A reassessment of hospital product and productivity changes over time

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Were the changes found in the first year of the prospective payment system (PPS) one-time changes that attenuated as hospitals gained familiarity with the system? The results of this research show that, over time, discharges to home (self-care) continued to decrease, discharges to home health agencies continued to increase, but transfers and discharges to skilled nursing facilities or intermediate care facilities accounted for an increasing share of total discharges. After a dramatic decrease in the first year, the use of laboratory tests, diagnostic tests, and X-rays returned, over time, almost to pre-PPS levels.

Introduction

The introduction of the prospective payment system (PPS) in 1983 led to a dramatic change in the treatment of Medicare inpatients. We, at The Commission on Professional and Hospital Activities (CPHA), undertook a longitudinal study of a cohort of 646 short-term, non-Federal community hospitals from nonwaivered States for 1980-85 to evaluate the impact of this change in reimbursement method.

The results of the first year after the introduction of PPS showed that quality measures—such as consultation rates, readmission rates, and in-hospital death rates—were not negatively affected (DesHarnais et al., 1987). We also showed that the hospital product changed and hospital productivity increased (Long et al., 1987). Our conclusion was that, in the first year following the introduction of PPS, the hospital product changed dramatically, inputs were reduced considerably, and quality appeared to be not impaired.

It is important in the evaluation of any new program to determine whether the changes observed immediately following its introduction were one-time changes that are attenuated over time or changes that persist to become the norm. In the case of PPS, two important considerations give cause for concern regarding the hospitals' second-year performance.

First, rigorously applied cost-containment strategies, particularly in the area of input reduction, were obviously partly responsible for the "... more than 15-percent profits from Medicare patients in fiscal 1985 ..." (Sorian, 1987). Given this unexpected result of the first year of PPS, it might reasonably be expected that hospitals would be less conscientious regarding cost-containment activities in the second year.

Second, several investigators have found that attempts to reduce the test-ordering practices of physicians generally meet with initial success, but within a short period of time (3 months to 1 year), these patterns return to preintervention levels (Schroeder et al., 1973; Eisenberg, 1977; Rhyne and Gehlback, 1979).

In this article, we report on the second-year findings of our research on the hospital product and productivity relative to Medicare patients only.

Methods

The methodology that follows has been described to some extent in Long et al. (1987) and to a much greater extent in Long, Chesney, and Fleming (1988).

Data source

The Quality of Care Data File of CPHA includes 646 U.S. non-Federal short-term hospitals from nonwaivered States that had complete data from 1980 to 1985. Third-quarter data were used for each year because all hospitals were in PPS by the third quarter of 1984. The hospitals in the file underrepresent government and investor-owned hospitals and hospitals in the Northeast and South.

The underrepresentation in the Northeast results from our decision to exclude waivered States, which would have confounded the results. The underrepresentation in the South is reflected also by the underrepresentation of small hospitals (1-99 beds). It might be argued that small and rural hospitals were most severely affected by PPS and, therefore, would be most likely to make changes to the product and reduce inputs. Given the mission of proprietary hospitals, it could be argued that they had the greatest incentive to change the product and reduce inputs. If this is so, our results are probably understated. On the other hand, it is conceivable that small and rural hospitals are generally located in areas that do not afford them the opportunity to discharge to other locations so readily. It may also be the case that small and rural hospitals do not have the capability of larger organizations to reduce or substitute inputs. If these circumstances prevail, our results would then be overstated. In Table 1, the distribution of sample hospitals and comparisons with the appropriate universe are shown.

Product definition

In defining the product for the purposes of this research, it is necessary to consider the entire episode of care. An episode may include care received in any one of a number of different health care settings. Although all episodes of care will not necessarily include care received

Table 1

Comparison of panel hospitals[1] with universe of hospitals, by hospital characteristic: United States, 1984

Hospital characteristic	Number of hospitals		Panel hospitals as a percent of universe
	Panel	Universe	
Total	646	5,637	11.5
Teaching status			
Nonteaching	522	4,685	11.1
Minor teaching[2]	110	817	13.4
Major teaching[3]	14	135	10.3
Type of control			
Government	133	1,626	8.1
Private not-for-profit	482	3,226	14.9
Investor-owned	31	785	3.9
Number of beds			
1-99	258	2,761	9.3
100-199	149	1,199	12.4
200-299	98	695	14.1
300-399	104	675	15.4
500 or more	37	307	12.0
Region			
North Central	285	1,658	17.1
Northeast	55	807	6.8
South	165	2,123	7.8
West	141	1,049	13.4

[1]Panel includes 646 U.S. short-term, non-Federal community hospitals in nonwaivered States, represented in the Quality of Care Data File of The Commission on Professional and Hospital Activities.
[2]Hospitals with less than 0.25 residents per bed.
[3]Hospitals with 0.25 or more residents per bed.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984; American Hospital Association: Data from the Annual Survey of Hospitals, 1984.

in more than one setting, it is possible to typify an episode of care as comprising three major components:

- Care received in an ambulatory setting prior to admission to an acute care hospital.
- Care received in an acute care hospital.
- Care received in a setting other than acute care, subsequent to discharge from an acute care hospital.

