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THE MEDICARE ADJUSTMENT FOR THE INDIRECT COSTS OF MEDICAL EDUCATION: HISTORICAL DEVELOPMENT AND CURRENT STATUS

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PREFACE

An integral part of the recently enacted Medicare Prospective Payment System is the "indirect medical education adjustment," yet there is a great deal of misunderstanding concerning the purpose of this adjustment. Its title has led many to believe that this adjustment to the DRG prices is to compensate for education and related program costs. However, its congressional sponsors and the AAMC have recognized from the beginning that these payments are in fact necessary to recognize the costs of tertiary care and the unique services which are most commonly provided in teaching hospitals, and the limitations of the Diagnosis Related Groups as a unit of payment.

In order to clarify the intent of this "indirect medical education adjustment," the AAMC contracted with Judith Lave, Ph.D., Professor of Health Economics at the University of Pittsburgh and former director of the Office of Research within the Health Care Financing Administration, to write her perceptions of the history and purposes of the indirect medical education adjustment.

I believe Dr. Lave has done an excellent job and provided a document which gives a thorough and thoughtful account of the development and intentions of this adjustment. I believe the document is worth your attention.

John A. D. Cooper, M.D.

EXECUTIVE SUMMARY

The concept of the indirect costs of medical education was introduced into the hospital payment lexicon in 1980 by the Health Care Financing Administration (HCFA). HCFA stated that in calculating the then "Section 223" cost limits, per diem allowable costs could be adjusted for a number of factors including the number of residents per bed. The "medical education" adjustment was included to account for the increase in per diem costs found to be associated with the number of residents per bed.

Since then, Medicare's reimbursement policy has been fundamentally changed. Retrospective cost based reimbursement is being supplanted by a prospective payment system. Under the fully implemented Medicare Prospective Payment System (PPS), Medicare's share of capital and direct graduate medical education costs still will be paid on the basis of reimbursable costs while prospectively set DRG payments will cover Medicare's share of hospital operating costs. In addition to the standard DRG payments and the cost reimbursed passthroughs, teaching hospitals will receive incremental payments tied to the number of residents per bed. These payments, which have become known as payments to cover the indirect costs of medical education, will account for approximately 5.5 percent of total Medicare payments under the fully implemented PPS system.

In the following overview, the concept of indirect medical education adjustment is discussed first. Next the approach used by HCFA to estimate this adjustment is outlined. Third the factors leading up to the doubling of the HCFA estimated adjustment and the implications of the doubling are discussed.

The size of payments made under the rubric "payments to cover the cost of medical education" makes the adjustment an easy target for budget cuts. However, if these payments are to be cut it is necessary that accompanying changes be made in PPS. Therefore, the paper concludes by describing changes which would enhance the equity and efficiency of PPS not only for teaching hospitals, but all hospitals and patients, including:

- recategorization of some of the more heterogeneous DRGs,
- improvements in the setting of the DRG relative prices,
- determination of improved wage indices,
- reassessment of the definition of the market for which factor price differences will be taken into consideration, and
- reconsideration of the number of locational factors that will be used in adjusting the standardized DRG rates for different hospitals.

Some of the changes, such as the DRG classification system, HCFA already has under examination. Others, such as a reconsideration of the market areas, have been virtually ignored. All, however, are of vital importance if the PPS is to provide the equity across hospitals that is required for a long term payment reform.

Introduction

On April 1, 1980, a proposed rule (NPRM) in the Federal Register introduced a new concept into the hospital payment lexicon: the adjustment for the indirect costs of medical education. In setting the proposed schedule of limits for hospital inpatient general routine operating costs for cost reporting periods beginning on or after July 1, 1980, the Health Care Financing Administration (HCFA) stated that Medicare allowable costs could be adjusted for differences among hospitals in location (urban/rural), area wage rates, bed size, and the number of interns and residents per bed. The adjustment for the number of interns and residents per bed was included to account for the increased per diem costs "due to approved medical education programs".[1]

