
Changing Patterns of Surgical Care in the United States, 1980-1995

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National inpatient and ambulatory surgery data were combined to examine changes over time in the location and amount of surgical care. The main pattern was a decline in the rate of inpatient operations that was outweighed by growth in ambulatory operations. However, the rate of inpatient operations did not decrease for patients age 65 years or over, despite the growth in ambulatory surgery. Other patterns seen for specific types of operations were the substitution of ambulatory for inpatient operations, increases primarily in the rate of inpatient operations, and decreases in total operations. These patterns have implications for control of health care costs.

INTRODUCTION

Ambulatory surgery grew dramatically during the 1980s and 1990s. In 1980, about 3 million operations were done in ambulatory settings (American College of Surgeons, 1991), but in 1995 the number had grown to 27 million (Kozak and Owings, 1998). This was a period of rapid change in the U.S. health care system. The 1983 implementation of the prospective payment system for Medicare patients based on diagnosis-related groups (DRGs) resulted in a profound change in the economic incentives for hospitals, making

ambulatory surgery advantageous (Schramm and Gabel, 1988). The rapid growth of managed care also helped stimulate ambulatory surgery. Health maintenance organizations, preferred-provider organizations, and prospective utilization review in private health insurance systems encouraged shifting operations away from more expensive inpatient settings (Guterman et al., 1988; Detmer and Gelijns, 1994). Technological advances, such as improved anesthetics and analgesics and minimally-invasive surgical techniques allowed an increasing range of operations to be done in ambulatory settings (Lumsdon, 1992; Davis, 1993).

Shifting operations to ambulatory settings was expected to help contain health care costs, based on the assumption that less expensive ambulatory surgery would substitute for inpatient surgery. However, that is not what happened. While ambulatory surgery grew, the number of inpatient operations stayed the same, at 27 million in both 1980 and 1995. This raises questions about the changing patterns of surgical care. Did some types of operations switch to ambulatory settings and others increase for inpatients, or were the same operations increasing in both settings? Did the same patterns hold for most operations, or were several types of changes happening at the same time? Answers to these questions are needed to understand the effects of current policies to control the sites and the costs of surgical care and to help guide efforts to reduce unnecessary surgery and improve the quality of surgical care.

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Patterns of surgical care could not be examined in depth in the past because of a lack of detailed national data on ambulatory surgery. The American Hospital Association (AHA) reports total numbers of inpatient operations and hospital-based ambulatory surgery, but not information about specific types of operations (American Hospital Association, 1996; American College of Surgeons, 1996). Billing data from Medicare have been used to explore surgical patterns for the elderly, but this study was limited by a lack of detailed data on ambulatory surgery (Leader and Moon, 1989). The National Hospital Discharge Survey (NHDS) has produced detailed nationally-representative statistics on inpatient surgery since 1965, but similar data were not available on ambulatory surgery until 1994. In 1994, 1995, and 1996 the NCHS collected data in the National Survey of Ambulatory Surgery (NSAS) which allowed the analysis conducted here.

In this study, data from the NHDS and NSAS were combined to examine national patterns of surgical care. Trends in inpatient operations were examined for the period 1980-1995 using data from NHDS. Estimates of ambulatory operations in 1995 were taken from NSAS and combined with the NHDS data to establish total rates for 1995. These data were used to identify various patterns that have developed in surgical care.

METHODS

In the NHDS, data were collected from a sample of inpatient records acquired from a national probability sample of non-Federal short-stay hospitals. These included hospitals with an average length of stay of fewer than 30 days for all patients, and general hospitals or children's general hospitals. Federal, military, and Department

of Veterans Affairs hospitals were excluded. In 1995, 466 hospitals participated in the survey, which was a response rate of 92 percent. Data were collected for 263,000 discharges from these hospitals.

In the NSAS, data were collected on ambulatory surgery patients in non-Federal short-stay hospitals and freestanding ambulatory surgery centers. A sample of visits was drawn from all locations within these facilities where ambulatory surgery was performed, including main or general operating rooms, all dedicated ambulatory surgery rooms, cystoscopy and endoscopy units, cardiac catheterization labs, and laser procedure rooms. Certain freestanding centers and specialized locations within hospitals were not covered, including those dedicated to dentistry, podiatry, abortion, family planning, birthing, pain block, and minor procedures (sometimes referred to as "lump and bump" rooms). In 1995, 489 facilities participated in the survey, which was a response rate of 80 percent, and they provided information on 122,000 ambulatory surgery patients.

In both surveys, data were weighted to produce national statistics using multi-stage estimation procedures. Descriptions of the estimation processes and other aspects of the surveys' design and operation have been published (Graves, 1995; McLemore and Lawrence, 1997).

Operations were coded according to the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) (Public Health Service and Health Care Financing Administration, 1991). This analysis included all operations except those coded to the category, "Miscellaneous Diagnostic and Therapeutic Procedures," (ICD-9-CM codes 87-99). NHDS data for this category were not comparable over time. Codes for many procedures in this category were not used for

NHDS data in 1980, which excluded these procedures from survey estimates. Some of these codes were not used until 1983, others until 1989, and all the codes were not used until 1991 (Gillum, Graves, and Kozak, 1996). In addition, estimates for this category increased in 1985 because of a change in data collection procedures. Part of the NHDS data began to be purchased from commercial abstracting services that year, and a larger number of non-surgical procedures per patient were reported in the purchased data than in the manually collected data (Graves, 1987).

The NSAS data for the “Miscellaneous Diagnostic and Therapeutic Procedures” category were also problematic. NSAS did not cover many settings in which diagnostic and therapeutic procedures were done on an ambulatory basis, such as emergency rooms, outpatient departments, radiology units, and doctors’ offices (Pokras, Kozak, and McCarthy, 1997). Estimates from the survey, therefore, do not represent the total number of diagnostic and therapeutic procedures done on an ambulatory basis.