A generalizable model that maintains the distinction between components of care, while recognizing that care received in the same setting (e.g., the home) may serve as more than one component, is shown in Figure 1. First is the preadmission component, second, the inpatient (acute care) component, and third, the post-discharge component.

Under PPS, the Medicare standardized payment for each diagnosis-related group (DRG) is intended to reflect the resources required to treat patients for the inpatient component of care. This might, therefore, be considered the hospital product. However, PPS payment rules further specify this product as being a discharge, classified and labeled by the DRG classification system. The model can now be refined to include this definition of product (Figure 2).

As previously discussed, it is possible that any given episode of care may include care provided in one, two, or all three of the episode components. A patient may be discharged from an acute care hospital without any need for further care: The episode of care is completed. On the other hand, a patient may be discharged from an acute care facility with the need for care in a more appropriate setting. The inpatient component is completed, but the episode of care is not completed. Following from the model presented in Figure 2, it is then reasonable to suggest that discharges with varying amounts of the episode of care completed represent different and distinct hospital products. This concept is presented graphically in Figure 3 by modifying the three-component episode of care model.

The above model applies only if the admission illness or disease state is held constant. That is to say, the products are different only if the patients were in an identical disease state upon admission. This admission disease state is referred to in this article as patient type.

The hospital product is then defined in terms of patient type and discharge destination. The validity of this definition of product relies upon two important assumptions. The first is that, from a clinical standpoint, the discharge-planning activity is appropriate. That is to say, there is an appropriate degree of fit between the level of care required by the patient to be discharged (or considered for discharge) and the level of care available in the receiving facility or setting. An appropriate degree of fit in this model implies the use of the lowest appropriate level of care available.
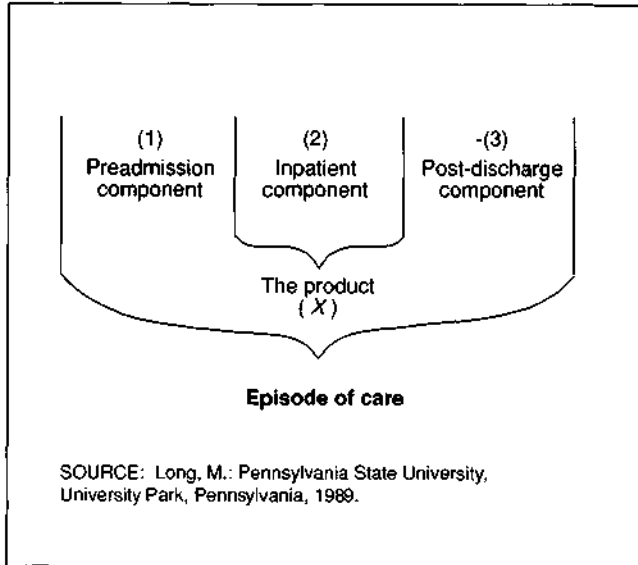
Five discharge destinations (or status) are identified in this research and are considered to represent five separate products. They are:

- Product A: Discharge to home (self-care).
- Product B: Discharged to home health agency (HHA).
- Product C: Discharged to skilled nursing facility (SNF) or intermediate care facility (ICF).
- Product D: Discharged to short-term hospital.
- Product E: Discharged dead.

