Are PPS payments adequate? Issues for updating and assessing rates

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Declining operating margins under Medicare's prospective payment system (PPS) have focused attention on the adequacy of payment rates. The question of whether annual updates to the rates have been too low or cost increases too high has become important. In this article we discuss issues relevant to updating PPS rates and judging their adequacy. We describe a modification to the current framework for recommending annual update factors. This framework is then used to retrospectively assess PPS payment and cost growth since 1985. The preliminary results suggest that current rates are more than adequate to support the cost of efficient care. Also discussed are why using financial margins to evaluate rates is problematic and alternative methods that might be employed.

Introduction

Since the implementation of Medicare's prospective payment system (PPS) for inpatient operating costs in 1983, the Federal Government has had the responsibility of setting rates each year. An important aspect of this effort has been determining the methodology for calculating the annual update factor. As the system approaches its 10th year, however, it has become apparent that developing methods for periodically assessing the adequacy of the PPS rates is also critical. That is, it is necessary to examine the cumulative impact of past updates and other factors that affect payments relative to factors that affect the resources necessary to provide patient care.

PPS is based on a set of standardized rates to which adjustments are applied to determine the payment for each Medicare case. These rates must be updated every year to allow for increases in the costs of providing efficient and quality care for Medicare beneficiaries. Section 1886(e)(4) of the Social Security Act requires that the Secretary of Health and Human Services consider the Prospective Payment Assessment Commission's (ProPAC) recommendations; then the Secretary recommends to Congress update factors that take into account the amounts necessary for the high-quality care. The statute also sets the amount of the update factors that are applied to the standardized amounts.

Trends in hospitals' PPS operating margins have focused attention on this process. Although these margins were initially much higher than anticipated—13.5 percent in the first year of PPS (hospital fiscal years that began in Federal fiscal year [FY] 1984) and 13.7 percent for PPS2—they have declined to -3.4 percent in the seventh year of PPS (FY 1990). The hospital industry attributes these negative margins to low updates and inadequate payments. Others, however, have examined factors underlying cost increases and wondered whether they may have been excessive (Fisher, 1992; Ashby and Lisk, 1992; Bradley and Kominski, 1992). The debate raises two important questions: How would policymakers know if PPS rates were adequate? That is, do PPS rates result in too few or too many dollars paid for inpatient services?

In this article, we discuss issues and provide some preliminary estimates relative to these questions. The article is divided into two primary areas. In the first part, we examine the annual update factor recommendations. After describing the current framework, we outline a proposed modification to the update methodology. Results from the current and modified frameworks are then compared. In the second part, we discuss the assessment of the adequacy of the rates at any point in time. We also examine the current use of PPS margins as an assessment tool and discuss some potential alternatives.

Current framework for recommending updates

The update factor plays a pivotal role in any administered price system. For the PPS, it provides the means for adjusting rates to reflect trends in factors such as inflation, production methods, and outputs. The update factor is crucial in assuring that payments made to hospitals remain consistent with the goals and objectives set forth for the system.

Since FY 1986, the Department of Health and Human Services (DHHS) has used an analytical framework developed by the Office of the Actuary, Health Care Financing Administration (HCFA) (*Federal Register*, 1985b; Arnett et al., 1985) to formulate that recommendation. The framework is based on an input-to-output relationship which yields the following identity:

$$\frac{\text{Nominal cost}}{\text{Discharge}} = \frac{\text{Real outputs}}{\text{Real caseweights}} \times \frac{\text{Real caseweights}}{\text{Discharges}} \times \frac{\text{Real non-capital inputs}}{\text{Real outputs}} \times \frac{\text{Nominal costs}}{\text{Real non-capital inputs}}$$

(A) (B) (C) (D) (E)

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where
(A) represents the average cost per discharge,
(B) represents DHHS' measure of case-mix constant intensity, (C) represents the case-mix index,
(D) represents the inverse of service productivity, and
(E) represents the hospital market basket.

This update framework accounts for increases in input prices faced by hospitals as measured by the hospital market basket developed by HCFA. Further, the framework has taken into account both policy adjustment factors and changes in case mix, as well as forecast corrections to previous estimates of the market basket rate of increase. Currently, the framework applies only to the diagnosis-related group (DRG) rates that determine operating payments. That is, the inputs and costs considered exclude capital costs which have recently begun a transition to prospective payment. In the following discussion of the update framework, we remain within this context. DHHS is currently developing an update framework for capital PPS payments that can be merged with the operating framework in the event of a unified PPS (*Federal Register*, 1992).

The policy adjustment factors consist of measures of change in hospital productivity, quality-enhancing scientific and technological advances, and changes in practice patterns. The productivity measure consists of a normative standard, based partly on economywide increases in productivity, to account for the effect on prices that productivity increases would have in a competitive industry. The science and technology factor adjusts for the diffusion of new technology that is cost-increasing and also quality-enhancing. Finally, the practice pattern adjustment is designed to ensure that the Federal Government shares in any improvements in practice patterns that make the provision of care less costly although maintaining quality of care.

Case-mix changes are also important to the framework. The case-mix index (CMI) is the measure of the average DRG weight and measures the average resource intensity of Medicare cases. CMI can change for any or all of the following reasons:

- The average resource use of Medicare patients changes (real case-mix change).
- Improvements in hospital coding of patient records result in higher weight DRG assignments (coding effects).
- The annual DRG reclassification and recalibration changes may not be budget neutral (reclassification effect).

