group was observed between Medicare and NHDS rates for all-listed thoracentesis, coronary artery bypass graft surgery, gall bladder removal, oophorectomy, reduction of fracture, excision or destruction of intervertebral disc and spinal fusion, total hip replacement, total knee replacement, amputation of lower limb, and mastectomy.

Medicare comparability ratios for selected procedures performed on those aged 65 and over ranged between 0.98 (prostatectomy) and 1.26 (continuous mechanical ventilation) in 1999 and between 1.06 (reduction of fracture) and 1.41 (pacemaker procedures) in 2007 (Table 6). In 2007, operations on the nose, mouth, and pharynx; endarterectomy of vessels of head and neck, except intracranial; insertion, replacement, removal, and revision of pacemaker leads or devices; hemodialysis; cardiac catheterization; and gastrostomy, had the highest comparability ratios between 1.31 and 1.41.

In 2007, the comparability ratios for about 50% of selected procedures were significantly different from one ranging from 1.16 to 1.41. This reflects more procedures recorded in Medicare data. The comparability ratio was higher for most of the cardiac procedures, and in general, was closer to one when fewer procedures were performed per discharge and for procedures with lower utilization rates.

Procedure mentions per discharge

In both years, no difference between the NHDS and Medicare estimates for the percentage of

discharges with no procedures or with one to three procedures was observed (Table 9). The percentage of Medicare discharges with five or more procedures recorded on the claim increased from 8.3% in 1999 to 10.4% in 2007.

Discussion

The fact that there was no significant difference between NHDS and Medicare discharge rates and in general, that the estimates changed over time in the same direction despite different methods of data collection, processing, and analysis, suggests a high degree of comparability between the two data sources with respect to coverage of the target population (i.e., hospitalized patients aged 65 and over).

An increase in the comparability ratio for all-listed procedures rates between 1999 and 2007 may be explained by an increase in the total number of procedures per discharge on Medicare claims. This in turn may be explained by changes in Medicare payment policies that may require more procedures included in the DRG that define Medicare payment to the providers of inpatient services. This analysis cannot be performed for specific procedures because NHDS collects only the first four procedures listed on the discharge summary, whereas any number of procedures in no particular order can be mentioned on the multiple Medicare claims per discharge. Even the equal portion of discharges with less than four procedures mentioned found in NHDS and Medicare data does not necessarily mean that the same procedures were mentioned in both data systems.

If the performance of a procedure can be captured on a claim or medical record in a single ICD–9–CM code, the Medicare and NHDS procedure rates are more likely to be comparable (i.e., to have a comparability ratio closer to one). For example, larger comparability ratios were found for cardiac procedures, such as a pacemaker-related procedure or angioplasty (comparability ratios of 1.41 and 1.24 in 2007, respectively) for which numerous codes are required to describe one operative

event; whereas hip replacement and hysterectomy are more likely to be recorded as a single code, and therefore have comparability ratios closer to one (1.10 and 1.08 in 2007, respectively). The difference in the number of procedures listed on the NHDS discharge record (four) and on the Medicare claim (six in 1999 and 2007, with a possible extension on another claim) may contribute to the difference in the rates of procedures that require multiple coding. In the case of a procedure not listed among first four procedures on discharge medical record, it would not be collected by NHDS.

The FFS Medicare inpatient claims data provide unique opportunities for health care research including Medicare costs analysis, longitudinal analysis of health care utilization by Medicare beneficiary, chronic conditions research, and data linkage across the continuum of health care covered by Medicare. Recently, Medicare claims data became more available for researchers through ResDAC (available from <http://www.resdac.org>), and more hospital-use estimates are and will be based on the claims data.

NHDS, conducted since 1965, was the longest continuous nationally representative survey of hospital inpatient care and provided unbiased national estimates widely used by policy makers and researchers, as well as by the hospital industry and state health departments. The design and operation of NHDS is currently undergoing a major transformation. A new larger survey (National Hospital Care Survey) will incorporate inpatient data formerly collected by NHDS, as well as ambulatory care data from the same hospitals. Beginning in 2011, all data collection for the inpatient component of the survey will be based on claims data.

This comparability study may help to understand and evaluate possible shifts in the trend statistics not only for the traditional Medicare population but also for inpatients of all ages.