Figure 1
Episode of care and episode components

SOURCE: Long, M.: Pennsylvania State University, University Park, Pennsylvania, 1989.
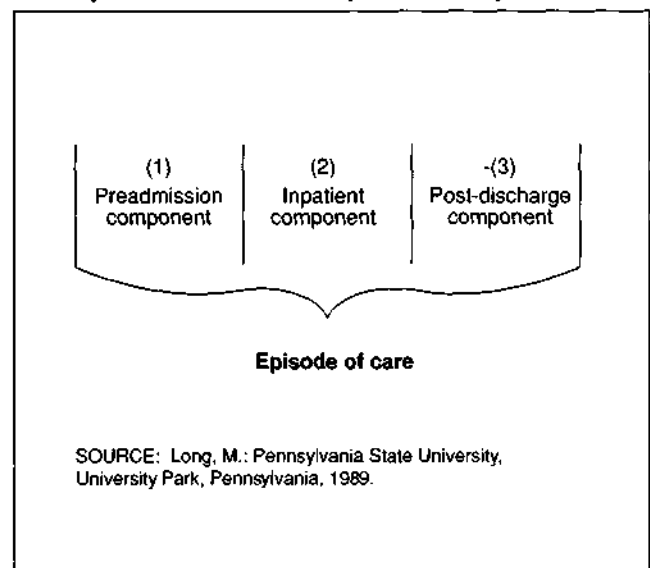
Figure 2
Episode of care and product

SOURCE: Long, M.: Pennsylvania State University, University Park, Pennsylvania, 1989.

Excluding product E, the discharge destinations just listed represent increasing levels of care available, ranging from the least (or none) in product A to the most in product D. Under the appropriate degree of fit already discussed, a discharging hospital might, for example, identify an HHA as being the setting in which a discharged patient would receive the care appropriate to his or her needs. In the event that no HHAs are available, the hospital would discharge to the next higher level of care, a SNF.

The second assumption follows from this: A sufficient supply of treatment facilities or settings exists, so that the level-of-care consideration discussed herein is the sole determinant of the resulting discharge location.

Prospective payment incentives

Because the incentive under PPS is to discharge as soon as possible and preferably not to another short-term hospital, there is no reason to suggest that the discharging hospital would prefer to discharge to any place other than the lowest appropriate level of care available. The incentive is such, however, that in the absence of any available, appropriate, lower level of care, a hospital might discharge a patient to home under self-care when a higher level of care is required. In terms of the model shown in Figure 3, the hospital prefers product Z to product X or Y, but does not benefit further from the setting of the third component of the episode of care nor from whether the setting is appropriate or not.

The extent to which a hospital under PPS increased the number of discharges of patients who might have been classified as requiring some level of care but who were sent home under their own care will show up under this model, inappropriately, as an increase in disease remission (product increase). It will appear as product X in Figure 3, when it should appear as product Y or Z. On the other hand, if, in the absence of any available, appropriate, lower level of care, the hospital elects to

delay the discharge until the patient is recovered to the point at which discharge to self-care is appropriate, this model correctly identifies an increase in disease remission (product increase).

It is clear from this discussion that the incentive for the hospital under PPS is to reduce the hospital product. In terms of this research, that would translate into a reduction in product A (patients discharged to self-care). Given that patients may be inappropriately discharged in this category, any reduction in product A identified in this work will tend to be an understatement of product reduction. Conversely, if an increase in product A is identified in this work, it will tend to be an overstatement of product increase.
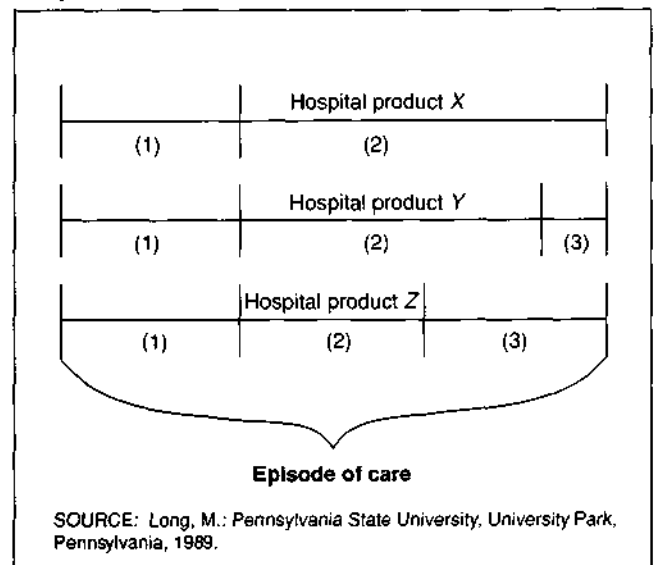
Patient type

The measure of patient severity of illness was determined in this research by incorporating the Body System Count Methodology (Mendenhall, 1984) into the DRG classification system. The Body System Count Methodology identifies all diagnoses for each patient, treats each as a principal diagnosis, and maps it into its major diagnostic category (MDC). Because MDCs roughly correspond to body systems, the number of different body systems (MDCs) can be counted. The larger the number of MDCs, the more complex the case. This variable was categorized as follows:

1 = 1 body system,
2 = 2 body systems,
3 = 3 body systems,
4 = 4 body systems,
5 = 5 or more body systems.