It should be noted that not all non-surgical diagnostic and therapeutic procedures are in the miscellaneous category of the coding system. Ones that are included in other categories, such as spinal tap (operations on the nervous system), bronchoscopy (operations on the respiratory system), and hemodialysis (operations on the cardiovascular system) are included in this article.

To avoid double counting, the NSAS data in this article excluded ambulatory surgery patients who were discharged to inpatient status. In most instances, the ambulatory operations for these patients became part of their inpatient record. Newborn infants, defined as patients admitted by birth, were excluded from the NHDS data.

Trends were examined for total operations and for each of the 15 operation categories in the ICD-9-CM, excluding the “Miscellaneous Diagnostic and Therapeutic Procedures” category. For each of four age groups, trends were analyzed for operation categories that included at least 75 percent of all inpatient operations in 1980 and of inpatient and ambulatory operations combined in 1995. One or more frequent operations within each of these categories were also examined. The specific operations were selected from ones tracked in the NHDS or NSAS annual summaries (Haupt, 1982; Graves and Owings, 1997; Hall and Lawrence, 1997). These operations had been chosen for annual reporting because of their high frequency or because they were of special interest.

Some frequent operations could not be included because of coding or methodological problems. For example, endoscopic polypectomy of large intestine, a leading ambulatory procedure for patients age 45-64 in 1995, could not be tracked before 1988 when a specific code to identify this procedure was added to the ICD-9-CM (Graves, 1991). Coronary artery bypass graft was not chosen because multiple codes are often used to describe a single bypass operation (Pokras, Kozak, and McCarthy, 1997). Hysterectomy was excluded because the hysterectomy trend appeared to be affected by methodological changes in the survey in 1988 (Haupt and Kozak, 1992). Despite such problems, it was possible to examine most of the leading operations for each age group.

Age-specific rates per 10,000 population were computed for the selected operations using the inpatient data from the NHDS for each year from 1980 through 1995 and combined NHDS and NSAS data for 1995.

The rates for sex-specific procedures were based on the population of the appropriate age and sex group. For obstetrical procedures, rates were calculated per 100 females with deliveries.

Standard errors for the estimates from each survey were computed using SUDAAN software, which took into account the complex sample designs of the surveys. A description of the software and the approach it uses has been published (Shah, Barnwell, and Bieler, 1995). Standard errors for combined ambulatory (x) and inpatient (y) estimates were calculated using the formula:

$$SE(X+Y)=\sqrt{[SE(X)]^2+[SE(Y)]^2}.$$

A weighted least squares regression method (Gillum, Graves, and Kozak, 1996; Sirken et al., 1990), was used to test for trends in the 1980-1995 rates of inpatient operations. The inpatient rates for 1980 were then compared with the combined inpatient and ambulatory rates in 1995 using the two-sided t -test with a critical value of 1.96 (0.05 level of significance). Because data were not available, this comparison could not include ambulatory surgery being performed in 1980. However, according to general estimates (American College of Surgeons, 1991), the volume of ambulatory surgery in 1980 was small compared with the volume in 1995.

RESULTS

Trends are shown in Table 1 for all operations and for the 15 operation categories that make up the procedure classification in ICD-9-CM, excluding the Miscellaneous Diagnostic and Therapeutic Procedures category. In addition to rates of inpatient operations for 1980, 1985, 1990, and 1995, results of the least squares regression tests for trends are shown. The 1995 rates of

ambulatory operations and of ambulatory and inpatient operations combined are shown in the table, followed by the results of t -tests that compared the 1980 inpatient rates with the 1995 combined rates.

Tables 2-5 show trends for leading operation categories and specific procedures within these categories for four age groups. When the information about the trends in inpatient surgery was combined with the findings about differences between rates of inpatient surgery in 1980 and total surgery in 1995, varying patterns were revealed, which for ease of reference are labeled in this article as: substitution, outweigh, inpatient increase, ambulatory addition, and decline.

Substitution

One expected pattern was a decreasing rate of inpatient operations with an equivalent increase in ambulatory surgery and no difference in overall rates. This pattern, which suggests a substitution of outpatient surgery for inpatient surgery, was seen for only two of the broad categories in Table 1: operations on the urinary system and operations on male genital organs, accounting for 6 percent of all operations in 1995. However, more categories and specific procedures within age groups followed this pattern.

Two of the leading categories for children under age 15 fit the substitution pattern: operations on the digestive system and operations on the musculoskeletal system (Table 2). Within the digestive system category, repair of inguinal hernia displayed the substitution pattern. The pattern was seen within the musculoskeletal category for reduction of fracture and dislocation and operations on muscle, tendon, fascia, and bursa. In addition, tonsillectomy fit the substitution pattern for children under age 15.

