
Trends in Length of Stay for Medicare Patients: 1979-87

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Hospital length of stay (LOS) declined steadily during the 1970s, then rapidly during the early years of the Medicare prospective payment system (PPS). In this article, the authors examine trends in hospital LOS for Medicare patients from 1979 through 1987 for all cases combined, for medical and surgical cases separately, and for different geographic regions. The increase in LOS for surgical cases from 1985 through 1987 represented two offsetting trends. Continuing declines in LOS for most procedures were offset by an increased shift toward complex, long LOS procedures.

INTRODUCTION

During the 1970s, hospital LOS for the Medicare population declined at an average annual rate of 1.9 percent (Prospective Payment Assessment Commission, 1988). LOS began to decrease more rapidly among Medicare patients in the early 1980s but leveled off by 1986 and remained relatively constant during the late 1980s (Prospective Payment Assessment Commission, 1992). A number of significant changes in health care delivery and financing during the late 1970s and early 1980s had a substantial effect on the utili-

zation of hospital inpatient care and thus LOS. Perhaps the most important factor was the Medicare PPS. PPS provides strong incentives for hospitals to reduce average LOS, and the rapid decline in LOS during the early 1980s is often cited as evidence of how rapidly hospitals responded to these incentives.

Other concurrent trends, however, also affected the utilization of hospital inpatient care beginning in the late 1970s and continuing through the late 1980s, including: (1) changes in case mix related to the adoption of new technologies; (2) increasing use of outpatient treatment, especially for surgical patients; (3) PPS incentives to substitute post-acute care services, such as skilled nursing facility care or home health care, for hospital inpatient care; (4) increased efforts, after the implementation of PPS, by peer review organizations (PROs) to review the appropriateness of inpatient surgical admissions; and (5) changes in consumer demands on the health care system. Other recent studies have examined the impact of technology, outpatient shift, and the use of post-acute care (Carter, Newhouse, and Relles, 1990; Kominski and Bradley, 1993; Neu and Harrison, 1988; Steiner and Neu, 1993; Jacobson, Kahan, and Noehrenberg, 1992).

This article focuses on trends in LOS for Medicare patients during the rapidly changing period from 1979 through 1987. Furthermore, we examine why LOS for Medicare patients began to level off after

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the introduction of PPS. Our results indicate that case-mix changes, especially among surgical cases, had a substantial effect on aggregate LOS. Furthermore, our findings refute a commonly held belief that PPS produced only a one-time savings in resource use (see, for example, Coulam and Gaumer, 1992).

Our analyses begin with overall trends in LOS and then focus on trends in LOS for surgical cases. Trends for surgical cases are of concern to policymakers for several reasons. Surgical cases accounted for about 30 percent of Medicare hospital admissions during the 1980s but almost 50 percent of payments for hospital inpatient care by 1987. The increased use of outpatient surgery has reduced the volume of simple surgical procedures performed on an inpatient basis, while technology diffusion has increased the availability of more complex surgical treatments. Therefore, greater use of outpatient surgery for short-stay procedures and increased use of complex, long-stay procedures are likely to result in higher inpatient costs per case. Policymakers should not necessarily conclude that higher costs per case indicate a failure of PPS incentives for efficiency, however.

Policymakers may also be interested in the indirect consequences of surgical LOSs on Medicare program expenditures. For example, declines in inpatient LOS for Medicare surgical patients resulted in a reduction in inpatient visits billed by physicians but an increase in followup visits in outpatient settings and in visits provided by physicians other than the primary surgeon (Kominski and Biddle, 1993). The reduction in inpatient visits represents an indirect impact of PPS on physician behavior and provides supporting evidence for reducing surgical global

fee payments prior to the implementation of the Medicare fee schedule. Although PPS-related declines in LOS may have reduced continuity of care, they do not appear to have affected health outcomes, at least during the first 2 years of PPS (Kahn et al., 1990).

Previous work by Gornick (1982) using Medicare data showed a slight increase from 1967 to 1977 in the percentage of surgical hospitalizations and a slower rate of decline in average LOS for surgical cases than for non-surgical cases. Other researchers (Sloan and Valvona, 1986; Showstack et al., 1985) studied LOS or costs using non-Medicare data on a limited number of surgical operations. These studies found that technology changes played a significant role in the cost and LOS of surgical cases. Our study provides more complete information on longitudinal trends in LOS for Medicare patients, especially those who undergo surgery, both before and after the implementation of PPS.

Geographic differences and changes in average LOS are of interest to policymakers as well. Numerous studies have documented geographic differences in practice patterns. Less attention has been paid to whether these differences have become more pronounced or have diminished as part of the substantial reductions in LOS in the early 1980s.