In preliminary analyses, DRGs explained 81 percent of the variation in length of stay (LOS) (Chesney, 1986) and the Body System Count explained an additional 7.5 percent. Disease Staging (Gonella, Louis, and McCord, 1976) was considered as a measure of severity,

Figure 3
Episode of care and various hospital products

SOURCE: Long, M.: Pennsylvania State University, University Park, Pennsylvania, 1989.

Table 2
Fictitious discharge data for patients in diagnosis-related group 25, by discharge destination: 1980 and 1983

Year	Patient type[1]	Number of discharges	Proportion of discharges to each discharge destination or status				
			Home self-care	Home health agency	Skilled nursing or intermediate care facility	Short-term hospital	Dead
1980	1	150	.93	.07	.00	.00	.00
	2	50	.80	.00	.20	.00	.00
	3	250	.80	.12	.08	.00	.00
	4	10	.90	.00	.00	.00	.10
	5	40	.50	.20	.25	.00	.05
1983	1	250	.73	.27	.00	.00	.00
	2	100	.65	.15	.15	.05	.00
	3	20	.70	.17	.13	.00	.00
	4	100	.60	.30	.00	.00	.10
	5	30	.50	.20	.20	.00	.10

[1]Patient type is based upon level-of-illness severity, represented by numbers indicating the number of body systems involved.

SOURCE: Long, M.: Pennsylvania State University, University Park, Pennsylvania, 1989.

but preliminary analyses showed that, although it was similar in its capacity to explain additional variance, it was highly correlated with the Body System Count (Pearson's $r = 0.903$). It was also much more costly to employ in such a large data set, so the Body System Count was preferred.

Index of product change

For each product, as defined above, a product change is defined as a change in the proportion of patients appearing in that discharge category (product). If the proportion of patients in Product A in one period of time is different from the proportion of patients in Product A at a later time period, the product has changed.

$$P_A^{t-1} \neq P_A^t$$

where

P_A = proportion of patients in product A,
t-1 = first time period, and
t = second time period.

However, a change in proportions as shown may be the result of differences in patient type in the two time periods. To control for this effect, an index of product change was used in this work and was calculated as follows:

$$\frac{\sum_{i=1}^{5} N_{ik}^{t-1} \, P_{ijk}^{t}}{\sum_{i=1}^{5} N_{ik}^{t-1} \, P_{ijk}^{t-1}} - 1$$

where

N_{ik} = the number of patients in patient type i (Body Systems Count) and DRG k,
P_{ijk} = the proportion of patients in patient type i, DRG k, and discharge location j,
t-1 = first time period, and
t = second time period.

This resulting value provides an indication of the magnitude and direction of a hospital's product change. A positive value indicates that, relative to the base year, a greater proportion of patients was discharged to the location that defines the product (e.g., self-care). A negative value indicates a smaller proportion, and a zero value indicates no difference in the proportion relative to the base year. Indexes were developed for all five products.

For further clarification of the index construction just described, examples are developed from the fictitious data presented in Table 2. Five hundred patients classified as DRG 25 are discharged from the same hospital in each of the years 1980 and 1983. The illness severity or patient type within DRG 25 is quite mixed. For example, in 1980, there were only 10 patients of severity level 4, but in 1983, there were 100 such patients. The proportion of the total patients in each severity level discharged to each of the five locations is shown for each year and this, too, is quite different for each year. For example, 93 percent of the 150 severity-level-1 patients were discharged to self-care in 1980, and 73 percent of the 250 severity-level-1 patients were discharged to that location in 1983.

An index of the product change for product A (discharged to self-care) is constructed as follows:

$$\frac{150(.73) + 50(.65) + 250(.70) + 10(.60) + 40(.50)}{150(.93) + 50(.80) + 250(.80) + 10(.90) + 40(.50)} - 1$$

Index = -0.189 with base year 1980 = 0. This indicates a reduction in product A in 1983 relative to 1980.

An index of product change for product B (discharged to HHA) is constructed as follows:

$$\frac{150(.27) + 50(.15) + 250(.17) + 10(.30) + 40(.20)}{150(.07) + 50(.00) + 250(.12) + 10(.00) + 40(.20)} - 1$$

Index = $+0.391$ with base year 1980 = 0. This indicates an increase in product B in 1983 relative to 1980.