Table 1
Trends in Rates for Categories of Operations: 1980, 1985, 1990, and 1995

Operation Category (ICD-9-CM Code)	Rate of Inpatient Operations per 10,000 Population				1980-1995 Inpatient Trend ¹	1995 Rate per 10,000 Population		1995 Combined Compared with 1980 Inpatient Rate ¹
	1980	1985	1990	1995		Ambulatory	Ambulatory and Inpatient Combined	
All Operations (01-86)	1,218.0	1,182.8	1,154.9	1,047.3	-	1,020.0	2,067.3	+
Operations on the Nervous System (01-05)	32.3	38.0	38.4	36.5	NS	41.3	77.8	+
Operations on the Endocrine System (06-07)	5.2	4.0	3.9	3.2	-	0.8	4.0	-
Operations on the Eye (08-16)	46.5	30.4	14.1	10.3	-	189.5	199.8	+
Operations on the Ear (18-20)	18.4	10.8	5.5	2.6	-	32.8	35.4	+
Operations on the Nose, Mouth, and Pharynx (21-29)	71.0	49.7	23.6	13.5	-	78.8	92.3	+
Operations on the Respiratory System (30-34)	38.5	41.5	39.4	39.8	NS	14.8	54.6	+
Operations on the Cardiovascular System (35-39)	59.9	102.2	156.6	185.1	+	25.6	210.7	+
Operations on the Hemic and Lymphatic System (40-41)	14.2	16.8	14.6	13.9	NS	5.1	19.0	+
Operations on the Digestive System (42-54)	235.8	243.0	212.7	194.1	-	243.6	437.7	+
Operations on the Urinary System (55-59)	85.1	73.2	67.2	42.2	-	52.6	94.7	NS
Operations on the Male Genital Organs (60-64) ²	73.3	65.1	49.5	27.6	-	39.0	66.6	NS
Operations on the Female Genital Organs (65-71) ³	366.3	271.9	191.1	155.9	-	152.0	307.8	-
Obstetrical Procedures (72-75) ⁴	95.8	111.7	168.7	169.0	+	⁽⁵⁾	169.2	+
Operations on the Musculoskeletal System (76-84)	142.5	149.1	126.4	117.7	-	154.4	272.1	+
Operations on the Integumentary System (85-86)	84.0	70.0	56.0	51.3	-	83.4	134.7	+

¹ A plus indicates that the trend or rate was significantly higher; a minus indicates significantly lower; and NS indicates that the trend or the difference in rates was not statistically significant.

² Rate per 10,000 male population.

³ Rate per 10,000 female population.

⁴ Rate per 100 deliveries.

⁵ Estimate is not reliable.

NOTES: Operation categories and code numbers are based on the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM).

SOURCES: National Center for Health Statistics: 1980-1995 National Hospital Discharge Survey and 1995 National Survey of Ambulatory Surgery.

Table 2
Trends in Rates of Selected Operations for Children Under Age 15: 1980, 1985, 1990, and 1995

Operation Category (ICD-9-CM Code)	Rate of Inpatient Operations per 10,000 Population				1980-1995 Inpatient Trend ¹	1995 Rate per 10,000 Population		1995 Combined Compared with 1980 Inpatient Rate ¹
	1980	1985	1990	1995		Ambulatory	Ambulatory and Inpatient Combined	
All Operations (01-86)	395.6	305.3	233.8	193.5	-	375.2	568.7	+
Operations on the Nervous System (01-05)	20.5	30.4	38.8	38.6	+	1.7	40.2	+
Spinal Tap (03.31)	12.6	21.9	30.6	27.2	+	(2)	27.8	+
Operations on the Ear (18-20)	48.9	24.9	14.9	6.4	-	112.9	119.3	+
Myringotomy with Insertion of Tube (20.01)	34.1	15.2	9.0	3.8	-	90.2	94.0	+
Operations on the Nose, Mouth, and Pharynx (21-29)	92.5	59.4	25.9	13.0	-	122.2	135.2	+
Operation on Teeth, Gums and Alveoli (23-24)	8.2	6.3	1.6	1.3	-	28.6	29.9	+
Tonsillectomy with and Without Adenoidectomy (28.2-28.3)	57.3	38.2	13.7	4.8	-	48.3	53.1	NS
Adenoidectomy Without Tonsillectomy (28.6)	14.3	3.8	1.5	0.7	-	23.5	24.3	+
Operations on the Digestive System (42-54)	62.1	45.7	39.2	33.4	-	29.1	62.5	NS
Appendectomy, Excluding Incidental (47.0)	15.0	13.4	12.3	9.1	-	(2)	9.2	-
Repair of Inguinal Hernia (53.0-53.1)	19.5	10.3	4.0	1.6	-	14.1	15.7	NS
Operations on the Musculoskeletal System (76-84)	48.9	45.2	29.8	25.2	-	27.1	52.3	NS
Reduction of Fracture and Dislocation (79)	18.0	18.1	11.3	9.1	-	8.1	17.2	NS
Operations on Muscle, Tendon, Fascia, and Bursa (82-83)	9.7	7.5	4.9	4.0	-	5.0	9.1	NS
Operations on the Integumentary System (85-86)	25.5	20.0	15.8	16.0	-	18.7	34.7	+
Excision or Destruction of Lesion or Tissue of Skin and Subcutaneous Tissue (86.2-86.4)	11.1	8.2	5.4	5.5	-	11.8	17.3	+

¹ A plus indicates that the trend or rate was significantly higher; a minus indicates significantly lower; and NS indicates that the trend or the difference in rates was not statistically significant.

² Estimate is not reliable.

NOTES: Operation categories and code numbers are based on the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM).

SOURCES: National Center for Health Statistics: 1980-1995 National Hospital Discharge Survey and 1995 National Survey of Ambulatory Surgery.

None of the leading operation categories for patients age 15-44 displayed a substitution pattern, but within the categories the pattern was seen for bilateral destruction of fallopian tubes (tubal sterilization) and reduction of fracture and dislocation (Table 3). Substitution was seen for patients age 45-64 for the categories of operations on the urinary system and operations on the female genital organs (Table 4). Among specific operations, cystoscopy and cholecystectomy fit the substitution pattern for this age group. Operations on the urinary system and cystoscopy also displayed the substitution pattern for patients age 65 or over (Table 5).

Outweigh

The overall 1980-1995 trend for operations in the United States was a decline in the rate of inpatient operations which was outweighed by growth in the rate of ambulatory procedures. The inpatient rate was 14 percent lower in 1995 than in 1980, but the 1995 combined ambulatory and inpatient rate was 70 percent higher than the 1980 inpatient rate. The outweigh pattern was seen for 6 of the 15 operation categories. These categories—operations on the eye; ear; nose, mouth, and pharynx; digestive system; musculoskeletal system; and integumentary system—accounted for 57 percent of total operations in 1995.