In this article, we examine several aspects of trends in hospital LOS from 1979 through 1987. First, we analyze trends in overall LOS for all Medicare patients and for medical and surgical cases separately. Second, we examine geographic differences in LOS trends for the four major census regions and for urban and rural areas. Finally, we focus on LOS trends for surgical cases only. In this phase of the

analysis, we re-examine overall trends and trends across geographic regions controlling for changes in case mix.

DATA SOURCES

Two sources of data were used in this study: the National Hospital Discharge Survey (NHDS) for calendar years (CYs) 1979 and 1981, and Federal fiscal year (FY) 1984, and Medicare hospital claims from the Health Care Financing Administration (HCFA) for CY 1981 and Federal FYs 1984-87.

The NHDS, initiated in 1964, is conducted yearly by the National Center for Health Statistics (NCHS). It contains demographic and medical information abstracted from hospital medical records for a sample of non-Federal, short-stay hospitals in 50 States and the District of Columbia. Approximately 200,000 to 250,000 patient records are abstracted each year from about 400 hospitals. Patients are selected randomly within hospitals, so both Medicare and non-Medicare patients are included. Hospitals are stratified by bed size, ownership, and geographic region. The data files include sampling weights for each record that can be used to produce national estimates. They also include information on payment source and up to four procedure codes.

The HCFA data sources included the Medicare provider analysis and review (MEDPAR) file for CY 1981, and the Patient Billing (PATBILL) files for Federal FYs 1984-87. Each file contains a 20-percent sample of all Medicare acute care hospital discharges from 50 States and the District of Columbia. The files for FYs 1984-86 were created from bills received approximately 1-1/2 to 2 years after the FY

closing date (i.e., September 30), so they can be considered virtually complete. The FY 1987 file was created from bills received as of July 1988, i.e., only 9 months after the close of the FY. Therefore, it may underestimate the number of cases with long LOSs. The 1981 MEDPAR file has only one procedure code on it, whereas the PATBILL files have up to three procedures. We refer to both the MEDPAR and PATBILL data bases as HCFA files.

We chose 1979 as the first point in our time series because the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) coding system was implemented starting in 1979. Therefore, from 1979 through 1987, the same coding system was used to identify surgical procedures in both the NHDS and HCFA files.¹ The NHDS is a valuable source of baseline (i.e., pre-PPS) time-series data on Medicare hospital utilization by procedure code because hospitals were not required to report procedure codes to HCFA using ICD-9-CM codes until 1982. Furthermore, because the 1981 MEDPAR file has only one procedure code, it is a less reliable source of data for surgical procedures than later HCFA files. (Some fiscal intermediaries systematically excluded surgical procedures from their data files used in the construction of the MEDPAR files during 1980-81. Thus, LOS for medical patients is biased by the inclusion of some surgical cases [Duggar et al., 1982].)

¹Information on LOS for surgical procedures prior to 1979 is available in the Series 13 reports issued by NCHS. These reports contain detailed information by procedure and age group for 1965, 1968, 1971, 1973, 1975, and 1978. Prior to 1979, surgical procedures were recorded in the NHDS using a modification of the *International Classification of Diseases, 8th Revision, Adapted* coding system. Because of some significant changes between this coding system and ICD-9-CM, trends for specific procedure codes prior to 1979 may not be meaningful.

METHODS

Data Base Construction

We selected all cases from the NHDS files that had Medicare listed as a source of payment. During preliminary data exploration, we examined the age distribution of these records and found two sources of error. First, the source-of-payment variable appeared to have discrepancies for children and young adults. For example, there was an excessive number of births coded as Medicare payment, so it appeared that Medicaid payment was sometimes coded as Medicare. Second, because the NHDS does not collect information on the century of birth, young children could not be distinguished from persons 100 years of age or over (99 is the maximum age in the data). Therefore, in our final sample, we selected cases with Medicare as a payment source for patients between 20 and 99 years of age who did not have a pregnancy or delivery-related diagnosis. Because the NHDS lists expected payment source, rather than actual, some patients included in our analysis may not have had their hospital stays paid for by Medicare. This is unlikely to have been an important source of bias, however. We used the NHDS data primarily to substitute for missing or unreliable HCFA data prior to FY 1984. We created a FY 1984 NHDS file from the 1983 and 1984 yearly files to overlap with the FY 1984 HCFA data. Our final unweighted sample sizes were: 53,249 (1979), 60,356 (1981), and 57,914 (FY 1984).

Surgical and medical cases were defined using diagnosis-related groups (DRGs). The HCFA files and the FY 1984 NHDS file included a DRG assignment for

each case. Almost all DRGs are defined as either surgical or medical. Therefore, we identified medical and surgical cases based on DRG assignment and excluded cases in DRGs that are not defined as strictly medical or surgical.² The 1979 and 1981 NHDS files did not include DRG assignment, so we identified surgical cases in those files in the following way. We used the list of operating room procedures from the FY 1984 GROUPER program, which was used by HCFA for DRG assignment in FY 1984, and identified surgical cases if the patient had at least one procedure code defined as an operating room procedure. This assignment rule for surgical cases uses the primary procedure, i.e., the most resource-intensive operating room procedure. In our analyses of case-mix change described in this section, we used the first-listed procedure code as the primary procedure to ensure consistency over time, because the 1981 HCFA data included only one procedure code.