The current framework allows for real case-mix change but removes the effects of coding. It also removes the effect on total payments of changing the DRG classifications and relative weights in order to retain budget neutrality for all changes other than patient severity and the update as required by the Social Security Act.

The adjustment in the current framework consists of a reduction for total observed case-mix change, an increase for the portion of case-mix change which HCFA believes is due to increased severity of illness rather than coding improvements, and an adjustment for the effect of reclassification and recalibration changes, to reflect what the total CMI change would have been if a new grouper and relative weights had not been instituted. The current DHHS framework adjusts for this element in the practice patterns and science and technology adjustments.

The starting point of the update recommendation is the projected rate of increase in the hospital market basket. The hospital market basket uses a variety of price proxies to measure the increase in costs faced by hospitals, and uses fixed weights to develop the overall rate of increase. In several years, the actual market basket rate of increase has been significantly different from that estimated at the time that the standardized amounts for that year were established. If the difference between the actual and the estimated rate of increase is greater than 0.25 percentage points, the current framework includes a factor to correct for the forecast error so that it is not carried forward into future standardized amounts.

Potential modification to the framework

One way to examine the system's ability to maintain adequate payments is to assess the update framework for modifications that would enable it to better account for important trends relevant to the provision of hospital services. We believe the current framework has a solid conceptual basis for considering hospital input, output, and cost factors. The proposed changes described later represent a modification to the way in which the policy adjustment factor targets are considered while maintaining the conceptual structure of the current framework. These changes were also described in the *Federal Register* (1992) in order to solicit comment prior to proposing a modified framework for the Secretary's FY 1994 update recommendation (*Federal Register*, 1992).

Under the proposal, DHHS would have two policy adjustment factors—productivity and intensity. The former would reflect a forward-looking adjustment for expected changes in service level productivity in hospitals. It is consistent with the standard productivity measures—output per unit of input—and would reflect the efficiency with which individual services (e.g., laboratory tests, diagnostic procedures) are produced. The intensity component would reflect how these services are used to produce the final output for Medicare payment purposes—the discharge. It would account for the intensity of services per discharge, and would include changes in the use of quality-enhancing services such as new technologies and expected modification of practice patterns to remove cost-ineffective services. It would also be used to account for changing resource requirements resulting from variations in within-DRG severity of illness. The intensity component would replace the previous separate components for practice patterns and science and technology from the current framework, which does not explicitly account for within-DRG severity changes.

In effect, these policy factors recognize two levels for the production in the hospital setting—individual services and the discharge. There are several rationales for this approach. First, it allows DHHS to refine the concepts of productivity, efficiency, and cost effectiveness as they apply to the hospital setting under a per case payment system. That is, it recognizes that because PPS does not pay for individual services provided during an inpatient stay, hospital performance under the system is a function of both the efficiency with which these outputs are produced and the cost effectiveness with which they are used. Second, with this change DHHS would be able to employ and develop a wider range of relevant data series to use in formulating annual recommendations. For example, the productivity standard can more directly consider data that are relevant to productivity in the hospital industry as well as the general economy. Third, a single intensity measure would replace the components for practice patterns and science and technology which are extremely difficult to measure individually with current data.

Finally, this framework recognizes that although hospitals are largely responsible for the efficiency with which individual services are produced, the cost-effective use of these services in providing care during the hospital stay is jointly determined by the hospital and its medical staff. Therefore, by distinguishing the two levels of production, DHHS can in the future improve the consistency between the objectives embodied in the cost-effective practice component of the PPS update recommendation and its volume performance standard recommendation for the physician fee schedule. This would assure that the incentives for use of hospital services do not differ between the two payment systems.

In employing this framework, DHHS would recognize that the potential for changes in service productivity is related to the overall output of services. In the economy as a whole, unit productivity tends to increase most rapidly during periods of output growth, and grow more slowly or decrease during periods in which output declines. Thus, in formulating its recommendation for the productivity component of the update factor, DHHS would consider expected growth in total hospital services including admissions, case mix, and intensity of services per admission. DHHS' expectations for output are therefore partly determined by its policy target for the intensity component, and will impact on the service productivity recommendation. In the following discussion we first describe how DHHS' recommendation for the intensity component would be determined. We then describe the development of the productivity recommendation.

Intensity

For purposes of the analysis, change in intensity is defined as the change in total outputs per discharge. The measure would account for both changes in the number of services and their complexity. Because PPS automatically adjusts payments for changes in resource use due to changes in DRG mix, DHHS considers changes in intensity adjusted for changes in real case mix—case-mix constant intensity. (This is comparable to the case-mix constant intensity measure calculated by Altman and Ashby [1992].) Within the update framework, intensity is considered to be a function of changes in the use of services that are quality-enhancing, that result from shifts in within-DRG severity, and that result from reductions of cost-ineffective practices. For FY 1993, the Secretary would have recommended that the intensity factor be 1.0 to 1.1 percent using this framework. The basis of this recommendation is discussed later.

The quality-enhancing technology component is intended to recognize the use of services that increase cost and have value in terms of enhanced health status that is commensurate with these costs. Such services may result from technological change or, in some cases, increased use of existing technologies. The latter recognizes that, as cost and medical effectiveness studies become available, some increased use of existing, as well as new, services might be warranted.