Study limitations

While NHDS samples discharges for all inpatients, Medicare inpatient

claims account for inpatient stays of Medicare Part A FFS beneficiaries. About 98% of persons aged 65 and over are Medicare beneficiaries and about 80% of them have Part A FFS coverage. Those who were not Medicare beneficiaries and who participated in Medicare HMO and other than FFS Medicare plans, were excluded from the analysis.

Although all efforts were made to select Medicare claims submitted by the hospitals in agreement with the NHDS sampling frame, some claims used in this analysis may have been submitted from hospitals outside of the NHDS hospital selection.

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Table 1. Denominators for rate calculation, by age and sex

Age in years, and sex	U.S. civilian population				Enrollment (July) in Medicare Part A FFS			
	1999		2007		1999		2007	
	Number in thousands	Percent	Number in thousands	Percent	Number in thousands	Percent	Number in thousands	Percent
65 and over								
All	34,239	100.0	37,888	100.0	26,406	100.0	28,167	100.0
Men	14,238	41.6	15,976	42.2	10,777	40.8	12,125	43.0
Women	20,001	58.4	21,912	57.8	15,629	59.2	16,042	57.0
65-74								
All	18,044	52.7	19,352	51.1	13,068	49.5	14,174	50.3
Men	8,148	23.8	8,887	23.5	5,945	22.5	6,730	23.9
Women	9,896	28.9	10,465	27.6	7,123	27.0	7,444	26.4
75-84								
All	12,047	35.2	13,024	34.4	9,646	36.5	9,732	34.6
Men	4,853	14.2	5,313	14.0	3,793	14.4	4,052	14.4
Women	7,194	21.0	7,711	20.4	5,853	22.2	5,680	20.2
85 and over								
All	4,149	12.1	5,512	14.5	3,692	14.0	4,261	15.1
Men	1,237	3.6	1,777	4.7	1,039	3.9	1,344	4.8
Women	2,911	8.5	3,735	9.9	2,653	10.0	2,917	10.4

NOTE: FFS is fee-for-service.

SOURCES: U.S. Census Bureau; Centers for Medicare & Medicaid Services, Medicare 5% sample.

Table 2. Medicare inpatient claims characteristics for hospitals comparable with the hospital selection in the National Hospital Discharge Survey

Inclusion criteria	Code used	Claim field name (CCW version)	Comments
50 states and the District of Columbia	1–39, 41–47, and 49–53	Provider SSA state code	
Short-term hospital.	0001–0879	Provider number, positions 3–6 (any code listed)	OSCAR provider number ¹
Critical access hospital (former rural primary care hospital) . .	1300–1399		
Rehabilitation hospital (excluded from PPS)	3025–3099		
Children’s hospital (excluded from PPS)	3300–3399		
Psychiatric hospital (excluded from PPS)	4000–4499		
Psychiatric unit of the hospital (excluded from PPS)	S	Provider number, position 3 (any code listed)	Third character in the OSCAR provider number
Rehabilitation unit of the hospital (excluded from PPS)	T		

¹Effective October 1, 2007, the OSCAR Provider Number has been renamed the CMS certification number.

NOTES: CCW is Chronic Condition Data Warehouse; SSA is Social Security Administration; PPS is Prospective Payment System; OSCAR is Online Survey Certification and Reporting.

Table 3. *International Classification of Diseases, 9th Revision, Clinical Modification* code for selected procedures, 1999 and 2007

Procedure name	ICD-9-CM code	
	1999	2007
All procedures	00-99	00-99
Operations on the nose, mouth, and pharynx	21-29	21-29
Thoracentesis	34.91	34.91
Coronary artery bypass graft (CABG)	36.1	36.1
Angioplasty with or without stent insertion	36.01,36.02,36.05-36.07	36.06,36.07,00.66
Endarterectomy of vessels of head, neck, except intracranial.	38.12	38.12
Cardiac catheterization	37.21-37.23	37.21-37.23
Insertion, replacement, removal and revision of pacemaker leads or devices.	37.7,37.8	37.7,37.8,00.50,00.52,00.53
Shunt or vascular bypass.	39.0-39.2	39.0-39.2
Hemodialysis	39.95	39.95
Gastrostomy.	43.1	43.1
Endoscopy of small intestine, with or without biopsy	45.11-45.14,45.16	45.11-45.14,45.16
Endoscopy of large intestine, with or without biopsy	45.21-45.25	45.21-45.25
Gall bladder removal	51.2	51.2
Prostatectomy.	60.2-60.6	60.2-60.6
Oophorectomy	65.3-65.6	65.3-65.6
Hysterectomy	68.3-68.7,68.9	68.3-68.7,68.9
Reduction of fracture	76.7,79.0-79.3	76.7,79.0-79.3
Excision or destruction of intervertebral disc and spinal fusion	80.5,81.0	80.5,81.0
Total hip replacement	81.51	81.51
Total knee replacement	81.54	81.54
Amputation of lower limb	84.1	84.1
Mastectomy (includes lumpectomy, resection of breast, and mastectomy).	85.21-85.23,85.33-85.36,85.4	85.21-85.23,85.33-85.36,85.4
Continuous mechanical ventilation	96.7	96.7