We also deleted from our HCFA files any record with an unrecognizable primary procedure code, because the GROUPER software will classify these patients into a medical DRG if their diagnosis codes are valid. For FYs 1984-87, these deletions accounted for only about 1 percent of the bills. However, because of the poor quality of the diagnosis and procedure coding on the 1981 MEDPAR file, about 6 percent of the bills were deleted. There were no invalid procedure codes in the NHDS files. The Institute of Medicine conducted studies on the quality of the NHDS and Medicare data. These

²The following DRGs were excluded using this criterion: 385-391, 433-438, 456-457, 469, and 470. These DRGs accounted for less than 0.75 percent of Medicare cases in FY 1984 and for an even smaller proportion of total cases in later years.

studies found that the primary procedure was coded accurately in about 75 percent of surgical cases (Institute of Medicine, 1977, 1980). These studies were performed using 1977 NHDS and 1974 Medicare data. The accuracy of Medicare data has improved considerably since the implementation of PPS (Fisher et al., 1992; Hsia et al., 1992).

Table 1 lists descriptive statistics for our final analytical files. In general, the two data sources are very comparable in age, gender, and average LOS. The only apparent discrepancy is the average LOS for surgical cases, which is about one-

half day higher in the NHDS in 1981. Because this difference is statistically significant ($p < .001$), we examined several possible sources for this difference. First, we adjusted the sampling weights in the 1981 NHDS to match the region, bed size, and ownership proportions in the 1981 HCFA file. We then calculated the average LOS for the cases deleted from the 1981 HCFA file. Neither of these adjustments reduced the difference in LOS for surgical patients, so we were unable to explain the remaining discrepancy. Other researchers have also found that NHDS data typically have a slightly higher LOS

Table 1
Comparison of Data Sources

Type of Case and Source of Data	Average Annual				Average Age	Proportion of Cases			
	Number of Cases ¹ in Thousands	Length of Stay	Percent Change in Length of Stay ²	Average Case-Mix Index ³		Died	Male	Under 65 Years of Age	85 Years of Age or Over
Medical Cases									
NHDS Data:									
CY 1979	1,442	9.7	—	NA	72.7	.08	.44	.14	.13
CY 1981	1,621	9.6	-0.5	NA	73.0	.08	.44	.13	.13
FY 1984	1,719	8.4	-4.5	0.97	73.7	.07	.43	.11	.14
HCFA Data:									
CY 1981	1,455	9.7	—	0.92	73.1	.06	.45	.12	.13
FY 1984	1,532	8.3	-5.0	0.95	73.6	.07	.44	.11	.14
FY 1985	1,394	7.6	-8.6	0.96	73.9	.07	.44	.11	.15
FY 1986	1,388	7.4	-1.7	0.93	73.9	.07	.44	.11	.15
FY 1987	1,354	7.5	1.1	0.93	74.0	.08	.43	.11	.16
Surgical Cases									
NHDS Data:									
CY 1979	532	12.8	—	NA	72.2	.04	.47	.11	.09
CY 1981	624	12.3	-1.9	NA	72.4	.03	.47	.10	.09
FY 1984	710	10.5	-5.0	1.59	72.8	.04	.46	.09	.10
HCFA Data:									
CY 1981	458	11.8	—	1.48	72.5	.03	.47	.10	.09
FY 1984	622	10.5	-3.8	1.57	72.9	.03	.47	.09	.10
FY 1985	553	10.4	-0.7	1.72	72.8	.04	.48	.10	.10
FY 1986	551	10.8	3.5	1.94	72.7	.04	.49	.10	.10
FY 1987	558	10.9	0.6	1.98	72.8	.04	.50	.09	.10

¹All frequencies are weighted to be equivalent to a 20-percent sample of Medicare discharges. The average case weights in the NHDS were 37 in CY 1979 and 1981 and 42 in FY 1984.

²The average annual percentage change in mean length of stay from the previously listed year.

³Average diagnosis-related group (DRG) relative weight per case, based on DRG relative weights in effect under the prospective payment system. For 1981, FY 1984 relative weights were used.

NOTES: NHDS is National Hospital Discharge Survey. HCFA is Health Care Financing Administration. NA is not available. FY is fiscal year. CY is calendar year.

SOURCES: National Center for Health Statistics: National Hospital Discharge Survey, 1979, 1981, 1983, and 1984; Health Care Financing Administration: Medicare provider analysis and review file, 1981, and Patient Billing files for fiscal years 1984-87.

than Medicare data (Lubitz, 1981). The discrepancy in our 1981 data is smaller than that reported in other studies.