We have no empirical evidence that accurately gauges the level for quality-enhancing technology changes. Typically, a specific new technology increases costs in some uses and decreases them in others. Concurrently, health status is improved in some situations although in other situations it may be unaffected or even worsened using the same technology. It is difficult to separate the relative significance of each of the cost-increasing effects of individual and new technologies. In the early years of PPS, ProPAC conducted several studies of new technology costs and concluded that they were fairly low. Those studies focused primarily on acquisition costs of new technologies but also looked at their diffusion and operating costs. Project Hope, under contract with ProPAC, annually estimates the incremental operating costs of specific cost-increasing technologies.

The component for reduction of cost-ineffective practice recognizes that some improvements in practice patterns could be made so that the intensity of services provided is more consistent with the efficient use of limited resources. That is, through this component DHHS would recognize that improvements could be made so that the number and complexity of services provided during an inpatient stay produce an improvement in health status which is consistent with the cost of care. This component of the update recommendation is intended to encourage both hospitals and physicians to more carefully consider the cost effectiveness of medical care.

The component for real within-DRG change is implicitly recognized in DHHS' current framework in the scientific and technological advances and in the practice pattern components. In the proposed framework, it would be recognized in the intensity component.

In considering an intensity standard for the framework, two types of measures are readily available. One is based on hospital charges, and the other is based on the number of services actually provided by each

Table 1

Case-mix constant intensity: Fiscal years 1986-91

Year	Output per Medicare discharge[1]	Case-mix constant intensity	
		One-half case-mix index growth is real[2]	1 percent is real[3]
	Percent change from previous year		
1986	5.2	3.4	4.1
1987	6.1	4.7	5.0
1988	3.9	2.9	2.9
1989	2.0	0.7	1.0
1990	1.5	0.3	0.4
1991	1.1	0.1	0.1
Cumulative, 1986-91	21.4	12.8	14.3

[1]Change in total charges per Medicare discharge adjusted for the change in the hospital component of the consumer price index. This measure includes output from capital and is taken into account in the framework for updating capital prospective payment system rates published in the *Federal Register* (1992).
[2]Adjusts for real case-mix change as 50 percent of total measured case-mix change (fiscal year 1988 adjusts for one-half of change remaining after reduction of 1.22 percent for administrative changes removed from the diagnosis-related group weights in fiscal year 1990).
[3]Adjusts for real case-mix change of 1 percent.

SOURCES: Health Care Financing Administration, Bureau of Policy Development, Bureau of Data Management and Strategy, and Office of the Actuary: Data are based on Hospital Cost Report Information System files.

department (Ashby and Altman, 1992; Fisher, 1992). Using either, similar trends can be observed. During 1984 and 1985, intensity per admission fell from pre-PPS levels. Since 1985, the case-mix adjusted intensity of services per inpatient admission has increased each year. These increases for 1986-88 are similar to pre-PPS increases; some moderations in the trend appeared in 1989.

Following methods developed by HCFA's Office of the Actuary for deriving hospital output estimates from total hospital charges, we have developed Medicare-specific intensity measures for inpatient services based on 1985-91 Medicare provider analysis and review (MEDPAR) billing data. Consistent with ProPAC, case-mix constant intensity is calculated as the change in total Medicare charges per discharge, adjusted for changes in the average charge per unit of service, as measured by the medical consumer price index (CPI) hospital component and changes in real case mix. Past studies of case-mix change by the RAND Corporation indicate that the change in real case mix ranges from 1.0 percent to one-half of total case-mix change (Carter and Ginsburg, 1985). If we assume that real case-mix change is one-half of total case-mix change, we estimate case-mix constant intensity to have grown by an average of 2.0 percent each year during the 1985-91 period, a cumulative increase of 12.8 percent. If we assume that real case mix has been growing at 1.0 percent annually, case-mix constant intensity has grown by an average of 2.3 percent annually, for a cumulative increase of 14.3 percent (Table 1).

There is also an interesting trend in the intensity changes during this period. In 1986-88, the annual change in intensity was from 3.7 to 3.9 percent, depending on the real case-mix estimate, whereas the annual average for 1989-91 was only 0.4 to 0.5 percent. One hypothesis concerning this trend is that it is a result of the financial incentives of the system. It is likely that there was a lessened cost-control effort following the high PPS1 and PPS2 profits, resulting in higher intensity growth observed through 1988. Similarly, the much lower rates of change for the recent years may have resulted from the lower update factors and falling margins during this period.

An intensity standard for the framework

The estimates of past intensity growth can be used as a guide in setting a policy standard for future growth as part of the update framework. DHHS believes that the estimated intensity increases have been due to a combination of changes in science and technology, increasing within-DRG severity and greater use of cost-ineffective services. Although use of the Project Hope studies provides a good tracking system for looking at the impact of particular technologies, using these studies on an annual basis for update recommendations requires a number of technical assumptions and policy judgments. Depending on these assumptions, the portion of the overall intensity increase attributable to quality-enhancing new technologies could vary considerably.

In lieu of precise annual estimates of these effects, DHHS makes a policy judgment for the proposed update factor. Specifically, DHHS would assume that one-half of the 2.0 to 2.3 percent annual increase was due to a combination of quality-enhancing services and within-DRG complexity. Therefore, based on these trends, DHHS' proposed recommendation would include a 1.0- to 1.1-percent positive adjustment to the update to allow for cost-effective increase in the intensity of services in FY 1993. The rationale for this judgment is to continue to provide a predictable and adequate amount for quality-enhancing services in addition to an adequate financial incentive for elimination of cost-ineffective practice. Indeed, using this standard provides hospitals a greater financial incentive for providing only cost-effective services because the proposed framework would no longer include a negative component for practice patterns. Thus, hospitals would keep any immediate gains from such changes. Moreover, the appropriate research on science and technology will continue to be examined,

particularly for guidance in the years when changes in quality-enhancing services may deviate substantially from the trend.