The outweigh pattern was the predominant pattern for each of the three age groups under age 65. For children under age 15, the rate of inpatient operations declined 51 percent from 1980 through 1995, but their 1995 rate of inpatient and ambulatory operations combined was 44 percent higher than their 1980 inpatient rate. Three of the six leading categories of operations for children displayed the outweigh pattern. These included operations on the ear; nose, mouth and pharynx; and

integumentary system. Within the ear category, the rate of inpatient myringotomy decreased almost 90 percent from 1980-1995, but the inpatient and ambulatory rate combined in 1995 was 2.8 times the 1980 inpatient rate. This pattern was also seen for children for operations on teeth, gums, and alveoli; adenoidectomy; and excision of skin.

For the age group 15-44, the rate of inpatient operations decreased 22 percent from 1980 through 1995, but the 1995 combined rate was 33 percent higher than the 1980 inpatient rate. The rates for three of the five major categories shown in Table 3 followed the outweigh pattern: operations on the digestive, musculoskeletal, and integumentary systems. Within the digestive category, endoscopy of large intestine and cholecystectomy displayed the outweigh pattern, as did operations on muscle, tendon, fascia, and bursa (musculoskeletal) and excision of skin lesion (integumentary).

The rate of inpatient operations for the age group 45-64 declined 22 percent from 1980 through 1995, but the 1995 rate for inpatient and ambulatory operations combined was 75 percent higher than the 1980 inpatient rate. Rates for four of the seven operation categories in Table 4 fit the outweigh pattern, including operations on the eye, digestive system, musculoskeletal system, and integumentary system. Among eye operations, the cataract procedures, extraction of lens and insertion of prosthetic lens, declined so much in inpatient settings that national estimates are no longer reliable, but the substantial amount of cataract surgery done in ambulatory settings resulted in combined ambulatory and inpatient rates for 1995 that were well above 1980 inpatient rates. Among digestive system operations, the inpatient rate of endoscopy of large intestine was cut almost in half from 1980-1995, but, because of its frequency as an ambulatory procedure,

Table 3

Trends in Rates of Selected Operations for Persons Age 15-44: 1980, 1985, 1990, and 1995

Operation Category (ICD-9-CM Code)	Rate of Inpatient Operations per 10,000 Population				1980-1995 Inpatient Trend ¹	1995 Rate per 10,000 Population		1995 Combined Compared with 1980 Inpatient Rate ¹
	1980	1985	1990	1995		Ambulatory	Ambulatory and Inpatient Combined	
All Operations (01-86)	1,294.0	1,157.7	1,169.4	1,013.8	-	713.2	1,727.1	+
Operations on the Digestive System (42-54)	186.4	167.4	128.0	109.1	-	158.1	267.3	+
Endoscopy of Small Intestine with or Without Biopsy (45.11-45.14,45.16)	8.6	11.6	12.7	12.3	+	32.9	45.2	+
Endoscopy of Large Intestine with or Without Biopsy (45.21-45.25)	12.4	10.5	6.8	5.4	-	27.2	32.5	+
Cholecystectomy (51.2)	16.1	14.9	17.7	13.7	-	10.4	24.1	+
Operations on Female Genital Organs (65-71) ²	600.6	431.0	292.4	223.2	-	256.1	479.3	-
Bilateral Destruction or Occlusion of Fallopian Tubes (66.2-66.3) ²	119.3	81.5	71.5	55.0	-	59.7	114.7	NS
Dilation and Curettage of Uterus (69.0) ²	179.6	84.6	30.2	15.0	-	54.2	69.2	-
Obstetrical Procedures (72-75) ³	95.8	111.7	168.7	169.1	+	(4)	169.3	+
Episiotomy (72.1,72.21,72.31,72.71,73.6) ³	53.6	47.2	42.6	37.4	-	(4)	37.4	-
Cesarean Section (74.0-74.2, 74.4,74.99) ³	16.4	22.8	23.5	20.9	+	(4)	20.9	+
Repair of Current Obstetric Laceration (75.5-75.6) ³	9.4	14.2	19.8	25.6	+	(4)	25.6	+
Operations on the Musculoskeletal System (76-84)	149.3	138.1	109.5	85.6	-	168.5	254.0	+
Reduction of Fracture and Dislocation (79)	25.7	25.3	20.3	18.7	-	8.5	27.2	NS
Operations on Muscle, Tendon, Fascia, and Bursa (82-83)	18.5	14.0	11.5	7.3	-	22.4	29.7	+
Operations on the Integumentary System (85-86)	81.5	60.3	45.4	35.8	-	68.5	104.3	+
Excision or Destruction of Lesion or Tissue of Skin and Subcutaneous Tissue (86.2-86.4)	31.1	21.8	15.6	11.5	-	26.5	38.0	+

¹ A plus indicates that the trend or rate was significantly higher; a minus indicates significantly lower; and NS indicates that the trend or the difference in rates was not statistically significant.

² Rate per 10,000 female population.

³ Rate per 100 deliveries.

⁴ Estimate is not reliable.

NOTES: Operation categories and code numbers are based on the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM).

SOURCES: National Center for Health Statistics: 1980-1995 National Hospital Discharge Survey and 1995 National Survey of Ambulatory Surgery.