NOTE: ICD-9-CM is *International Classification of Diseases, 9th Revision, Clinical Modification*.

Table 4. Hospital discharges and all-listed procedures among persons aged 65 and over, by age and sex

	1999				2007				Percent change between 2007 and 1999	
	NHDS		Medicare FFS		NHDS		Medicare FFS			
	Number in thousands	SE in thousands	Number in thousands	SE in thousands	Number in thousands	SE in thousands	Number in thousands	SE in thousands	NHDS	Medicare
Discharges										
All	12,683	469	9,726	1.1	12,863	573	10,009	1.5	1.4	†2.9
Sex										
Men	5,245	201	4,019	0.7	5,453	264	4,242	1.0	4.0	†5.6
Women	7,438	275	5,707	0.9	7,411	317	5,767	1.1	-0.4	†1.1
Age in years										
65–74	4,883	181	3,506	0.6	4,722	218	3,503	0.9	-3.3	†-0.1
75–84	5,227	200	4,075	0.7	5,188	246	4,041	1.0	-0.7	†-0.8
85 and over	2,572	113	2,145	0.5	2,954	132	2,466	0.7	†14.9	†15.0
Procedures										
All	15,467	697	13,364	31.5	16,029	714	15,095	34.3	3.6	†12.9
Sex										
Men	7,012	334	6,127	21.2	7,337	345	7,121	23.7	4.6	†16.2
Women	8,455	376	7,237	23.2	8,691	383	7,974	24.7	2.8	†10.2
Age in years										
65–74	6,771	304	5,598	20.4	6,958	350	6,257	22.1	2.8	†11.8
75–84	6,295	303	5,623	20.3	6,386	279	6,151	21.7	1.4	†9.4
85 and over	2,401	130	2,144	12.3	2,684	130	2,687	14.0	11.8	†25.4
Discharges with procedure(s) listed										
All	7,057	301	5,341	0.0	7,197	305	5,722	0.0	2.0	†7.1
Sex										
Men	3,098	138	2,339	0.0	3,180	141	2,562	0.0	2.6	†9.5
Women	3,959	168	3,002	0.0	4,017	170	3,160	0.0	1.5	†5.2
Age in years										
65–74	2,981	128	2,140	0.0	2,988	140	2,242	0.0	0.2	†4.8
75–84	2,876	129	2,234	0.0	2,866	118	2,318	0.0	-0.3	†3.8
85 and over	1,200	59	968	0.0	1,343	66	1,162	0.0	11.9	†20.0

† The change between 2007 and 1999 is statistically significant ($p < 0.05$, z test).

0.0 Quantity more than zero but less than 0.05.

NOTES: NHDS is National Hospital Discharge Survey; FFS is fee-for-service; SE is standard error.

SOURCES: CDC/NCHS, National Hospital Discharge Survey and Health Data Interactive; Centers for Medicare & Medicaid Services, Medicare 5% sample.