To eliminate the effect of extreme outliers, we truncated LOS at 100 days for all cases (i.e., all records with values greater than 100 were set to 100). This was the 99.9th percentile of the distribution in both the HCFA and NHDS files. For analyses using HCFA data, we used the entire 20-percent sample for surgical cases and a 5-percent sample for medical cases. For analyses using the NHDS data, we adjusted the sample weights to produce frequencies comparable to the 20-percent HCFA sample.

Analytic Methods

For medical and surgical patients, we examined trends in: (1) overall LOS for medical and surgical patients; (2) the distribution of patients by LOS category (i.e., 1 day, 2 day, etc.) for medical and surgical patients; (3) overall LOS for medical and surgical patients by urban or rural location and four major census regions; and (4) overall LOS for surgical patients by urban or rural location and four major census regions after controlling for changes in case mix. Cases were assigned to geographic areas based on where the patient was hospitalized. Urban areas are defined as counties included in a metropolitan statistical area (MSA) in FY 1987. Rural areas are all counties not included in an MSA.

For each of these analyses, we also calculated the average annual change in LOS for time periods spanning years missing from our data sets (e.g., 1979-81, 1981-84, 1984-87).

We adjusted for changes in surgical case mix using the following formula:

$$ALOS_{i,y} | CM_t = \sum_{i=1}^n p_{i,t} * ALOS_{i,y}$$

= average LOS in year *y* holding case mix constant in year *t*,

where $p_{i,t}$ = proportion of surgical cases with procedure *i* holding case mix constant in year *t*,

$ALOS_{i,y}$ = average LOS for procedure *i* in year *y*, and

i = primary surgical procedure defined at the three-digit level of the ICD-9-CM coding system. (We analyzed surgical procedures defined at the three-digit level to achieve a balance between clinical specificity and adequate sample size.)

We held surgical case mix constant using three different years (1981, 1984, and 1987) to examine the sensitivity of our findings to alternative case-mix distributions.

For all of our analyses, we present trends without reporting measures of statistical significance. Most of our analyses involve comparisons between categories with more than 10,000 unweighted cases, so even very small differences are statistically significant. Thus, we present the trends to focus on the magnitude of changes from 1979-87.

RESULTS

Overall Trends

Average LOS was at its peak for Medicare patients in 1967 at 13.4 days. It declined to about 11 days in 1975, an average annual rate of about 2.8 percent. From 1975 to 1981, average LOS decreased at a much slower average annual rate of about 1.1 percent (Office of Technology Assessment, 1985; Guterman and Dobson, 1986).

Based on our analysis, average LOS for all Medicare patients declined from 10.2 days in 1981 to 8.5 days in FY 1987, as shown in Table 2. This represents a 16.5-percent total decrease and an average annual decrease of 3.0 percent. This annual rate of decline was much greater than the rate of decline from 1975 to 1981. The average annual decline was even greater between 1981 and FY 1985. Data from other sources (Prospective Payment Assessment Commission, 1988; Guterman and Dobson, 1986) indicate that most of the decline during this period occurred from 1982 to 1984.

Medical Versus Surgical Cases

The total decline in average LOS was much greater for medical cases than for surgical cases from 1981 to FY 1987. This finding is consistent with trends for all patients in the United States (Pokras et al., 1989) and supports the conclusion that PPS had an important spillover effect on all hospital patients, not just Medicare patients. Furthermore, LOS for surgical cases began to increase after FY 1985. This increase among surgical cases offset the continued decline among medical cases and produced a relatively constant overall LOS.

Average LOS declined almost two times faster for medical cases than for surgical cases from 1981 to FY 1985. This difference between medical and surgical cases is slightly greater than estimates from earlier periods. One study found that average LOS decreased about 1.5 times faster for medical cases than for surgical cases from 1967 to 1977 (Gornick, 1982).

Changes in LOS distributions were very distinct for medical and surgical cases, as shown in Table 3. The proportion of cases

Table 2
Overall Trends in Length of Stay

Year or Span	Number of Cases in Thousands ¹	Percent Surgical	Average Length of Stay		
			Total	Medical	Surgical
			Number of Days		
CY 1979	1,974	27	10.5	9.7	12.8
CY 1981	1,913	24	10.2	9.7	11.8
FY 1984	2,154	29	8.9	8.3	10.5
FY 1985	1,948	28	8.4	7.6	10.4
FY 1986	1,938	28	8.4	7.4	10.8
FY 1987	1,912	29	8.5	7.5	10.9
			Average Annual Percent Change		
CY 1981-FY 1987	—	—	-3.0	-4.1	-1.4
CY 1981-FY 1985	—	—	-4.7	-5.9	-3.1
FY 1985-FY 1987	—	—	+0.6	-0.7	+2.4

¹All frequencies are weighted to equal a 20-percent sample of hospital stays.