In the long run, the intensity standard should be based on a wider body of research. Although DHHS will continue to examine historical trends in formulating this component, the intent is that it will become a forward-looking factor that incorporates knowledge from medical effectiveness studies. Moreover, DHHS hopes to identify a set of efficient or "best practice" hospitals to serve as a basis for this adjustment.

In recognition of the joint roles of hospitals and their medical staff in furnishing inpatient care, DHHS intends to examine methods for calibrating the hospital update recommendation with the annual volume performance standard recommendation for the Medicare physician fee schedule. In evaluating methods for calibrating the two recommendations, one potential area of study will be to examine services billed by both physicians under Medicare Part B and by hospitals under Medicare Part A.

Productivity

Service-level productivity is defined as the ratio of total service output to full-time equivalent employees (FTEs). It is also called intermediate productivity because services become inputs for the production of a hospital discharge. Although DHHS recognizes that productivity is multifactor (that is, it is a function of labor, non-labor material, and capital inputs), it proposes to use a labor-productivity measure in its update framework because this framework currently applies to operating payment. This approach is consistent with ProPAC's framework which uses labor productivity as a standard. Moreover, labor productivity has some advantages as a measure. First, it is widely used and understood by policymakers and the public. Second, labor is the only input for which independent measures of quantity—FTEs or hours—are available. Measures for non-labor inputs and for capital must currently be derived from hospital cost data.

In the future, a different measure can be incorporated if the updates for operating and capital payments are combined. To recognize that shortrun output changes are apportioned to the labor input, DHHS proposes to weight the productivity measure for operating costs by the appropriate share of labor input to total operating input to determine the expected effect on cost per case (for further discussion, see *Federal Register*, 1992).

In examining how to use productivity data to structure a policy target for the framework, DHHS considered several factors. First, although the objective was to use productivity trends to support this component, it was not to have a policy target based on direct extrapolation of these trends: This would carry the risk of either rewarding hospitals for past performance that was not up to expected standards, or penalizing them by setting standards based on the year's productivity gains that were above expectations. Second, it is recognized that some productivity improvements have resulted from increased output of services that are not cost-effective or quality-enhancing. Rather than having the recommendation reflect this effect, DHHS' objective was to have a productivity target consistent with the service output that would result under the recommended intensity standard. Finally, DHHS wanted to continue to reflect trends in both the hospital industry and the general economy.

For these reasons DHHS has chosen a standard based on the historical relationship between productivity and output, and the expected level of hospital output during the update year. Specifically, the policy target is calculated by multiplying the historical ratio of productivity change to output change by expected output, multiplied by the share of labor in total operating inputs. This standard has the advantage of using an established relationship—that productivity varies with aggregate output—but being forward-looking by using expected output levels for the period to which the update applies. Moreover, the expected output levels can be calculated based on the intensity recommendation. Finally, although it uses the longrun relationship between productivity and output as a basis, this standard would automatically recognize that in the short run, productivity tends to be lower when output growth is slow and higher when output growth is relatively rapid.

In analyzing trends in gross domestic product and output per hour for the economy, we found that on average the ratio of productivity growth to output growth has been approximately 0.3 to 0.35, depending on the exact time period. In comparison, estimates of output and productivity for the hospital sector imply a ratio of 0.34 for the 1979-89 period (Fisher, 1992). ProPAC estimated cumulative service-level productivity growth to be 4.7 percent or 1.1 percent annually from 1985-89. At the same time, they estimate total service growth at 3.8 percent annually, implying a ratio of service productivity growth to output growth of approximately 0.3. These estimates imply that a 1.0-percent increase in output would be correlated with a 0.3 to 0.35 percent change in output per hour. Thus, DHHS proposes using this range for its standard.

The expected change in total hospital service output is calculated as the product of projected growth in total admissions (adjusted for outpatient usage), projected real case-mix growth, and cost-effective increase in intensity of services (DHHS' recommended intensity target). Because FTEs cannot specifically be allocated to Medicare patients, DHHS proposes basing this standard on total hospital output. Case-mix growth and intensity numbers for Medicare are used as proxies for those of the total hospital, since case-mix increases (used in the intensity measure as well) are unavailable for non-Medicare patients. Thus, expected output growth is simply the product of the expected change in intensity (1.0 to 1.1 percent), projected total admissions change (2.3 percent for 1993), and projected real case-mix growth (1 percent for 1993), or 4.3 to 4.5 percent. The share of direct labor services in the hospital market basket (consisting of wages, salaries, and employee

benefits) is 61.7 percent. Multiplying the expected change in total hospital service output by the ratio of historical service productivity change to total service growth of 0.30 to 0.35, and by the direct labor share percentage provides the productivity standard of 0.8 to 1.0 percent. By applying the direct labor share percentage to calculate the standard, the framework implicitly assumes that productivity for non-labor material inputs is zero. Because productivity for these inputs has generally been negative in recent years (Fisher, 1992), this standard requires productivity improvement.