Because many familiar indexes are based on 100, it is perhaps more intuitively appealing to simply multiply the

resulting index number by 100, so that the two indexes become -18.9 and $+39.1$ Throughout this article, the indexes are interpreted this way, and the two example indexes would be said to show a 19-index-point reduction and a 39-index-point increase, respectively.

Index of productivity change

Productivity reflects the relationship between inputs and an unambiguously defined output or product. In order to assess productivity changes, it is necessary to identify all inputs and their relative contributions to output (weights).

Our data set does not capture all possible inputs; therefore, we are not able to consider the substitutability of inputs or the relative weights of the included inputs. That is to say, we do not know if the reduction in one input is offset by the introduction of a substitute input (not included in our data set) or whether a 10-percent decrease in one input is offset by a 1-percent increase in another (included) input. However, for the purposes of this article, it is suggested that, all things being equal, a reduction in the inputs herein identified constitutes a productivity increase.

In this research, we examined the change in the number of specific inputs within the products as previously discussed. The input measures included were:

- Overall average length of stay (ALOS).
- Preoperative and postoperative length of stay for surgical patients.
- Average number of different laboratory tests.
- Average number of different diagnostic tests.
- Average number of chest X-rays.
- Average number of different drugs.

In order to evaluate a productivity change, it is necessary to consider the amount and type of inputs expended in the treatment of patients of a given patient type and a given discharge location (product). Any change in inputs, over time, for the same patient types and the same product, represents a productivity change. In general, for each input measure incorporated in this work, the following comparisons were made:

$$A_{hj}^{t-1} \quad \text{versus} \quad A_{hj}^{t}$$

where

A	=	input measure (e.g., diagnostic tests),
h	=	patient type (Body System Count by DRG),
j	=	product (discharge location),
t-1	=	first time period, and
t	=	second time period.

In evaluating productivity changes across patient type, a standardized distribution of cases over patient types was incorporated into an index in a manner analogous to that used in the product change analyses. That is to say, input use was determined for each year, while controlling for

patient type (severity level within DRG). The index was calculated as follows:

$$\frac{\sum\limits_{i=1}^{5} N_{ijk}^{t-1} \; A_{ijk}^{t}}{\sum\limits_{i=1}^{5} N_{ijk}^{t-1} \; A_{ijk}^{t-1}} - 1$$

where

N_{ijk}	=	the number of patients in patient type i (Body System Count), DRG k and product j (discharge category),
A	=	input measure,
t-1	=	first time period, and
t	=	second time period.

Results

For ease of interpretation, the results are presented in the form of yearly changes in the index value (Table 3). The year 1980 serves as the base year and has an index value of 100. Each subsequent year shows the change from the previous year as a positive or negative number of index points.

The change that might be attributed to the effect of PPS is determined by the difference between the index values for 1983 and 1984 and appears in the results under 1984. In a similar manner, the change that took place in the second year of PPS is determined by the difference between the index values for 1984 and 1985 and appears in the results under 1985.

Product change

In Table 3, it is shown that, when controlling for patient type, the proportion of patients discharged to self-care in the first year of PPS decreased 3.7 index

Table 3

Change in hospital product index[1] for panel hospitals[2], by hospital product[3]: 1981-85

Hospital product	1981	1982	1983	1984	1985
			Index-point change		
A	−0.2	−0.2	−0.4	−3.7	−3.2
B	+1.1	+2.1	+6.8	+7.7	+10.3
C	−0.6	−1.4	+2.3	+10.5	+12.6
D	+14.5	+9.8	+19.2	+79.6	+44.1
E	−1.8	−0.4	−6.0	+0.5	+5.4

[1]Base year (1980) = 100.
[2]Panel includes 646 U.S. short-term, non-Federal community hospitals in nonwaivered States, represented in the Quality of Care Data File of The Commission on Professional and Hospital Activities.
[3]Product A = discharged to self-care; product B = discharged to short-term hospital; product C = discharged to skilled nursing facility or intermediate care facility; product D = discharged to home health agency; product E = discharged dead.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984.

points. The proportion of patients discharged to all other locations increased during the same period, with those discharged to HHAs showing the largest increase of 79.6 index points. Discharges to short-term hospitals increased 7.7 index points, discharges to SNFs or ICFs increased 10.5 index points, and those discharged dead increased 0.5 index points.