NOTES: CY is calendar year. FY is fiscal year.

SOURCES: National Center for Health Statistics: National Hospital Discharge Survey, 1979; Health Care Financing Administration: Medicare provider analysis and review file, 1981, and Patient Billing files for fiscal years 1984-87.

with stays greater than 2 weeks decreased from 17.9 to 10.0 percent for medical cases and from 27.4 to 21.9 percent for surgical cases from 1981 to FY 1987.

For medical cases, the proportion of cases with stays of 3 days or fewer increased from 21.8 to 27.8 percent during this period. Surgical cases with 1-day stays also increased during this period. Surgical cases with 2- and 3-day stays declined, however. The substantial changes in the proportions of short-stay surgical cases is consistent with an increase in outpatient surgery during this period. There is no evidence that the slight increase in inpatient death rates during this period, shown in Table 1, affected LOS. A previous study reported that deaths ac-

counted for one-third of all 1-day hospital stays for the aged Medicare population in 1977 (Gornick, 1982). Deaths accounted for only about 6 percent of the 1-day stays for surgical cases in both the 1981 and FY 1987 HCFA files, however.

The mean and median LOSs for medical cases declined by almost the same amount from 1981 to FY 1987. These declines were almost identical because of the overall shift in the distribution of medical cases toward shorter stays. For surgical cases, however, the mean LOS declined much more than the median. This difference occurred because of a reduction in both short-stay and long-stay surgical cases.

Table 3
Distribution of Cases, by Length of Stay and Type of Case

Length of Stay	Calendar Year 1979	Calendar Year 1981	Fiscal Year 1984	Fiscal Year 1987
Medical Cases			Percent	
1 Day	5.8	5.2	6.4	7.3
2 Days	7.2	7.9	9.3	9.7
3 Days	8.4	8.7	10.2	10.8
4-5 Days	17.1	17.2	19.7	21.1
6-7 Days	14.6	14.5	15.5	16.1
8-10 Days	16.0	16.0	15.5	15.4
11-14 Days	12.9	12.5	10.7	9.6
15-21 Days	9.9	9.8	7.3	6.0
22-28 Days	3.8	3.8	2.6	2.1
29-42 Days	2.8	2.7	1.7	1.2
43 Days or More	1.5	1.6	1.1	0.7
Median	6.6	6.5	5.6	5.1
Mean	9.7	9.7	8.3	7.5
Surgical Cases				
1 Day	2.3	2.4	4.7	5.7
2 Days	8.2	11.4	14.9	7.0
3 Days	8.5	10.0	8.0	7.1
4-5 Days	13.5	12.8	12.2	14.5
6-7 Days	9.7	9.8	10.4	12.2
8-10 Days	13.6	13.2	13.8	16.8
11-14 Days	13.7	12.9	13.3	14.9
15-21 Days	14.7	13.8	12.2	11.9
22-28 Days	7.3	6.2	4.8	4.5
29-42 Days	5.3	4.5	3.5	3.3
43 Days or More	3.2	2.9	2.2	2.2
Median	8.6	7.7	7.0	7.6
Mean	12.8	11.8	10.5	10.9

SOURCES: National Center for Health Statistics: National Hospital Discharge Survey, 1979; Health Care Financing Administration: Medicare provider analysis and review file for 1981, and Patient Billing files for fiscal years 1984-87.

The greatest increases were for surgical cases with stays of 8-10 days and for medical cases with stays of 4-5 days. The trends in all LOS intervals were consistent over time, except for surgical cases with 2-day stays. These cases increased from 1981 to FY 1984, then decreased substantially. (The large increase from 1981 to FY 1984 for 2-day surgical stays also occurred in the NHDS data.)

Geographic Variations

Table 4 shows the large differences in LOS between the 4 major census regions

and between urban and rural areas in 1981. The trends in LOS indicate that all regions experienced about the same percent decrease from 1981 to FY 1987, with the exception of the North Central region. The average annual decline in LOS for medical cases was very similar in urban and rural areas. LOS for surgical cases, however, declined much more rapidly in rural areas than in urban areas.