Comparison of proposed and current frameworks

Table 2 provides a comparison of the two frameworks in terms of individual components and recommended update factors. As discussed, only the policy adjustment factors differ between the frameworks. These are described later, along with the components the two frameworks have in common.

Change in case mix

The modified analysis continues to take into account changes in case mix, net of changes attributable to improved coding practices, and DRG reclassification and recalibration. HCFA found that the observed increase in case mix was 2.5 percent during FY 1991. DHHS estimates real case-mix increase at 1.0 to 1.3 percent. It defines real case-mix change as actual changes in the mix (and resource requirements) of Medicare patients as opposed to changes in coding behavior that result in assignment of cases to higher-weighted DRGs but do not reflect greater resource requirements. This estimate is supported by past studies of case-mix change by the RAND Corporation (Carter and Ginsburg, 1985). In addition, DHHS estimates that DRG reclassification and recalibration in FY 1992 resulted in a 1.0-percent increase in the CMI. This estimate results from classifying cases using FY 1991 and FY 1992 groupers, without any other case changes. Any resulting change in the CMI based on the FY 1992 grouper compared with the FY 1991 grouper must be the result of reclassification and recalibration effects. The adjustment to account for changes in case mix during FY 1991, the most recent year for which data are available, is -2.5 to -2.2 percent (the sum of -2.5, 1.0 to 1.3, and -1.0).

Table 2

Proposed update framework: Preliminary estimates for fiscal year 1993

Individual components	Framework	
	Current	Proposed
Market basket (MB)	MB	MB
Policy adjustment factors		
Productivity	−1.0	−1.0 to −0.8
Intensity	—	1.0 to 1.1
Science and technology	0.3 to 0.5	—
Practice patterns	−1.8 to 0	—
Real within-DRG change	—	—
Subtotal	−2.5 to −0.5	0.0 to 0.3
Case-mix adjustment factors		
Observed case-mix change	−2.5	−2.5
Real across DRG change	1.0 to 1.3	1.0 to 1.3
Effect of 1991 reclassification and recalibration	−1.0	−1.0
Subtotal	−2.5 to −2.2	−2.5 to −2.2
Forecast error correction	−0.9	−0.9
Total recommended update	MB−5.9 to MB−3.6	MB−3.4 to MB−2.8

NOTES: The actual fiscal year 1993 recommendation using the current framework included a one time 0.14 percent adjustment to reflect the implementation of new the Occupational Safety and Health Administration guidelines. DRG is diagnosis-related group.

SOURCES: Health Care Financing Administration: Bureau of Policy Development, Bureau of Data Management, and Strategy and Office of the Actuary: Data are based on Hospital Cost Report Information System files.

Correction for market basket forecast

The FY 1991 estimated market basket percentage increase used to update the payment rates was 5.2 percent. DHHS' most recent data indicate the actual FY 1991 increase was 4.3 percent, reflecting that the increase in wages was lower than projected. The resulting error in the projected FY 1991 market basket rate of increase forecast was -0.9 percentage points. DHHS' policy has been to make a forecast error correction if their estimate is off by 0.25 percentage points or more; it would continue to make corrections for forecast errors under the proposed framework, and would therefore include a forecast error adjustment of −0.9 percentage points in setting PPS rates for FY 1993.

Policy adjustment factors

Although the productivity recommendation of -0.8 to -1.0 in the proposed framework is comparable to the -1.0 factor used each year in the current framework, the intensity recommendation differs considerably from the current counterparts. Using the existing framework would lead to a recommendation in a range of -1.8 to 0 for practice patterns and 0.3 to 0.5 for science and technology. Thus, the total policy adjustment target (including productivity) is -2.5 to -0.5 under the existing framework compared with 0.0 to 0.3 in the proposed framework.

Assessing the adequacy of rates

Currently, one of the most usable and controversial measures associated with the PPS is financial margins. They have been used to judge the adequacy of PPS rates, although they have not been scrutinized carefully as to their appropriateness for that purpose. In this section, we present trends in margins, consider their validity for judging adequacy of the rates, and discuss alternative methods.

Table 3 shows the changes in Medicare and total margins, revenues, and costs from 1985 through 1990. PPS margins have declined during this time, from

13.7 percent in 1985 to -3.4 percent in 1990. Examination of the increases in costs and revenues per discharge shows that Medicare operating costs per case have increased 55.1 percent from FY 1986 through FY 1990, whereas Medicare payments have increased 29.1 percent during the same period, a little more than one-half as much as the increase in Medicare costs.

Total margins, on the other hand, decreased in the first years of PPS, but have leveled off in recent years. Total operating cost per case has increased 66.1 percent, while total operating revenues per case have increased 60.1 percent. Medicare costs have increased somewhat more slowly than total hospital costs, but the main difference in the movement of Medicare and total margins over time is due to the difference in Medicare and total revenue growth. These results amplify the concern over the adequacy of increases in Medicare payments: Are the declining margins caused by inadequate updates, or rather by hospitals' inability to control costs?

The trends in PPS margins and the associated controversy highlight the need to develop methods for systematically evaluating the PPS. Any system based on pre-set rates requires not only an update process, but also a periodic assessment of the rate structure and its impacts on providers and beneficiaries. One aspect of this process is assessing the rates relative to the goals and objectives engendered in the system. In the current climate, an important first step is addressing whether the current rates are too low or whether they are adequate to satisfy the system's policy goals. That is, has the update process appropriately recognized changes in the delivery of care, patient characteristics, technology, and other factors that have affected the cost of care?