Table 4

Trends in Rates of Selected Operations for Persons Age 45-64: 1980, 1985, 1990, and 1995

Operation Category (ICD-9-CM Code)	Rate of Inpatient Operations per 10,000 Population				1980-1995 Inpatient Trend ¹	1995 Rate per 10,000 Population		1995 Combined Compared with 1980 Inpatient Rate ¹
	1980	1985	1990	1995		Ambulatory	Ambulatory and Inpatient Combined	
All Operations (01-86)	1,415.4	1,393.3	1,260.1	1,098.5	-	1,371.7	2,470.2	+
Operations on the Eye (08-16)	58.2	35.6	16.4	10.5	-	153.2	163.7	+
Extraction of Lens (13.1-13.6)	24.3	9.4	2.2	(2)	- (2)	58.1	59.8	+
Insertion of Prosthetic Lens (13.7)	7.8	8.3	2.2	(2)	- (2)	46.3	47.8	+
Operations on the Cardiovascular System (35-39)	130.4	218.4	311.0	315.5	+	51.9	367.4	+
Removal of Coronary Artery Obstruction (36.0)	(3)	10.5	32.0	37.1	+	(4)	38.7	+
Cardiac Catheterization (37.21-37.23)	42.0	78.5	98.8	83.9	+	28.8	112.7	+
Operations on the Digestive System (42-54)	357.1	348.9	299.7	243.5	-	399.3	642.8	+
Endoscopy of Small Intestine with or Without Biopsy (45.11-45.14)	21.7	35.3	46.1	42.0	+	96.4	138.4	+
Endoscopy of Large Intestine with or Without Biopsy (45.21-45.25)	40.3	37.8	29.4	21.3	-	130.6	152.0	+
Cholecystectomy (51.2)	35.8	35.2	36.3	27.0	-	15.5	42.4	NS
Operations on the Urinary System (55-59)	126.1	101.3	92.2	54.6	-	79.6	134.2	NS
Operations with or Without Biopsy (57.31-57.33)	55.8	38.2	27.4	9.7	-	41.5	51.2	NS
Cystoscopy on the Female Genital Organs (65-71) ⁵	362.9	259.9	206.0	190.1	-	148.9	339.0	NS
Dilation and Curettage of Uterus (69.0) ⁵	103.7	35.9	13.0	4.3	-	60.4	64.8	-
Operations on the Musculoskeletal System (76-84)	175.7	198.9	158.6	151.7	-	255.9	407.6	+
Operations on Muscle, Tendon, Fascia, and Bursa (82-83)	26.7	22.1	17.3	13.8	-	44.2	58.0	+
Operations on the Integumentary System (85-86)	122.9	105.8	76.8	73.6	-	142.1	215.6	+
Excision or Destruction of Lesion or Tissue of Skin and Subcutaneous Tissue (86.2-86.4)	43.0	33.1	22.0	23.7	-	45.2	68.9	+

¹ A plus indicates that the trend or rate was significantly higher; a minus indicates significantly lower; and NS indicates that the trend or the difference in rates was not statistically significant.

² NHDS estimates for 1993-1995 are unreliable. Inpatient trend for 1980-1992 tested.

³ NHDS estimates for 1980-1982 are unreliable. Rates tested for 1983-1995.

⁴ Estimate is not reliable.

⁵ Rate per 10,000 female population.

NOTES: Operation categories and code numbers are based on the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM). NHDS is National Hospital Discharge Survey. SOURCES: National Center for Health Statistics: 1980-1995 National Hospital Discharge Survey and 1995 National Survey of Ambulatory Surgery.

Table 5

Trends in Rates of Selected Operations for Persons Age 65 or Over: 1980, 1985, 1990, and 1995

Operation Category (ICD-9-CM Code)	Rate of Inpatient Operations per 10,000 Population				1980-1995 Inpatient Trend ¹	1995 Rate per 10,000 Population		1995 Combined Compared with 1980 Inpatient Rate ¹
	1980	1985	1990	1995		Ambulatory	Ambulatory and Inpatient Combined	
All Operations (01-86)	2,209.6	2,542.9	2,542.0	2,555.0	NS	2,662.0	5,217.0	+
Operations on the Eye (08-16)	234.8	145.3	59.0	46.0	-	1,139.5	1,185.5	+
Extraction of Lens (13.1-13.6)	130.4	55.3	16.4	(2)	(-)	572.4	586.7	+
Insertion of Prosthetic Lens (13.7)	59.9	49.0	15.4	(2)	(-)	429.4	442.9	+
Operations on the Cardiovascular System (35-39)	200.9	365.3	595.8	762.9	+	82.0	844.9	+
Removal of Coronary Artery Obstruction (36.0)	(3)	8.2	36.8	62.2	+	(4)	64.1	+
Cardiac Catheterization (37.21-37.23)	32.6	80.0	134.9	158.1	+	41.2	199.2	+
Insertion, Replacement, Removal, and Revision of Pacemaker Leads or Device (37.7-37.8) ⁵	56.6	58.9	63.6	76.2	+	4.1	80.4	+
Operations on the Digestive System (42-54)	572.5	731.7	699.9	692.9	NS	671.1	1,364.1	+
Endoscopy of Small Intestine with or Without Biopsy (45.11-45.14,45.16)	34.7	84.8	132.7	152.4	+	171.6	324.0	+
Endoscopy of Large Intestine with or Without Biopsy (45.21-45.25)	84.3	113.1	105.5	99.1	NS	238.2	337.3	+
Operations on the Urinary System (55-59)	290.0	288.0	258.3	153.8	-	173.7	327.5	NS
Cystoscopy with or Without Biopsy (57.31-57.33)	151.1	133.0	101.6	41.9	-	99.6	141.5	NS
Operations on Male Genital Organs (60-64) ⁶	359.8	363.3	302.9	166.4	-	91.6	258.0	-
Prostatectomy (60.2-60.6) ⁶	242.3	249.6	226.2	134.1	-	14.7	148.8	-
Operations on the Musculoskeletal System (76-84)	244.4	303.0	309.0	337.2	+	166.0	503.2	+
Reduction of Fracture and Dislocation (79)	67.1	75.9	75.2	76.3	+	7.5	83.8	+
Operations on the Integumentary System (85-86)	143.7	142.4	134.2	131.9	-	156.2	288.2	+
Excision or Destruction of Lesion or Tissue of Skin and Subcutaneous Tissue (86.2-86.4)	55.7	56.2	62.2	53.3	NS	63.9	117.2	+

¹ A plus indicates that the trend or rate was significantly higher; a minus indicates significantly lower; and NS indicates that the trend or the difference in rates was not statistically significant.