From 1981 to FY 1985, the national average annual rate of decline in LOS was 5.9 percent for medical cases and 3.1 percent for surgical cases (Table 2). For medical

Table 4
Geographic Variation in Average Length of Stay

Year and Type of Case	Location Type		Census Region			
	Rural	Urban	Northeast	North Central	South	West
Medical Cases			Number of Days			
CY 1981	8.2	10.2	11.8	9.9	8.9	8.0
FY 1984	7.0	8.8	10.7	8.0	7.6	6.7
FY 1985	6.4	8.0	9.9	7.1	7.0	6.1
FY 1986	6.3	7.8	9.2	7.1	7.1	6.1
FY 1987	6.5	7.9	9.3	7.2	7.2	6.2
Change From 1981 to 1987:			Percent Change			
Total	-21.5	-22.9	-21.5	-27.6	-19.1	-22.7
Average Annual	-4.0	-4.3	-4.0	-5.2	-3.5	-4.2
Change From 1981 to 1985:						
Total	-22.0	-21.6	-16.1	-28.3	-21.3	-23.8
Average Annual	-6.0	-5.9	-4.3	-8.0	-5.8	-6.6
Change From 1985 to 1987:						
Total	1.6	-1.2	-6.1	1.4	2.9	1.6
Average Annual	0.8	-0.6	-3.1	0.7	1.4	0.8
Surgical Cases			Number of Days			
CY 1981	10.8	12.0	13.5	12.4	11.2	9.5
FY 1984	9.2	10.8	12.4	10.5	10.1	8.8
FY 1985	9.0	10.7	12.1	10.3	10.2	8.8
FY 1986	9.3	11.1	12.7	10.6	10.6	8.9
FY 1987	9.3	11.2	12.8	10.6	10.7	9.0
Change From 1981 to 1987:			Percent Change			
Total	-13.9	-7.0	-4.8	-14.5	-4.9	-5.6
Average Annual	-2.5	-1.2	-0.8	-2.6	-0.8	-1.0
Change From 1981 to 1985:						
Total	-16.7	-10.8	-10.4	-16.9	-8.9	-7.4
Average Annual	-4.5	-2.8	-2.7	-4.5	-2.3	-1.9
Change From 1985 to 1987:						
Total	3.3	4.7	5.8	2.9	4.9	2.3
Average Annual	1.7	2.3	2.9	1.4	2.4	1.1

NOTES: CY is calendar year. FY is fiscal year.

SOURCE: Health Care Financing Administration: Medicare provider analysis and review file for 1981, and Patient Billing files for fiscal years 1984-87.

cases, there were large geographic differences in the annual rate of decline, most notably between the Northeast and North Central regions. For surgical cases, there were large differences between the North Central and other regions and between urban and rural areas.

After FY 1985, LOS for surgical cases increased in each geographic region. LOS for medical cases, however, remained relatively stable across census regions between FYs 1985-86, except in the Northeast, where they declined substantially. This large decline in the Northeast was responsible for continued declines in the national average LOS for both urban and rural areas.

LOS for medical cases increased after FY 1986 in all four census regions and in urban and rural areas. Only the Northeast region, which continued to have the highest average LOS, had a decline in LOS for medical cases from FY 1985 to FY 1986. This result is particularly interesting for the following reason. Two States in this region (New York and Massachusetts) had waivers that exempted them from PPS prior to FY 1986, but both allowed their waivers to expire and began receiving PPS payments during FY 1986. Therefore, hospitals in these States were subject to PPS incentives to reduce LOS for the first time during FY 1986.

Our findings indicate that geographic differences in average LOS have not diminished. Average LOS varied considerably across census regions and between urban and rural areas in 1981. These differences remained in FY 1987.

For medical cases, average LOS was 24.4 percent higher in urban areas than in rural areas in 1981. By FY 1987, the difference between urban and rural areas was 21.5 percent. Similarly, the difference in

average LOS for medical cases between the highest and lowest census regions was 47.5 percent in 1981 and 50.0 percent in FY 1987.

For surgical cases, average LOS in urban areas was 11.1 percent higher than in rural areas in 1981 and 20.4 higher in FY 1987. The difference in LOS between the highest and lowest census regions remained relatively constant at about 42.1 percent from 1981 to FY 1987.

Effect of Changing Case Mix

Medicare discharges were highest in FY 1984 and have declined steadily since then, as shown in Table 2. Another study found that Medicare admission rates reached their peak in FY 1983 (Office of Technology Assessment, 1985). One important reason for the decline in hospital admissions has been the increased use of outpatient surgery for relatively simple procedures (Prospective Payment Assessment Commission, 1989). The percentage of inpatient surgical cases, however, has remained relatively constant at between 28 and 29 percent, despite this increase in outpatient surgery. Because the proportion of inpatient surgical cases remained constant while their average LOS increased, we examined the effect of changing case mix on LOS trends for surgical cases.