In examining methods for assessing the PPS rates, it is important to consider the system's basic objectives. In general, PPS was intended to provide both a means to control the growth in hospital expenditures and financial incentives for hospitals to give quality care in the most efficient manner. The Social Security Act specifies that in updating the rates, the DHHS Secretary shall determine the percent increase and take into account "amounts necessary for the efficient and effective delivery of medically appropriate and necessary care of high quality." In assessing PPS rates, it is important to consider them in the context of efficient and effective care.

How useful are financial margins?

Currently, PPS margins are the most widely available and visible tools used to examine PPS rates. These margins compare PPS revenues with operating costs from Medicare cost reports. Because revenues per discharge are largely determined by the ratesetting process, these margins have provided a seemingly natural yardstick with which to measure the adequacy of the rates. From the falling and recently negative average PPS margins, it has been inferred by some that the current rates are too low. These margins, however, may provide misleading information about how well PPS rates meet the system's basic objectives of paying an adequate amount for efficient and effective care. Indeed, margins may only be useful for this purpose if costs as well as revenues are scrutinized. That is, how well do reported accounting costs reflect the actual costs of providing efficient and effective care?

In profit-oriented industries, margins provide a measure of financial performance. Although it is likely that firms have objectives other than pure profit maximization, the margin provides a summary measure of their simultaneous ability to generate revenue and to control costs. Margin data do not only measure the adequacy of revenues, however. Even if other objectives result in firms not absolutely minimizing costs as in a perfectly competitive industry, it can be assumed that discretion to allow costs to rise relative to revenues is limited by their profit-oriented status, competition, and stockholders.

The hospital industry is mostly not-for-profit, however, and it is widely believed that costs are subject to considerable discretion by both hospitals and physicians. That is, costs are more determined by decisions internal to the institution and its medical staff than by traditional market forces. There is now a considerable literature concerning how not-for-profit hospitals formulate objectives and make decisions on

Table 3

Medicare and total margins and increases in costs and revenues per case: Fiscal years 1985-1990

	Medicare operating			Total hospital		
		Percentage increase			Percentage increase	
Year[1]	Margin	Cost per case	Payment per case	Margin	Cost per case	Revenue per case
1985	13.7	10.1	9.9	7.2	—	—
1986	9.9	9.6	3.2	5.0	10.4	8.4
1987	6.2	9.3	5.3	3.9	10.9	9.7
1988	3.6	8.5	6.2	4.2	10.0	10.3
1989	-0.6	10.2	6.0	3.6	11.5	11.4
1990	-3.4	8.3	5.5	3.5	10.6	10.0
Cumulative, 1986-90	—	55.1	29.1	—	66.1	60.7

[1]Data are based on the hospital cost reporting period ending in the Federal fiscal year shown.

NOTE: Increases in costs and payments per case are case weighted.

SOURCES: Health Care Financing Administration, Bureau of Policy Development, and Office of Research and Demonstrations: Data are based on Hospital Cost Report Information System files.

cost and output (Davis, 1972; Harris, 1977; Pauly and Redisch, 1973). This literature implies two important aspects of hospitals relevant to costs: (1) They may pursue a number of objectives other than maximizing surpluses, such as prestige of medical staff and hospital amenities; and (2) there is a dichotomy of decisionmaking and priorities between hospital administration and medical staff. Both are hypothesized to result in costs higher than would be consistent with a more competitive, profit-oriented market and therefore higher than necessary for the provision of efficient and cost-effective care.

A question relevant to interpreting PPS financial margins is whether costs in excess of those necessary for efficient and effective care would persist after 8 years of the financial incentives inherent in prospective payment. The data demonstrate that, although there was a very small increase in Medicare operating costs during PPS1, probably in response to the system's implementation, annual growth in cost per case since that year has been high—roughly twice the rate of input price inflation. One explanation, consistent with the theories of hospital behavior, is that raising revenues is preferable to controlling costs in response to financial pressure such as might be imposed by prospective payment. Indeed, total margins have been fairly stable despite the rapid decline in PPS margins because hospitals have been successful at raising revenues from other sources. There is also evidence that the higher than expected PPS margins during the system's first 2 years may be directly related to the rapid cost increases in the following years (Sheingold, 1989). That is, hospitals and medical staff responded to the profits provided by PPS in its first years by relaxing their initial cost control initiatives. This study also suggests that even during PPS1, the ability to increase revenues through case-mix upcoding substituted for cost control efforts.

Although none of the evidence is as yet conclusive, it does suggest that costs, on average, may have grown more rapidly than necessary to maintain the provision of quality care. Therefore, falling or negative PPS margins are not necessarily indicative of inadequate PPS rates. Instead, it leaves open the possibility that hospital costs are too high, rather than that PPS rates are too low. Thus, further research must find a way to compare revenues provided under the system with a cost standard representing efficient and cost-effective care rather than costs actually reported. That is, we must examine how the costs of efficient or best practice hospitals compare with the current PPS rates. The following sections discuss one method suggesting this approach, and issues relevant to expanded research in this area.