The changes in the second year of PPS followed a very similar pattern, except for the magnitude of some changes. Discharges to self-care decreased in the second year by an amount almost identical to that of the first year (-3.2 index points compared with -3.7 index points). Although discharges to HHAs showed a very large increase in the second year (+44.1 index points), the change was not as large as the first year change. Commensurate with this slowing of the increase in discharges to HHAs in the second year of PPS, discharges to short-term hospitals (+10.3 index points), SNFs or ICFs (+12.6 index points), and dead (+5.4 index points) all increased more in the second year than they did in the first year of PPS.

Productivity changes

The change in inputs for each discharge location, controlling for patient type, is shown in Tables 4 through 8.

During the first year of PPS (1984), all three LOS components decreased quite substantially in all five discharge locations. The use of laboratory tests, diagnostic tests, and X-rays also decreased quite substantially in all five products during the same period. The drug input increased for patients discharged to self-care and those discharged to SNFs or ICFs but decreased for patients in all other discharge locations.

In the second year of PPS (1984-85), with five exceptions, all three LOS components for all discharge locations decreased still more. However, use of laboratory tests, diagnostic tests, X-rays, and drugs increased in the second year of PPS. In several cases, the

increase in the second year was substantial enough to bring about a return almost to pre-PPS levels.

In Table 4, it can be seen that, for patients discharged to self-care, the use of laboratory tests increased 14.3 index points in the second year of PPS, after having decreased in the first year (1984) by 19.3 index points. The 1985 usage therefore was within 5.0 index points of the pre-PPS (1983) level. The use of diagnostic tests increased 7.3 index points in the second year, with the 1985 usage returning to within 3.1 index points of the pre-PPS level. Drug use increased 0.3 index points in the second year, but this input showed very little fluctuation throughout the entire study period, 1980-85. X-ray usage increased 3.6 index points in the second year, with the 1985 usage remaining 6.7 index points below the pre-PPS level.

For patients discharged to short-term hospitals, the use of laboratory tests increased 15.7 index points in the second year (Table 5), with the 1985 usage remaining 8.9 index points below the pre-PPS level. The use of diagnostic tests increased 13.1 index points in the second year, with the 1985 usage remaining 4.9 index points below the pre-PPS level. Drug use, again, showed very little change throughout the study period. The use of X-rays increased 6.9 index points in the second year, with the 1985 usage remaining 10.1 index points below the pre-PPS level.

For patients discharged to SNFs or ICFs, the use of laboratory tests increased 16.0 index points in the second year (Table 6), with the 1985 usage remaining 4.2 index points below the pre-PPS level. Diagnostic test usage increased 7.3 index points in the second year, with the 1985 usage returning to within 2.8 index points of the pre-PPS level. Drug use decreased 6.7 index points in the second year, with 1985 usage returning to within 0.6 index point of the pre-PPS level. The use of X-rays increased 8.6 index points in the second year, with 1985 usage remaining 3.9 index points below the pre-PPS level.

For patients discharged to an HHA, the use of laboratory tests increased 23.8 index points in the second year (Table 7), with 1985 usage returning to within

Table 4

Change in productivity index[1] for patients discharged to (home) self-care, by type of input: 1981-85

Input	1981	1982	1983	1984	1985
	Index-point change				
Average length of stay (ALOS)	-3.9	-2.1	-9.4	-12.8	-3.0
Preoperative ALOS	-4.3	-2.5	-9.9	-13.2	-5.3
Postoperative ALOS	-3.7	-3.3	-8.8	-13.2	-2.1
Laboratory tests	+0.1	+1.0	-2.4	-19.3	+14.3
Diagnostic tests	+2.0	+1.5	-2.6	-10.4	+7.3
Drugs	+1.3	+1.0	-2.0	+1.0	+0.3
X-rays	+0.7	-0.9	-3.4	-10.3	+3.6

[1]Base year (1980) = 100.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984.

Table 5

Change in productivity index[1] for patients discharged to short-term hospitals, by type of input: 1981-85

Input	1981	1982	1983	1984	1985
	Index-point change				
Average length of stay (ALOS)	+7.2	-6.2	-5.4	-23.1	0.0
Preoperative ALOS	+14.7	+14.5	-48.9	-25.4	+4.3
Postoperative ALOS	+16.2	+36.4	-29.0	-29.5	+16.3
Laboratory tests	+0.2	+0.5	+2.1	-24.6	+15.7
Diagnostic tests	+3.5	+2.9	-2.8	-18.0	+13.1
Drugs	+9.2	+0.1	-4.4	-2.9	+4.4
X-rays	+1.0	-4.2	+1.5	-17.1	+6.9

[1]Base year (1980) = 100.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984.