Since then, Medicare hospital reimbursement policy has been fundamentally changed: retrospective, cost based reimbursement is being replaced by a prospective payment system. The new system includes explicit additional payments to teaching hospitals. These payments, which are also directly related to the number of interns and residents per bed, are described in the implementing regulations as compensation for the "indirect costs" of education. These payments will account for approximately 5.5 percent of total Medicare payments for hospitals under the fully implemented prospective payment system.[2]

Now under the pressure of large and persistent federal budget deficits, the social policy of subsidizing graduate medical education through increased payments for patient care is increasingly open to question. In addition, given the "budget neutrality" of the new system more payments to hospitals with large graduate medical education programs means lower payments for those hospitals with none. Some have argued that the additional payments to teaching hospitals are unfair as they reward uneconomic behavior in those hospitals. The teaching hospitals, however, stress that their higher costs are related to legitimate differences in other factors associated with teaching programs, such as the severity of illness, that make their patients more expensive to treat. Thus, they maintain these extra payments should not be described as subsidies for teaching but as legitimate payments in recognition of other factors not adequately accounted for in the new system.

Given the magnitude of the payments resulting from the resident to bed adjustment, it is important to understand its origin and evolution. This paper begins with a brief discussion of the background events leading up to the introduction of the resident to bed adjustment in 1980. Next, it describes how the adjustment was incorporated into the new Medicare hospital prospective payment system. It then goes on to examine the factors that contribute to the observed relationship between the number of residents per bed and Medicare operating costs per case. This section

sets the basis for a consideration of the factors that must be explicitly considered as the prospective payment system evolves.

Background to the April 1, 1980 NPRM

Section 223 of the Social Security Amendments of 1972 authorized the Secretary of Health, Education and Welfare to set prospective limits on the amount of costs authorized for reimbursement to institutional providers under Part A of Medicare. These limits were to be based on the estimated costs necessary to provide needed services efficiently. Such estimates, however, are extraordinarily difficult to make. Given the limitations of data and methods at that time, early efforts to implement this provision focused on setting limits on hospital routine per diem costs. Routine per diem costs sufficiently above the costs of comparable hospitals were considered unreasonable and therefore not reimbursable.

Between 1974, when the regulations implementing the legislation were first published, and 1980 the methods used to establish the limits were changed in a number of ways. These changes stemmed from three interacting conditions: (1) improvements in the Federal government's ability to classify hospitals and thus to compare hospital costs, (2) a steady lowering of limits due to the improvement in classification systems and increasing pressure for Federal budget savings, and (3) revision of the methods to compare costs to respond to the needs of groups of institutions which were disproportionately affected by the lowering of the limits.

For the purpose of this paper, one such change should be noted. In 1979 it was decided that in calculating its routine per diem costs, a hospital could exclude all direct teaching costs. The direct costs for teaching were excluded because it did not seem fair to compare the routine per diem costs of nonteaching hospitals to those of teaching hospitals if the direct costs of teaching were included. The costs of teaching hospitals would surely be higher. This exclusion set a precedent for separating out direct teaching costs, a separation that carried over into the design of the Medicare Prospective Payment System.

By 1979, the cost limits were set at the 80th percentile of the costs of comparable hospitals; and the hospital size, location (urban/rural) and area wage rates were taken into consideration in determining comparability among hospitals. The Administration intended to lower the Section 223 limits further. However, any significant reduction in the limits would have hurt many hospitals; and, without any change in the grouping methodology, it would have had a particularly severe impact on teaching hospitals, especially those with very large graduate medical education programs. Thus political pressure was put on the Department of Health and Human Services (the successor of the Department of Health, Education and

Welfare) to take the special circumstances of the teaching hospitals into account.