Retrospective cost and revenue analysis

One potential method of assessing PPS rates that can be readily applied is to retrospectively calculate the operating cost increases that would have been consistent with efficient practice and compare them with revenues during the same period. To be consistent with the proposed update methodology, we calculate a proxy for efficient practice costs based on the productivity and intensity standards from the framework. The calculation is based on basic identity describing the relationship among costs, inputs, and outputs underlying the update methodology. Specifically, the change in efficient practice costs per case is calculated in each year from 1986-91 as the product of the change in outputs, the change in the inverse of productivity, and the change in input prices, or:

$$\Delta\text{cost} = (\Delta \text{ real case mix})\,(\Delta\text{allowable intensity})\,(\Delta\ 1/\text{productivity standard})\,(\Delta \text{ market basket})$$

Table 4 illustrates these calculations. Cumulative growth in efficient costs was 41.3 percent. To roughly compare these calculations with the costs used for the margin calculations on Table 3, we recalculate this cumulative increase through 1990 to be 35.1 percent. In contrast, the cumulative increase in actual costs was 55.1 percent or about 3 percentage points per year higher than efficient costs.

On Table 5, we calculate PPS revenues per case during this same period. These are calculated as the product of the update factor in effect each year, total case-mix growth, and residual payment change. The latter captures the effect of legislated changes such as the indirect medical education adjustment. Hospitals received an increase of 35 percent during this period, or about 1 percentage point less per year than the increase in efficient costs.

This difference would be consistent with stated policy objectives during this period rather than with underpayment. When setting the update to the standardized amounts for FY 1986, DHHS stated that a negative update was justified because of the overstatement of the base-year costs used to determine the FY 1984 and FY 1985 standardized amounts, but that they believed that such a negative update would be disruptive and cause unintended consequences which could compromise the quality of care provided to Medicare beneficiaries (*Federal Register*, 1985). Instead, DHHS anticipated that payments would increase more slowly than expected cost increases, in order to gradually adjust the standardized amounts to their appropriate levels. ProPAC agreed that the FY 1985 standardized amounts were set at too high a level, and also agreed that a precipitous adjustment would not be appropriate. ProPAC believed that the base-year costs used to calculate the standardized amounts were overstated by 12.3 percent by FY 1987. They then divided these overstated costs into elements that should be entirely adjusted for (such as shifts in accounting practices, site of care substitution, and cost report audits) and savings created by increased hospital efficiency that should be shared between the industry and the Medicare program. The resulting adjustment to the standardized amounts averaged 8.0 percent. ProPAC recommended that an average 5.4 percent reduction (5.7-percent reduction for urban hospitals and a 3.3-percent reduction for rural hospitals) to the standardized amounts be made over a 3-year period to reflect the inappropriate levels of base-year costs

Table 4

Cumulative percent change in expected cost per case increases, assuming one-half of actual annual case-mix index (CMI) growth is real: Fiscal years 1986-91

Year	Total	Actual market basket[1]	Productivity[2]	Real CMI growth[3]	Allowable intensity[4]
1986	6.6	3.9	−0.8	1.7	1.7
1987	6.6	3.7	−0.8	1.3	2.4
1988	6.5	4.7	−0.8	1.1	1.4
1989	6.3	5.4	−0.8	1.3	0.3
1990	5.0	4.5	−0.8	1.1	0.2
1991	4.6	4.4	−0.8	0.9	0.1
Cumulative change (compounded)[5]	41.3	—	—	—	—

[1]Actual market basket figures include correction for any forecast errors.
[2]The productivity amount is based on average annual increases in real Medicare output of 3.38 percent from fiscal years 1985-91.
[3]The fiscal year 1988 real CMI amount is determined as one-half of the increase remaining after removing the 1.22 percentage point increase that is due to administrative factors, and was removed from the diagnosis-related group (DRG) weights in fiscal year 1990.
[4]Growth rates for fiscal years 1990-91 are calculated net of the effect of the fiscal year 1990 reduction of the DRG weights.
[5]If real CMI growth is assumed to be 1.0 percent annually, the cumulative percent change would be 40.4 percent.

SOURCES: Health Care Financing Administration, Bureau of Policy Development, Office of the Actuary, and Bureau of Data Management and Strategy: Data are based on Medicare Provider Analysis and Review File.

Table 5

Percent increase in the prospective payment system (PPS) payments per case: Fiscal years 1985-91

Year	Total increase	Average published update	PPS case-mix index growth	Residual payment change[1]
1986	3.2	0.5	3.4	−0.7
1987	5.3	1.2	2.5	1.5
1988	6.2	1.5	3.3	1.3
1989	6.0	3.3	2.7	−0.1
1990	5.5	5.8	1.0	−1.3
1991	4.6	3.4	2.7	−1.5
Cumulative change (compounded)	35.0	—	—	—

[1]Residual payment growth is caused by factors such as increased indirect medical education (IME) and disproportionate share hospitals (DSH) and legislative changes (such as increases in the DSH adjustment formula).

SOURCES: Health Care Financing Administration: Bureau of Policy Development, Office of Research and Demonstrations, and Office of the Actuary: Data are based on Hospital Cost Report Information System and Medicare Provider Analysis and Review files.

reflected in the original standardized amounts (ProPAC, 1987). This adjustment recognized that the low update factors for FYs 1985 and 1986 were intended, in part, to reflect the overstated base-year costs.

Another way of examining these estimates is to recalculate margins based on actual revenues per case and the efficient costs. Using the 13.7-percent margin for 1985 as a starting point, 1991 margins would be nearly 10 percent if cost growth were consistent with these estimates of efficient practices.

Assessing rates using the efficient hospital

Another method that has been suggested is to define a set of efficient or best practice hospitals and use their cost experience to assess the adequacy of the rates. That is, rather than using the average cost of all hospitals to calculate revenue margins, the costs of efficient hospitals would be used. Their experience over time could also provide information for setting the productivity and intensity standards in the update framework.