² NHDS estimates for 1994-1995 are unreliable. Inpatient trend for 1980-1993 tested.

³ NHDS estimates for 1980-1982 are unreliable. Rates tested for 1983-1995.

⁴ Estimate is not reliable.

⁵ 1980-86 Insertion, replacement, revision, and removal of cardiac pacemaker system.

⁶ Rates per 10,000 male population.

NOTES: Operation categories and code numbers are based on the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM). NHDS is National Hospital Discharge Survey.

SOURCES: National Center for Health Statistics: 1980-1995 National Hospital Discharge Survey and 1995 National Survey of Ambulatory Surgery.

overall the operation increased nearly four-fold during that period. As for younger patients, rates of operations on muscle, tendon, fascia and bursa and excision of skin fit the outweigh pattern for patients in the age group 45-64.

The rate of operations for patients age 65 or over did not display the outweigh pattern because their inpatient rate did not decline from 1980-1995. However, the outweigh pattern was seen for the category operations on the eye. The inpatient rate for eye operations decreased 80 percent during the 1980-1995 period, but because of growth in ambulatory settings, the combined ambulatory and inpatient rate for 1995 was five times the 1980 inpatient rate. Operations on the integumentary system also displayed the outweigh pattern for elderly patients.

Inpatient Increase

Two categories of operations had what can be described as an inpatient increase pattern. These categories—operations on the cardiovascular system and obstetrical procedures—increased as inpatient operations and had higher combined inpatient and ambulatory rates in 1995 than inpatient rates in 1980. These two categories accounted for 22 percent of total operations in 1995.

Children under age 15 displayed the inpatient increase pattern for the category of operations on the nervous system, and within the category for spinal tap. Patients age 15-44 had inpatient increases in obstetrical procedures as a group, and among the specific obstetrical procedures examined, there were inpatient increases in cesarean section and repair of current obstetric laceration. The rate of endoscopy of small intestine increased for inpatients age 15-44, as well as increasing for ambulatory patients.

The inpatient increase pattern was seen for the operations on the cardiovascular system for patients age 45-64 and age 65 or over. Among the specific cardiovascular operations examined, inpatient increases were seen for both age groups for removal of coronary artery obstruction (angioplasty) and cardiac catheterization. The age group 65 or over also had an inpatient increase for pacemaker procedures. The elderly exhibited the inpatient increase pattern for operations on the musculoskeletal system and within the category for reduction of fracture and dislocation. In addition, both age groups, like the group age 15-44, had increases in endoscopy of small intestine in inpatient settings, as well as in ambulatory settings.

Ambulatory Addition

The ambulatory addition pattern was identified when inpatient rates did not change significantly from 1980 through 1995, but the rate of ambulatory and inpatient operations combined was higher in 1995 than the inpatient rate in 1980, indicating additional operations done in ambulatory settings. This was the overall pattern for patients age 65 or over. It was also the overall pattern for three of the broad categories, operations on the nervous system, respiratory system, and hemic and lymphatic system, which accounted for 7 percent of the all operations in 1995. Only the age group 65 or over exhibited the ambulatory addition pattern for the categories and operations examined. Operations on the digestive system, and within the category, endoscopy of large intestine, fit the ambulatory addition pattern for the elderly. In contrast, these followed the outweigh pattern for age groups 15-44 and 45-64, with inpatient rates declining rather than remaining the same. Likewise, rates for excision of skin showed

the ambulatory increase pattern for those age 65 or over but the outweigh pattern for the three younger age groups.

Decline

Finally, a pattern of decline was seen for some operations. This pattern was evident when the rate of inpatient operations declined during the period 1980-1995 and the rate of ambulatory and inpatient operations combined was significantly lower in 1995 than the 1980 inpatient rate. Among the broad categories, operations on the endocrine system and female genital organs showed this pattern. These two categories made up 8 percent of total operations in 1995.

Declines for specific age groups included appendectomy for children under age 15 years; their appendectomy rate was 39 percent lower in 1995 than in 1980. Females age 15-44 experienced declines in the rate for operations on the female genital organs, and within that category, for dilation and curettage of uterus (D & C). The rate of D & C also declined for females age 45-64. Although most obstetrical procedures were increasing, the rate of episiotomy per delivery declined for females age 15-44. For males age 65 or over, operations on male genital organs declined in inpatient settings and overall, and the prostatectomy rate was 39 percent lower in 1995 than it had been in 1980.

DISCUSSION

Major Trend Pattern

The major trend in surgery during the period 1980-1995 has been a decline in the rate of inpatient operations, but growth in ambulatory surgery that outweighed this inpatient decline. Two major factors have been suggested to explain this pattern.

First, advances in surgical techniques have made surgery easier on patients and thus increased the demand for care (Meddings et al., 1997; Legorreta et al., 1993). Second, health care policies created economic incentives that stimulated not just a shift to ambulatory settings, but explosive growth in ambulatory surgery (Rutkow, 1997; Schramm and Gabel, 1988).

Improvements in anesthesia have lessened post-operative nausea, headaches, and drowsiness (Detmer and Gelijns, 1994). Minimally invasive procedures, such as laser surgery, laparoscopy, and endoscopy have reduced surgical trauma and pain and allowed more rapid return to normal activities (Lumsdon, 1992). These advances changed the risk-benefit ratio for many operations. Patients with low level symptoms are more likely to request an operation to alleviate their condition when the procedure becomes less onerous and the convalescence shorter. Patients who were considered too frail to undergo procedures become candidates for surgery when a minimally-invasive technique is developed. The result is a substantially expanded pool of potential surgical patients. Demand may also have increased because technological advances allowed operations to shift to ambulatory settings, which are said to be more pleasant for patients and doctors (Durant, 1989; Kaye, 1995).