Table 5. Discharge rates, by age and sex, 1999 and 2007

Age in years, and sex	1999					2007					Percent change between 2007 and 1999	
	NHDS ¹		Medicare ²		Ratio	NHDS ¹		Medicare ²		Rate	NHDS	Medicare
	Rate	SE	Rate	SE		Rate	SE	Rate	SE			
65 and over												
All	3,704.1	136.9	3,683.1	0.42	0.99	3,395.1	151.3	3,553.6	0.54	1.05	-8.3	†-3.5
Men	3,683.6	141.1	3,729.1	0.67	1.01	3,412.9	165.3	3,498.7	0.83	1.03	-7.3	†-6.2
Women	3,718.7	137.3	3,651.4	0.54	0.98	3,382.1	144.6	3,595.2	0.70	1.06	-9.1	†-1.5
65-74												
All	2,706.4	100.2	2,683.1	0.49	0.99	2,439.9	112.4	2,471.4	0.63	1.01	-9.8	†-7.9
Men	2,835.3	110.1	2,778.9	0.76	0.98	2,559.3	116.5	2,513.8	0.96	0.98	-9.7	†-9.5
Women	2,600.2	99.3	2,603.2	0.64	1.00	2,338.4	114.6	2,433.0	0.84	1.04	-10.1	†-6.5
75-84												
All	4,338.9	165.7	4,223.9	0.76	0.97	3,983.3	188.9	4,152.0	1.01	1.04	-8.2	†-1.7
Men	4,476.3	185.2	4,492.1	1.26	1.00	4,162.6	237.1	4,285.5	1.60	1.03	-7.0	†-4.6
Women	4,246.1	161.0	4,050.1	0.96	0.95	3,859.8	165.6	4,056.8	1.30	1.05	-9.1	†0.2
85 and over												
All	6,200.2	271.4	5,809.4	1.46	0.94	5,358.9	239.2	5,787.1	1.66	1.08	†-13.6	†-0.4
Men	6,160.2	308.5	6,379.5	2.90	1.04	5,440.6	287.6	6,059.1	3.15	††1.11	-11.7	†-5.0
Women	6,217.2	274.7	5,586.0	1.69	††0.90	5,320.0	237.6	5,661.9	1.94	1.06	†-14.4	†1.4

† The change between 2007 and 1999 is statistically significant ($p < 0.05$, z test).

†† Medicare rate differs from NHDS discharge rate at the statistically significant level ($p < 0.05$, z test).

¹NHDS discharge rate per 10,000 civilian population.

²Medicare discharge rate per 10,000 Medicare Part A fee-for-service beneficiaries.

NOTES: NHDS is National Hospital Discharge Survey; SE is standard error.

SOURCES: CDC/NCHS, National Hospital Discharge Survey and Health Data Interactive; Centers for Medicare & Medicaid Services, Medicare 5% sample.