Table 6

Change in productivity index[1] for patients discharged to skilled nursing facilities or intermediate care facilities, by type of input: 1981-85

Input	1981	1982	1983	1984	1985
			Index-point change		
Average length of stay (ALOS)	−0.7	−0.9	−11.5	−15.6	−3.6
Preoperative ALOS	−2.7	−5.4	−11.5	−13.9	+0.2
Postoperative ALOS	−1.3	−0.8	−11.7	−16.0	−4.9
Laboratory tests	+0.4	+2.2	−1.1	−20.2	+16.0
Diagnostic tests	+1.7	+4.5	−0.3	−10.1	+7.3
Drugs	−15.4	+17.3	−11.8	+6.1	−6.7
X-rays	+1.4	−0.2	−1.4	−12.5	+8.6

[1]Base year (1980) = 100.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984.

3.0 index points of the pre-PPS level. Diagnostic test usage increased 8.8 index points in the second year, with 1985 usage remaining 7.9 index points below the pre-PPS level. Drug use increased 3.2 index points in the second year, but the use of this input fluctuated throughout the study period. The use of X-rays increased 12.2 index points in the second year (the difference between -0.196 and -0.074), with 1985 usage remaining 5.4 index points below the pre-PPS level.

For patients discharged dead, the use of laboratory tests increased 14.3 index points in the second year (Table 8), with 1985 usage remaining 5.8 index points below the pre-PPS level. Diagnostic test usage increased 8.1 index points in the second year, with 1985 usage remaining 5.2 index points below the pre-PPS level. The drug input showed very little change throughout the study period, 1980-85. X-ray usage increased 7.9 index points in the second year, with 1985 usage remaining 5.1 index points below the pre-PPS level.

Table 7

Change in productivity index[1] for patients discharged to home health agencies, by type of input: 1981-85

Input	1981	1982	1983	1984	1985
			Index-point change		
Average length of stay (ALOS)	−5.3	−8.5	+29.9	−46.0	−4.7
Preoperative ALOS	−0.5	−8.7	+9.3	−19.8	−2.8
Postoperative ALOS	−10.6	−9.1	−4.2	−8.6	−4.5
Laboratory tests	−0.7	+3.5	+0.4	−26.8	+23.8
Diagnostic tests	−0.2	+1.6	+5.5	−16.7	+8.8
Drugs	−0.5	+2.2	+1.5	−4.6	+3.2
X-rays	−1.6	+3.4	−3.8	−17.6	+12.2

[1]Base year (1980) = 100.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984.

Table 8

Change in productivity index[1] for patients discharged dead, by type of input: 1981-85

Input	1981	1982	1983	1984	1985
			Index-point change		
Average length of stay (ALOS)	−8.1	+9.5	−9.7	−18.0	−1.4
Preoperative ALOS	−11.7	+9.9	−17.9	−5.3	−6.5
Postoperative ALOS	−3.0	+8.0	−4.5	−24.7	−2.9
Laboratory tests	−0.9	+5.3	−2.5	−20.1	+14.3
Diagnostic tests	+2.5	+4.9	+2.9	−13.3	+8.1
Drugs	+2.3	+5.5	−1.6	−3.3	+0.3
X-rays	+1.7	+5.1	−2.3	−13.0	+7.9

[1]Base year (1980) = 100.

SOURCE: The Commission on Professional and Hospital Activities: Data from the Quality of Care Data File, 1984.

Summary of productivity changes

Given that the drug input changed relatively little over the entire study period, the productivity changes can be summarized in terms of the change in index points, 1983-84 (first year of PPS), and 1984-85 (second year of PPS) for laboratory tests, diagnostic tests, and X-rays, within each of the five discharge locations (products).

From Table 9, it can be seen that all inputs in all products decreased in the first year of PPS, and all inputs in all products increased in the second year of PPS. The average index-point decrease, in the first year, was greatest for those patients discharged to HHAs and smallest for those discharged to self-care. The average index-point increase in the second year was greatest in the HHA category and smallest in the self-care category. In fact, the order of magnitude of decrease in the first year was, with one slight exception, replicated by the order of magnitude of increase in the second year.

Conclusions and discussion

The effect of PPS on the hospital product and productivity has been reported in considerable detail elsewhere (Long et al., 1987). The results shown here reaffirm the fact that, controlling for patient severity, fewer patients were discharged for whom the hospital considered the episode of care to be complete (discharged to self-care). By far the major share of the difference in the proportion of patients discharged to self-care in 1983 (pre-PPS) and 1984 (PPS) was taken up by the HHAs. In terms of the product definition employed in this work, the hospital product was considerably reduced.