A number of economic incentives were instituted in the 1980s to encourage ambulatory surgery. The Medicare program expanded to cover care in ambulatory surgery centers. Deductibles and copayments were waived at first for Medicare patients who had ambulatory surgery, and physicians temporarily received 100 percent payment for ambulatory surgery, rather than the 80 percent payment for inpatient care. Once the prospective payment system was in effect for inpatient

care, hospitals had strong incentives to shift patients to outpatient facilities where their services continued to be reimbursed on a cost basis, in contrast to the fixed payments based on DRGs for inpatient care (Leader and Moon, 1989). Many State Medicaid plans and private insurers followed the lead of the Medicare program and adopted similar economic incentives to encourage ambulatory surgery. The rapidly growing managed care programs emphasized substitution of ambulatory for inpatient surgery (Ermann, 1988; Detmer and Gelijns, 1994).

Substitution Pattern

Though not as common, a substitution pattern was seen in which operations shifted from inpatient to ambulatory settings without a change in total rates. For some of these operations there may not have been major advances in the surgical techniques that would change the risk-benefit ratio. For example, although a laparoscopic approach for repair of inguinal hernia was developed, it has not been generally adopted (Rutkow and Robbins, 1993; Soper, Brunt, and Kerbl, 1994).

Some procedures, such as cystoscopy, may be shifting not just out of inpatient settings, but away from ambulatory surgery centers as well, into office-based settings (Kaye, 1995). These procedures may appear stable according to the data presented, which does not cover the office-based settings, but actually they may be increasing.

The combined ambulatory and inpatient rate of cholecystectomy in 1995 was not significantly different from the inpatient rate in 1980 for persons age 45-64, but this may be due to a large sampling error because of the small number of cases in the sample that were in that age group and had cholecystectomy. The combined

ambulatory and inpatient rate for persons age 15-44, which was based on a larger number of cases in the sample, was significantly higher in 1995 than the inpatient rate in 1980. Increases have also been reported elsewhere since the development of a laparoscopic technique (Escarce, Chen and Schwartz, 1995; Steiner, et al., 1994; Legorreta et al., 1993).

The tonsillectomy rate for children was stable in the time period examined, but the inpatient tonsillectomy rate has been declining at least since 1965 when the NHDS began (Pokras, McCarthy, and Graves, 1989). The inpatient tonsillectomy rate per 10,000 population under age 15 went from 165.5 in 1965 to 57.4 in 1980. Increased use of antibiotics and evaluation of the appropriate indications for the procedure have been suggested as reasons for the decrease (Duffy and Farley, 1995; Metropolitan Life Insurance Company, 1993).

Other Patterns

Some operations increased only in inpatient settings or in both inpatient and ambulatory settings. Inpatient increases, like the growth in ambulatory surgery, may have been stimulated by technological advances that altered risk-benefit ratios, increasing demand for the improved operations. In addition, the shift of certain types of operations to ambulatory settings may have freed up inpatient facilities for other types of operations (Evans and Robinson, 1980; Edelman et al., 1995).

Increased ambulatory surgery without a significant drop in inpatient surgery was the predominate pattern for patients age 65 or over. Technological innovations and economic incentives apparently encourage ambulatory surgery for this age group, but the lower health status and larger number of chronic conditions for the elderly (Benson and Marano, 1998) may require them to

have more operations in inpatient settings than younger patients. Another reason that inpatient surgery did not decrease for this age group may be that managed care, with its emphasis on ambulatory services, is not as widespread for Medicare patients as for younger patients (Gold, 1999).

The rates for certain operations declined in the period 1980-1995, probably because alternative treatments were found that were less invasive or more effective. For example, hysteroscopy, biopsy, and diagnostic ultrasound, have been recommended to replace D & C of uterus (Coulter, Klassen, and MacKenzie, 1993; Giusa-Chiferi, Goncalves, and Baracat, 1996; Emanuel, Wamsteker, and Lammes, 1997). Drug therapy and the use of new technologies such as stents and hyperthermia are thought to have reduced the need for prostatectomies (Oesterling, 1995; Barry et al., 1997). Appendectomy was probably performed less often because the incidence of appendicitis declined (Addiss et al., 1990), but improved diagnostic tests also may have reduced the number of unnecessary appendectomies (Soper, Brunt, and Kerbl; 1994; Rao et al., 1998). In addition, operations that were shifting to office-based settings could appear to be declining because those settings were excluded from this study.

Comparisons with AHA Data

Data from the AHA's Annual Survey of Hospitals also document a decrease in inpatient surgery and an increase in ambulatory surgery since 1980 (American College of Surgeons, 1991; 1996). However, the AHA data differ from the NCHS data in some respects. More procedures are reported to be done on an ambulatory than on an inpatient basis in the AHA data. In the NCHS data, procedures are divided about equally between the two settings. The AHA esti-

mate of total number of procedures is also much lower than the NCHS estimate. These differences may be due to variations in the definition of an operation.

For the AHA survey, each visit to an operating room or procedure room is counted as one operation, regardless of the number of procedures performed (American Hospital Association, 1996). Hospitals are instructed not to count endoscopies if they are performed as diagnostic tests, but "surgery" is not further defined, leaving each hospital to decide what procedures to include in its count (Edelman et al., 1995).

In contrast, procedures performed during an operating room visit are coded individually in the NCHS surveys. In some instances, more than one ICD-9-CM code is used to describe a single procedure. Diagnostic endoscopies are included in the NCHS data, as are other non-surgical procedures that are probably excluded from AHA data. A measure from the NCHS surveys more similar to AHA-defined surgery would be the number of discharges that had a surgical operation. The NCHS estimate was 26.9 million discharges with surgical operations in 1995, excluding those from freestanding ambulatory surgery centers (but including endoscopies with biopsies). A total of 23.2 million surgical operations were reported for community hospitals in the 1995 AHA survey.