Table 6. Inpatient all-listed procedure rates, 1999 and 2007

Procedure name	1999					2007					Percent change between 2007 and 1999	
	NHDS ¹		Medicare ²		Ratio	NHDS ¹		Medicare ²		Rate	NHDS	Medicare
	Rate	SE	Rate	SE		Rate	SE	Rate	SE			
All procedures	4,517.2	203.6	5,061.0	11.9	†1.12	4,230.5	188.5	5,359.1	12.2	†1.27	-6.3	††5.9
Operations on the nose, mouth, and pharynx	16.3	1.8	20.3	0.6	†1.25	13.8	1.4	18.3	0.5	†1.33	-15.3	††-9.9
Thoracentesis	30.5	2.1	37.4	0.6	†1.23	40.6	3.8	43.4	0.7	1.07	††33.1	††16.0
Coronary artery bypass graft	94.1	7.5	106.6	1.2	1.13	60.9	5.2	70.3	1.0	1.15	††-35.3	††-34.1
Angioplasty with or without stent insertion	145.8	11.4	166.9	1.7	1.14	161.0	15.6	200.2	1.8	†1.24	10.4	††20.0
Endarterectomy of vessels of head, neck, except intracranial	28.8	2.3	35.3	0.6	†1.23	17.5	1.6	23.4	0.4	†1.34	††-39.2	††-33.7
Cardiac catheterization	180.4	12.6	208.9	1.3	†1.16	136.5	9.3	184.0	1.2	†1.35	††-24.3	††-11.9
Insertion, replacement, removal and revision of pacemaker leads or devices	83.3	6.2	104.6	1.3	†1.26	75.9	5.0	107.1	1.3	†1.41	-8.9	2.4
Shunt or vascular bypass	28.8	2.2	33.6	0.6	†1.17	17.5	1.8	18.6	0.4	1.06	††-39.2	††-44.6
Hemodialysis	65.9	5.8	82.7	1.5	†1.25	76.8	6.8	100.3	1.6	†1.31	16.5	††21.3
Gastrostomy	40.4	2.7	48.7	0.6	†1.21	26.1	2.0	34.3	0.5	†1.31	††-35.4	††-29.6
Endoscopy of small intestine, with or without biopsy	161.2	8.1	179.9	1.2	†1.12	143.8	7.7	166.3	1.2	†1.16	-10.8	††-7.6
Endoscopy of large intestine, with or without biopsy	104.4	5.3	110.2	1.0	1.06	75.2	4.0	89.0	0.8	†1.18	††-28.0	††-19.2
Gall bladder removal	46.0	3.0	46.2	0.6	1.00	35.4	2.3	38.1	0.5	1.08	††-23.0	††-17.5
Prostatectomy	41.0	3.5	40.1	0.6	0.98	21.2	2.1	25.8	0.4	†1.22	††-48.3	††-35.7
Oophorectomy	16.1	1.4	19.5	0.4	†1.21	12.4	1.3	14.9	0.3	1.20	-23.0	††-23.6
Hysterectomy	17.1	1.3	19.1	0.4	1.12	13.3	1.4	14.4	0.3	1.08	-22.2	††-24.6
Reduction of fracture	77.9	5.5	77.9	0.8	1.00	69.4	4.5	73.3	0.8	1.06	-10.9	-5.9
Excision or destruction of intervertebral disc and spinal fusion	28.4	3.7	29.1	0.6	1.02	40.9	4.0	46.4	0.8	1.13	††44.0	††59.5
Total hip replacement	29.7	2.4	30.0	0.5	1.01	33.0	2.7	36.3	0.5	1.10	11.1	††21.0
Total knee replacement	53.3	4.4	55.4	0.7	1.04	83.4	7.1	91.5	0.9	1.10	††56.5	††65.2
Amputation of lower limb	23.3	2.2	27.4	0.6	1.18	16.4	1.4	18.1	0.5	1.10	††-29.6	††-33.9
Mastectomy (includes lumpectomy, resection of breast, and mammectomy)	16.6	1.6	17.4	0.4	1.05	9.1	1.2	9.8	0.3	1.08	††-45.2	††-43.7
Continuous mechanical ventilation	86.5	3.8	109.4	1.0	†1.26	85.6	5.8	102.9	1.0	†1.20	-1.0	††-5.9

† Medicare rate differs from NHDS procedure rate at the statistically significant level ($p < 0.05$, z test).

†† The change between 2007 and 1999 is statistically significant ($p < 0.05$, z test).

¹NHDS procedure rate per 10,000 civilian population.

²Medicare procedure rate per 10,000 Medicare Part A fee-for-service beneficiaries.

NOTES: NHDS is National Hospital Discharge Survey; SE is standard error.

SOURCES: CDC/NCHS, National Hospital Discharge Survey and Health Data Interactive; Centers for Medicare & Medicaid Services, Medicare 5% sample.