The trends in LOS for surgical cases overall and by geographic region, holding case mix constant, are shown in Table 5. In contrast to the results in Tables 2 and 4, LOS for surgical cases continued to decline after FY 1984 when adjusting for case-mix changes. For example, holding case mix constant at 1987 levels, LOS for surgical cases declined from 12.4 to 10.9 days between 1984 and 1987—a decline

Table 5
Average Length of Stay for Surgical Cases Holding Case Mix Constant

Year, Type of Area, and Census Region	Actual Length of Stay	Length of Stay Using Case Mix From		
		1981	1984	1987
Total				
		Number of Days		
CY 1981	11.8	11.8	12.2	14.4
FY 1984	10.5	10.5	10.5	12.4
FY 1987	10.9	9.1	9.4	10.9
Change From 1981 to 1987:				
		Percent Change		
Total	-8.0	-23.2	-23.3	-24.7
Average Annual	-1.4	-4.3	-4.3	-4.6
Rural				
		Number of Days		
CY 1981	10.8	10.8	11.1	13.2
FY 1984	9.2	9.1	9.4	11.1
FY 1987	9.3	7.9	8.2	9.5
Change From 1981 to 1987:				
		Percent Change		
Total	-13.9	-26.4	-26.5	-27.7
Average Annual	-2.5	-5.0	-5.0	-5.3
Urban				
		Number of Days		
CY 1981	12.0	12.0	12.4	14.6
FY 1984	10.8	10.7	10.7	12.7
FY 1987	11.2	9.3	9.6	11.1
Change From 1981 to 1987:				
		Percent Change		
Total	-7.0	-22.2	-22.6	-24.1
Average annual	-1.2	-4.1	-4.2	-4.5
Northeast				
		Number of Days		
CY 1981	13.5	13.5	13.8	16.4
FY 1984	12.4	12.6	12.5	14.8
FY 1987	12.8	10.8	11.2	13.1
Change From 1981 to 1987:				
		Percent Change		
Total	-4.8	-20.0	-19.3	-20.0
Average Annual	-0.8	-3.7	-3.5	-3.6

See footnotes at end of table.

of 12.1 percent. For medical cases, in contrast, the unadjusted LOS showed an increase during the same period from 10.5 to 10.9 days.

In general, the adjusted data in Table 5 support the conclusion that LOS for surgical cases began increasing after 1984 because a larger share of surgeries performed on an inpatient basis were long LOS procedures. This occurred because of the shift of short LOS procedures to outpatient settings and because of increased diffusion of complex surgical procedures, such as coronary artery bypass graft surgery (Kominski and Bradley, 1993).

The large differences in average annual changes in LOS between census regions and between urban and rural areas also diminished when adjusting for case-mix change. For example, the unadjusted rate of decline for rural areas was about 100 percent greater than the rate for urban areas, whereas the adjusted rate was only about 20 percent greater. LOS continued to decline in all four census regions and in both urban and rural areas. The findings in Table 5 indicate that the unadjusted trends in LOS were affected substantially by changes in the mix of inpatient surgical procedures.

The geographic differences in average LOS for surgical cases were still evident

Table 5—Continued
Average Length of Stay for Surgical Cases Holding Case Mix Constant

Year, Type of Area, and Census Region	Actual Length of Stay	Length of Stay Using Case Mix From		
		1981	1984	1987
North Central				
		Number of Days		
CY 1981	12.4	12.3	12.7	14.9
FY 1984	10.5	10.4	10.6	12.5
FY 1987	10.6	8.9	9.2	10.6
Change From 1981 to 1987:				
		Percent Change		
Total	-14.5	-27.9	-27.3	-29.0
Average Annual	-2.6	-5.3	-5.2	-5.6
South				
		Number of Days		
CY 1981	11.2	11.4	11.8	13.9
FY 1984	10.1	10.0	10.2	12.1
FY 1987	10.7	9.1	9.3	10.7
Change From 1981 to 1987:				
		Percent Change		
Total	-4.9	-20.5	-21.0	-23.4
Average Annual	-0.8	-3.7	-3.8	-4.3
West				
		Number of Days		
CY 1981	9.5	9.6	10.0	11.8
FY 1984	8.8	8.4	8.5	10.1
FY 1987	9.0	7.5	7.6	8.9
Change From 1981 to 1987:				
		Percent Change		
Total	-5.6	-21.3	-23.5	-24.9
Average Annual	-1.0	-3.9	-4.4	-4.7

NOTES: CY is calendar year. FY is fiscal year.

SOURCE: Health Care Financing Administration: Medicare provider analysis and review file for 1981, and Patient Billing files for fiscal years 1984-87.

in FY 1987, even after adjusting for changes in case mix. Holding case mix constant at FY 1987 levels, the difference in LOS between urban and rural areas was 10.6 percent in 1981 and 16.0 percent in FY 1987. Both of these percentages are smaller than the unadjusted differences calculated using data in Table 4. The adjusted difference between the highest and lowest census regions was 39.0 percent in 1981 and 47.0 percent in FY 1987.

CONCLUSIONS

Several important developments in health care delivery and financing occurred during the late 1970s and early 1980s that affected trends in hospital inpatient LOS for Medicare patients. Perhaps the most important was the Medicare PPS. In addition, other concurrent

factors affected trends in hospital LOS. The two most important factors were increased use of outpatient surgery for certain procedures and increased use of complex surgical procedures made possible by the diffusion of medical technology.