Comparisons with Other Studies

In an earlier study of Medicare trends based on billing data, researchers found a pattern similar to that seen in the NCHS data for patients age 65 or over. The rate of inpatient surgery was relatively stable, but there was a large increase in ambulatory surgery (Leader and Moon, 1989). These data showed overall trends only, not trends for specific operations.

Data from the Agency for Health Care Policy and Research's (AHCPR) Hospital Cost and Utilization Project was used to identify 37 specific inpatient operations that declined by at least 40 percent in the 1980s (Duffy and Farley, 1995). These included operations also found to be decreasing in the NHDS data, such as extraction of lens, myringotomy, tonsillectomy and adenoidectomy, D & C of uterus, and excision or destruction of lesion or tissue of skin and subcutaneous tissue. However, the frequency of ambulatory procedures could not be monitored with the AHCPR data.

Rutkow (1997) combined ambulatory data from the NSAS and inpatient data from NHDS to examine frequently performed surgical procedures. He found higher numbers of nearly all the operations he examined for ambulatory and inpatients combined in 1994 than for inpatients in 1983. He did not examine population-based rates, nor data for specific age groups.

Because the "Miscellaneous Diagnostic and Therapeutic Procedures" category was excluded from this article the data for total operations shown in this study are not the same as estimates of total procedures shown in previous NCHS publications (Haupt, 1982; Graves and Owings, 1997; Hall and Lawrence, 1997). In 1980, 3.9 million procedures were estimated in this miscellaneous category for hospital inpatients. In 1995, the inpatient estimate was 12.4 million and another 2.8 million of these procedures were reported for ambulatory surgery patients. If these procedures had been included, the decline in the rate of total inpatient procedures from 1980 to 1995 would not have been seen.

Limitations

How the shift from inpatient to ambulatory operations affected health care costs could not be examined directly in this

study because cost data are not collected in the NHDS. The NSAS included an item on total charges, but the charge data have not been released because of low response rates and concerns about their quality. Although the large increase in total operations strongly suggests that total costs for operations increased, these utilization data can not rule out the possibility that the ambulatory operations were done so cheaply that total costs decreased.

The comparison of rates of operations in 1980 and 1995 does not take into account the ambulatory surgery that was already underway in 1980. According to the AHA data, approximately 3.2 million ambulatory surgical procedures were reported in hospitals in 1980 (American College of Surgeons, 1991). Some operations were also being done in freestanding ambulatory surgery centers, but not many. An estimate of operations in these centers was only 377,000 in 1983 (American College of Surgeons, 1991). Even if these numbers were doubled, to approximate the definitional differences between AHA and NCHS data, and added to the 1980 inpatient estimate, the 1995 total of ambulatory and inpatient operations would remain 19 million higher. Likewise, for many specific operations combined 1995 rates were substantially higher than 1980 inpatient rates, and so their pattern would not change if the number of ambulatory operations could be added to the 1980 data.

Changes in coding and data collection procedures may have caused increases in estimates of some operations, especially diagnostic procedures, such as spinal tap, and relatively minor procedures, such as fetal monitoring during delivery (Kozak, 1989). In addition, the 1983 implementation of the Medicare prospective payment system based on DRGs probably resulted in more complete reporting of secondary diagnoses and procedures (Cohen et al., 1987).

Exclusions

The exclusion of procedures performed in doctors' offices and in hospital outpatient and emergency departments omitted predominately non-surgical diagnostic and therapeutic procedures, according to data from the National Ambulatory Medical Care Survey (Woodwell, 1997) and the National Hospital Ambulatory Medical Care Survey (McCaig, 1997; Stussman, 1997). However, the same factors that have stimulated the growth of ambulatory surgery centers, such as technological advances and desires for less costly and more convenient settings, can be expected to encourage procedures to shift to doctors' offices (Davis, 1993; Rutkow and Robbins, 1993; Courtiss et al., 1994).

Because certain freestanding ambulatory surgical centers and specialized locations within hospitals were excluded from the NSAS design, ambulatory operations associated with some specialties were underestimated. For example, the exclusion of dentistry locations affected the estimate of operations on teeth, gums, and alveoli. Obstetrical procedures in birthing centers were not covered, and neither were skin excisions done in rooms of hospitals dedicated to minor procedures. When procedures in excluded specialties were performed in general operating rooms or other locations in scope for the surveys, they were included in the estimates.

CONCLUSION

The explosive growth of ambulatory surgery was one of the major developments in the recent decades of turbulent changes in the U.S. health care system. The increased provision of surgical care in ambu-

latory settings has important implications for access to services, control of health care costs, and the quality of care. However, neither the changing patterns of surgical care nor their effects have been fully explored.

Combining data from two national surveys, this study provided a detailed examination of national patterns in surgical care. A general pattern of decreasing inpatient operations and increasing total operations was identified, but the data for specific operations revealed a variety of patterns. Some types of operations switched almost entirely to ambulatory settings, and others increased primarily in inpatient settings. Several other patterns were also seen. These findings suggest that surgical patterns are affected by the interaction of a number of factors, including advances in medical technology, changes in the organization and financing of the health care system, patients' health status, and availability of alternative treatments, that need to be taken into account in the formulation of health policy.

The study also shows the importance of comprehensive data to monitor and evaluate changes in the health care system. Extrapolating the overall surgical trend from either the inpatient or ambulatory data would have been misleading. It will likely become increasingly important to include information about surgery performed in additional sites, such as doctors' offices, to obtain a complete picture of surgery in the United States. Data on trends in the costs of surgical care also need to be explored. The utilization patterns examined here allow only general estimates of the trends in costs, leaving many questions about how the expected lower costs per patient for ambulatory surgery and the greater total amount of surgery have balanced out.

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