Recognizing that this research did not capture all of the inputs necessary to a hospital stay, the evidence is strongly suggestive of a productivity increase in the first year of PPS. That is to say, all inputs considered in this work, controlling for patient severity, were reduced.

In the second year of PPS, the hospital product was further reduced. In other words, controlling for patient severity, fewer patients were discharged for whom the hospital considered the episode of care to be complete. The decrease in the proportion of patients discharged to

Table 9

Summary of changes in productivity index following the introduction of the prospective payment system: 1983-85

Type of discharge or input	First year[1]	Second year[2]
Home (self-care)	Index-point change	
Laboratory tests	−19.3	+14.3
Diagnostic tests	−10.4	+7.3
X-ray	−10.3	+3.6
Average	−13.33	+8.40
Short-term hospital		
Laboratory tests	−24.6	+15.7
Diagnostic tests	−18.0	+13.1
X-ray	−17.0	+6.9
Average	−19.87	+11.90
Skilled nursing facilities or intermediate care facilities		
Laboratory tests	−20.2	+16.0
Diagnostic tests	−10.1	+7.3
X-ray	−12.5	+8.6
Average	−14.27	+10.63
Home health agency		
Laboratory tests	−26.8	+23.8
Diagnostic tests	−16.7	+8.8
X-ray	−17.6	+12.2
Average	−20.37	+14.93
Dead		
Laboratory tests	−20.1	+14.3
Diagnostic tests	−13.3	+8.1
X-ray	−13.0	+7.9
Average	−15.47	+10.10

[1]1983-84.
[2]1984-85.

self-care in the second year of PPS was almost of the same magnitude as the first-year reduction. However, in the second year, more of the difference was taken up by SNFs and ICFs (+10.5 index points in 1984 and +12.6 index points in 1985) and less by HHAs (+79.6 index points in 1984 and 44.4 index points in 1985).

Given that HHA services are less capital-intensive than SNF and ICF services, the short-run supply of HHA services is more elastic. The results of this study show that HHAs did respond more readily to an increase in the demand for nonhospital services in the first year of PPS. By the second year, SNFs and ICFs had time to bring more beds up to readiness and were able to handle a greater share of the increased demand for nonhospital services.

The productivity gains of the first year of PPS practically disappeared in the second year as input usage increased almost to pre-PPS levels. With a drop in the admission rate following PPS, the inpatient population was generally sicker than the pre-PPS patient population had been and therefore required greater input usage. However, the largest drop in admissions came in the first year, when input usage decreased dramatically. In addition to this, in this work, we controlled for patient severity, thereby ruling out increased severity as a reason

for increased input usage. It is possible, however, that the severity measure incorporated in the index construction did not fully capture the change in severity level of the patient population and that there was a lag period resulting in the increased input usage in the second year of PPS.

A much more plausible explanation is that hospitals reacted in the first year of PPS to a conviction that costs must be reduced in order to survive in an environment of fixed-price payment. Even though PPS was designed to be budget-neutral, and DRG weights and standardized adjusted payment amounts were empirically derived, the system relied upon the use of the mean of these cost data in determining these parameters. Hospitals were therefore motivated to reduce costs by reducing inputs to a point below the vaguely understood (at that time) payment amount. This required controlling LOS and the use of tests.

The monitoring of LOS had become institutionalized even prior to PPS and, as such, had become a relatively inexpensive cost-control program. On the other hand, it is typical in any program or experiment to reduce test use for an initial reduction in the use of tests to be followed by a return to preintervention levels. Eisenberg (1985) refers to this as the tendency for change to decay rather than persist. Schroeder et al. (1984) have shown that the most effective way to change physician's usage of services may be to have costs associated with it that outweigh any benefits. When faced with an excellent profit picture, an institutionalized, relatively inexpensive LOS review system, and a potentially costly test-utilization control system, it is reasonable to suggest that hospitals would deemphasize test-utilization controls. Under these circumstances, LOS would continue to decrease, and test use would begin to return to some previously internalized norm.

As the hospital-specific component of the payment amount is phased out, DRG weights are recalibrated, and standardized adjusted amounts are recalculated using more recent cost data, it is postulated that much more emphasis will be placed on test-utilization control. Hospitals will respond to a "system average cost price" by reducing, if not minimizing, cost. Length of stay shows signs of bottoming out, so input reduction will continue, perhaps with some vacillation, as PPS seeks to establish the "true" market supply price. Continued trend data will provide the opportunity to evaluate this postulate.

Acknowledgment

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