Table 7. All-listed procedure rates, by age, 2007

Procedure name	Ages 65–74					Ages 75–84					Ages 85 and over				
	NHDS ¹		Medicare ²			NHDS ¹		Medicare ²			NHDS ¹		Medicare ²		
	Rate	SE	Rate	SE	Ratio	Rate	SE	Rate	SE	Ratio	Rate	SE	Rate	SE	Ratio
All procedures	3,595.7	180.7	4,414.5	15.6	†1.23	4,903.5	214.3	6,320.1	22.3	†1.29	4,869.2	236.3	6,306.4	33.0	†1.30
Operations on the nose, mouth, and pharynx	10.5	1.5	15.5	0.7	†1.48	17.3	2.8	20.1	0.9	1.16	17.0	3.0	23.3	1.4	1.37
Thoracentesis	24.5	3.8	28.0	0.8	1.14	47.5	4.8	49.0	1.2	1.03	80.8	13.5	81.8	2.4	1.01
Coronary artery bypass graft (CABG)	67.3	6.7	75.4	1.4	1.12	70.0	7.5	84.4	1.8	1.21	16.5	2.9	21.1	1.3	1.28
Angioplasty with or without stent insertion	168.6	16.0	200.8	2.6	†1.19	187.1	22.0	233.2	3.3	†1.25	72.4	9.8	122.9	3.6	†1.70
Endarterectomy of vessels of head, neck, except intracranial	17.0	1.8	20.6	0.6	1.21	21.5	2.7	30.7	0.8	†1.43	9.9	2.5	16.1	0.9	†1.63
Cardiac catheterization	138.9	10.6	179.3	1.6	†1.29	164.3	12.0	220.9	2.2	†1.34	62.2	6.8	115.3	2.4	†1.85
Insertion, replacement, removal and revision of pacemaker leads or devices	39.2	3.7	51.2	1.2	†1.31	100.5	7.9	140.0	2.4	†1.39	149.7	12.9	218.0	4.6	†1.46
Shunt or vascular bypass	19.3	2.1	18.5	0.6	0.96	19.1	3.5	21.3	0.7	1.12	7.5	1.8	13.1	0.8	†1.75
Hemodialysis	82.3	11.2	97.2	2.3	1.18	82.1	6.6	114.9	2.9	†1.4	44.9	5.8	77.0	3.4	†1.71
Gastrostomy	11.4	1.6	18.0	0.5	†1.58	31.5	3.2	40.8	0.9	†1.3	65.0	8.2	73.9	1.9	1.14
Endoscopy of small intestine, with or without biopsy	93.5	5.4	110.0	1.3	†1.18	181.4	11.5	204.3	2.2	1.13	231.7	18.9	266.6	3.7	1.15
Endoscopy of large intestine, with or without biopsy	47.6	3.1	57.2	0.9	†1.20	97.9	6.1	114.0	1.6	†1.16	118.8	10.9	137.6	2.7	1.16
Gall bladder removal	27.9	3.0	32.9	0.7	1.18	44.7	3.6	44.2	1.0	0.99	40.2	4.8	41.4	1.4	1.03
Prostatectomy	25.2	2.6	27.2	0.6	1.08	18.8	3.0	26.7	0.8	†1.42	12.7	2.3	19.0	1.0	†1.50
Oophorectomy	15.1	2.0	17.5	0.5	1.16	12.0	1.7	14.3	0.5	1.19	4.3	1.2	7.5	0.6	1.74
Hysterectomy	15.1	1.9	17.6	0.5	1.17	14.3	2.6	13.6	0.5	0.95	††	††	5.4	†0.5	††
Reduction of fracture	34.4	2.8	35.3	0.8	1.03	71.8	5.6	82.6	1.4	1.15	186.5	18.5	178.6	3.1	0.96
Excision or destruction of intervertebral disc and spinal fusion	54.1	5.9	59.4	1.2	1.10	33.2	4.6	42.0	1.2	1.27	12.6	3.3	12.9	1.0	1.02
Total hip replacement	33.6	3.8	34.1	0.7	1.01	37.7	3.2	44.0	1.0	1.17	19.7	3.7	26.1	1.1	1.32
Total knee replacement	95.8	8.8	99.5	1.3	1.04	89.4	7.9	104.9	1.5	1.17	25.7	4.5	34.5	1.3	1.34
Amputation of lower limb	15.8	2.1	15.5	0.6	0.98	17.0	2.2	19.0	0.8	1.12	17.5	3.9	24.6	1.3	1.41
Mastectomy (includes lumpectomy, resection of breast, and mastectomy)	9.9	1.8	9.3	0.4	0.94	9.4	1.6	10.6	0.5	1.13	5.6	1.5	9.7	0.7	1.73
Continuous mechanical ventilation	72.8	6.8	79.4	1.2	1.09	97.3	8.5	123.8	1.8	†1.27	103.2	8.3	133.5	2.8	†1.29

† Medicare rate differs from NHDS procedure rate at the statistically significant level ($p < 0.05$, z test).

†† Estimate is not reliable.

¹NHDS procedure rate per 10,000 civilian population.

²Medicare procedure rate per 10,000 Medicare Part A fee-for-service beneficiaries.

NOTES: NHDS is National Hospital Discharge Survey; SE is standard error.

SOURCES: CDC/NCHS, National Hospital Discharge Survey and Health Data Interactive; Centers for Medicare & Medicaid Services, Medicare 5% sample.