Defining efficiency in hospitals is difficult for several reasons. In contrast, the basic economic concept of efficiency is relatively simple—that output be produced at the minimum cost that is technically feasible. In the perfectly competitive market, several conditions assure that this occurs. These conditions include a relatively homogeneous and identifiable output, good information for buyers, and free exit and entry to the market. Because the market works to eliminate any producer not at minimum cost, the efficient firm is easy to identify—all firms that exist at the market price. Many economists have described conditions under which profit maximization is not the only goal of managers, and therefore not all firms will produce at lowest cost. For example, some may trade a share of profits for increased amenities such as more luxurious office space. Thus, efficiency has also been defined in terms of the costs of the highest cost producer that can survive at the market price although the market will also include producers with lower costs.

Applying the economic concept of efficiency to the hospital industry is even more complex. The final output is hard to define and measure, there is much uncertainty about how to produce it, there are substantial barriers to entering the industry, and third-party payment tends to make physicians and patients less sensitive to price and how it compares with value. Moreover, most hospitals are not-for-profit and must attract patients both directly and indirectly through the

quality of the medical staff they recruit. As discussed previously, they may pursue multiple objectives which lead to spending that would not meet a traditional market test (e.g., the purchase of under-utilized technologies) and hence, patient care is not produced at the lowest possible cost. Thus, although hospitals will certainly exhibit different degrees of inefficiency (relative to minimizing costs), there will likely be few, if any, efficient hospitals to use for a benchmark.

Another complication is that there are problems in accurately defining a hospital's appropriate output and, therefore, cost. Although a discharge within a particular DRG is the current output measure, it has several weaknesses in judging efficiency. First, the true episode of care must carefully be considered. With some limited bundling of pre-admission services, PPS-relevant costs are those related to services provided in the hospital during the stay. To get the full cost of the output for efficiency comparisons, however, services that are provided in other settings and reasonably related to the inpatient stay must be included. This is particularly true because opportunities for shifting inpatient care to outpatient settings, skilled nursing facilities, and home health agencies differ across hospitals. It is hoped that the development of the National Claims History data base will make the task of examining entire episodes of care easier.

Moreover, the true final output is an improvement in health as a result of a hospital discharge. Without a measure of patients' health status, it is difficult to compare efficiency across hospitals. As an example, consider two hospitals discharging patients in a particular DRG. Hospital A uses high technology diagnostics and special care days. Hospital B uses standard diagnostic tests and all routine care units. If both patients have the same health status improvement—the same quality of care—both hospitals have produced the same output and hospital B is more efficient. If, however, the patient discharged from hospital A is healthier (e.g., has a lower probability of death or lower related subsequent expenditures) as a result of the more costly care, then the two hospitals have produced different outputs and relative efficiency is difficult to assess.

Operationalizing a definition of efficiency

There are two potential ways to operationalize an efficiency concept for payment purposes:

- To the extent that some of the previously noted problems can be addressed, use available data to calculate a cost that reflects the representative (efficient) hospital.
- Define an efficient production of care for each diagnosis, estimate its cost using input price data, and use that cost as the efficient cost.

The second approach is consistent with the operations research and cost effectiveness literature. Medical decisionmaking models of efficient production of care for each diagnosis could be constructed using expert consensus and costed using data on individual services. This approach has the advantage of defining efficiency independent of hospital cost data and thus avoids some of the problems previously discussed. Given current knowledge concerning effectiveness of medical care and lack of guidelines for practice, this method would be difficult to implement. Eventually, as effectiveness research and guideline development progress, medical decisionmaking models could be used to set efficient price standards either to be used directly for payment or to use as a reference in evaluating hospital cost data.

For all intents and purposes, DHHS currently employs the first method. Using standardization, it does its best to control for output differences (case mix, teaching), input price differences (the wage index), and patient characteristics (a hospital's disproportionate share patient percentage). DHHS then uses the cost data to set a price. For the time being, DHHS has relied on an average of costs standardized for the previously noted factors to set the PPS rates.

Is there a better method of using hospital cost data to define the efficient hospital? There are several techniques being discussed that would provide efficiency rankings. These include data envelopment analysis and frontier analysis. Application of these techniques is not yet extensive and needs further development. Moreover, there are enough caveats about these approaches that it is not clear that they would provide efficiency rankings that are superior to the current approach.

Discussion summary

One of the most important factors for the continued viability of PPS will be the assurance that the system's rates are consistent with its objectives. If rates are too low, there is the risk of undermining access to, and quality of, care for Medicare beneficiaries, or shifting of the costs of their care to other payers. If rates are too high, resources devoted to inpatient stays will likely exceed what is necessary for cost-effective care. In this article, we have examined a proposed modification for the update framework and made an initial effort at examining the adequacy of PPS rates since 1985. Considerable time and research will be needed to better develop methods for this pursuit.

Clearly, finding a cost standard to compare with PPS rates, rather than using reported average costs, will be critical. Thus, considerable effort will be needed in order to identify efficient or best practice hospitals or methods of production. A starting point might be to use newly available data bases to begin to more carefully examine the total resources related to an episode of inpatient care and its outcomes. With this information incorporated, analysis of "winners" and "losers" under the system and application of techniques such as frontier analysis may begin to usefully profile efficient practice.

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