Our findings provide further insight into recent trends in LOS, particularly for surgical cases. Historically, Medicare LOS declined about 2.7 percent per year for medical cases and about 1.9 percent per year for surgical cases from 1967 to 1975. From 1975 to 1981, LOS declined at a somewhat slower rate (Gornick, 1982). Between 1981 and FY 1984, however, we found average annual decreases in LOS of 5.0 percent for medical cases and 3.8 percent for surgical cases. These rates of decrease are much greater than previous trends and appear to represent a strong

hospital response to the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 limits and PPS. Data from other sources (Prospective Payment Assessment Commission, 1988; Guterman and Dobson, 1986) indicate that the largest declines in LOS occurred from 1982 to 1984. Those findings, combined with our results, suggest that there was a strong anticipatory response to PPS.

Aggregate LOS for Medicare cases remained relatively constant from FY 1985 to FY 1987. The average LOS for medical cases remained relatively stable but increased slightly for surgical cases. Our study demonstrates that these recent trends are the result of two opposing effects. LOS continued to decline for most medical and surgical cases, but inpatient case mix for surgical cases shifted substantially toward longer stay procedures. After adjusting for case-mix changes among surgical cases, LOS continued to decline from FY 1984 to FY 1987. Furthermore, the rate of annual decline after FY 1984 was almost as large as the rate of annual decline from 1981 to FY 1984. This finding indicates that, after adjusting for case-mix change, PPS continued to have a strong effect on reducing surgical lengths of stay.

Geographic differences in average LOS have not diminished. Average LOS varied considerably across census regions and between urban and rural areas in 1981. These differences remained in FY 1987. Thus, practice patterns do not appear to have converged to a national norm under PPS as of 1987.

Our findings support the overall conclusion that PPS had a substantial and continuing impact in reducing one important component of hospital services, i.e., inpatient days. Newhouse and Byrne (1988)

found that the reduction in inpatient days during the first 2 years of PPS was partially offset by an increase in days in PPS-exempt units, such as rehabilitation hospitals. Our findings support this conclusion, particularly for surgical patients, although we did not examine this effect directly.

The ongoing influence of PPS on LOS has been offset by a shift in case mix toward procedures that require longer lengths of stay. This shift in case mix is the result of greater use of outpatient surgery and advances in medical technology. Both of these factors tend to reduce short-stay admissions and to increase long-stay admissions, and neither effect is directly attributable to PPS. Use of outpatient surgery was increasing prior to PPS, and there is no evidence that PPS has delayed the adoption of new technologies. In separate analyses conducted as part of this study but not reported here, we found rapid volume declines for selected procedures performed on an outpatient basis after FY 1984. These findings suggest that PPS accelerated the substitution of outpatient for inpatient surgery and are consistent with findings from other researchers (Leader and Moon, 1989). Furthermore, our findings provide important evidence that declines in LOS were not a one-time phenomenon in response to the introduction of PPS, and support the speculation that LOS began to increase after 1985 because of an increase in the portion of long LOS conditions (Coulam and Gaumer, 1992). Our findings also indicate that ongoing evaluations of the impact of PPS must account for the substantial influence of changing case mix.

The persistent variations across geographic regions indicate that PPS did not

lead to more uniform practice patterns between 1984 and 1987. Furthermore, rates of surgery per 1,000 Medicare beneficiaries have become more disparate since 1983 (Latta and Keene, 1989). These regional variations raise continuing questions about the appropriateness of clinical practice patterns and are the focus of a substantial number of ongoing studies, including those conducted by the Patient Outcomes Research Teams.

Finally, our findings concerning persistent differences in LOS across geographic regions also provide support for the uniform surgical global fee policy for physicians performing surgery implemented under the Medicare fee schedule. Before 1992, global fee payment policies varied across carriers, with no uniform requirements regarding the amount of followup care included in the payment for surgery. As of 1992, the global fee includes payment for all postoperative care provided by the primary surgeon for up to 90 days after major surgeries, regardless of the site of care. Other studies have found that, prior to the adoption of the uniform global fee policy, PPS-related declines in LOS resulted in fewer inpatient followup visits provided to Medicare patients who underwent surgery, but in more outpatient visits provided by physicians other than the surgeon (Rosenbach, 1988; Kominski and Biddle, 1993). By establishing a uniform definition for the postoperative period, the Medicare fee schedule may result in more followup care being provided by the primary surgeon and thus a reduction in expenditures for physician services after surgery. However, if inpatient LOS continues to decline during the 1990s, further research should be conducted to ensure that physicians who perform surgery also provide

the followup care, in both inpatient and outpatient settings, that has been included in the calculation of their global fee payments.

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