Table 8. All-listed procedure rates, by sex, 2007

Procedure name	Men					Women				
	NHDS ¹		Medicare ²			NHDS ¹		Medicare ²		
	Rate	SE	Rate	SE	Ratio	Rate	SE	Rate	SE	Ratio
All procedures	4,592.5	216.1	5,872.9	19.5	†1.28	3,966.6	174.6	4,970.8	15.4	†1.25
Operations on the nose, mouth, and pharynx	17.1	2.2	20.9	0.8	1.22	11.3	1.7	16.3	0.6	†1.44
Thoracentesis	36.0	4.8	46.4	1.1	†1.29	44.0	4.5	41.1	0.9	0.93
Coronary artery bypass graft	98.9	8.4	110.8	1.8	1.12	33.1	3.9	39.6	0.9	1.20
Angioplasty with or without stent insertion	234.0	24.1	279.9	3.3	1.20	107.7	10.5	140.0	2.0	†1.30
Endarterectomy of vessels of head, neck, except intracranial	23.5	2.7	31.1	0.8	†1.32	13.2	1.5	17.6	0.5	†1.33
Cardiac catheterization	181.2	13.3	236.1	2.0	†1.30	103.9	7.8	144.6	1.4	†1.39
Insertion, replacement, removal and revision of pacemaker leads or devices	88.8	6.8	122.8	2.1	†1.38	67.3	6.0	95.2	1.6	†1.41
Shunt or vascular bypass	22.9	2.4	24.9	0.7	1.09	13.6	2.3	13.9	0.5	1.02
Hemodialysis	83.8	8.2	114.6	2.6	†1.37	71.7	8.3	89.4	2.1	†1.25
Gastrostomy	26.5	2.7	36.9	0.8	†1.39	25.9	2.5	32.4	0.6	†1.25
Endoscopy of small intestine, with or without biopsy	137.4	7.9	164.1	1.8	†1.19	148.5	8.6	168.0	1.5	†1.13
Endoscopy of large intestine, with or without biopsy	69.8	4.8	82.1	1.2	†1.18	79.2	4.7	94.2	1.1	†1.19
Gall bladder removal	34.5	3.3	41.3	0.8	†1.20	36.1	3.4	35.7	0.7	0.99
Prostatectomy	50.2	5.1	59.8	1.0	1.19	...	...	...	...	...
Oophorectomy . . . . .	...	...	...	...	...	21.5	2.2	26.1	0.6	†1.21
Hysterectomy . . . . .	...	...	...	...	...	23.1	2.4	25.3	0.6	1.10
Reduction of fracture	37.2	3.4	40.8	0.9	1.10	92.8	6.7	97.9	1.2	1.05
Excision or destruction of intervertebral disc and spinal fusion	45.8	5.0	48.2	1.2	1.05	37.3	4.5	44.9	1.0	1.20
Total hip replacement	32.3	3.9	31.2	0.7	0.97	33.5	3.0	40.1	0.7	†1.20
Total knee replacement	71.6	7.1	75.4	1.2	1.05	92.0	7.8	103.7	1.2	1.13
Amputation of lower limb	20.1	2.1	24.0	0.8	1.19	13.8	1.7	13.6	0.5	0.99
Mastectomy (includes lumpectomy, resection of breast, and mammectomy) . . . . .	...	...	...	...	...	15.5	2.1	16.9	0.5	1.09
Continuous mechanical ventilation	97.1	7.8	117.2	1.6	†1.21	77.3	5.6	92.1	1.2	†1.19

† Medicare rate differs from NHDS procedure rate at the statistically significant level ($p < 0.05$, z test).

... Category not applicable.

¹NHDS procedure rate per 10,000 civilian population.

²Medicare procedure rate per 10,000 Medicare Part A fee-for-service beneficiaries.

NOTES: NHDS is National Hospital Discharge Survey; SE is standard error.

SOURCES: CDC/NCHS, National Hospital Discharge Survey and Health Data Interactive; Centers for Medicare & Medicaid Services, Medicare 5% sample.

Table 9. Percentage of hospital inpatient discharges, by number of procedures mentioned, 1999 and 2007

	1999		2007	
	NHDS	Medicare	NHDS	Medicare
All discharges	100.0	100.0	100.0	100.0
No procedure	44.4	45.4	44.0	43.5
1–3 procedures	43.3	42.0	42.7	41.5
4 procedures	12.4	4.3	13.2	4.6
4 or more procedures	12.4	12.6	13.2	15.0
5 or more procedures . . . . .	...	8.3	...	10.4

... Category not applicable.

NOTE: NHDS is National Hospital Discharge Survey.

SOURCES: CDC/NCHS, National Hospital Discharge Survey and Health Data Interactive; Centers for Medicare & Medicaid Services, Medicare 5% sample.

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