Two options were considered to adjust for the higher costs of teaching hospitals. The first option was to create special groups of teaching hospitals. Grouping variables considered included: nature of affiliation with a medical school, the number of approved residency programs and the number of interns and residents (hereafter residents) per bed. However, data analysis did not reveal any obvious groups; for example, there were no clear cut breaks in the distribution of the number of residents per bed. Thus any effort to form groups would have created a significant boundary problem. The second option was to use a continuous adjustment procedure. Statistical analysis suggested that, after controlling for bed size, location and area wages, routine costs per day in teaching hospitals increased on average 4.7 percent with every .1 resident per bed. This empirical relationship could be used to adjust a hospital's limit.

The Office of Research in HCFA recommended application of this teaching adjustment factor (to the limit that otherwise would have been set on the basis of bed size, wage level and location) in determining the routine cost limits for teaching hospitals. At the same time it acknowledged that, despite this observed relationship, the specific cost elements increased by the level of teaching activity were not identified.[3] The recommendation to use a resident to bed adjustment was accepted, but not without discussion. There was some concern expressed within HCFA that the higher costs of teaching hospitals were due to lower levels of productivity and that pressure should be placed on these institutions to become more efficient. In addition, there was some concern that this adjustment might lead to an expansion in the number of residency programs.

The April 1980 NPRM and the June 1980 final rule made a number of changes in prior regulations: they lowered the limit from the 80th percentile of the cost distribution of comparable hospitals to 112 percent of the mean and they provided for an adjustment in the limit depending on the number of residents per bed. An explanation of the adjustment for the allowed higher costs for teaching hospitals was given in the April NPRM.[4]

> We believe these increases in per diem costs occur because the provision of graduate medical education causes increases in certain types of costs that are only indirectly related to education programs. For example, a hospital with an approved medical education program may be required, for training purposes, to maintain more detailed and complete medical records than a nonteaching hospital. However, medical records are not considered educational expenses and, therefore, are not excluded from the costs subject to the limitation under the current schedule.

Thus, this adjustment was clearly labelled an adjustment for the *indirect* costs associated with medical education programs.

The Adjustment for Medical Education Under Prospective Payment

Between 1980, when the resident to bed adjustment to the limits was adopted, and 1983 when the prospective payment legislation (PL-98-21) was passed, the approach taken to adjust for the higher costs of teaching hospitals remained unchanged. While the 223 routine cost limits were in effect, the 4.7 percent adjustment for the indirect costs of medical education continued. The Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) made fundamental changes in the way that hospitals were reimbursed under Medicare—it extended the 223 limits to cover total operating costs per discharge and it set a limit on the allowable rate of increase in operating costs per case. Nevertheless, the method used to set the total operating cost limits for teaching hospitals paralleled that for the routine cost limits—the limit was adjusted upwards with the number of residents per bed and the magnitude of the percentage adjustment was determined by a statistical analysis similar to one used to set the adjustment to the routine limits.

The TEFRA legislation directed the Secretary of Health and Human Services to report back to the Congress by December 1982 on a method to set prospective payments for hospitals under Medicare. In designing the new system, the Secretary made an early policy decision that Medicare would pay a single price for a given product. The issues of the teaching hospitals and methods to pay for graduate medical education were reopened and alternatives to the current adjustment procedures were explored.[5] The decisions reached were laid out in the Report to the Congress.

The first major decision had to do with paying for the direct costs of teaching.[6]

> The Department believes that the direct costs of approved medical education programs should be excluded from the rate and be reimbursed as per the present system. This approach will assure that the base rate is related to a patient care outcome and not significantly influenced by factors whose existence is really based on objectives quite apart from the care of particular patients in a particular hospital.

The second major decision had to do with the indirect costs of teaching:[7]

> The indirect costs of graduate medical education are the higher patient care costs incurred by hospitals with medical education programs. Although it is not known precisely what part of these higher costs are due to teaching (more

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tests, more procedures, etc.), and what part is due to other factors (the particular types of patients which a teaching hospital may attract), the Medicare cost reports clearly demonstrate that costs per case are higher in teaching hospitals.

It is also true that the mere presence of interns and residents in an institution puts extra demands on other staff and leads to the existence of higher staffing levels. The process of graduate medical education results in very intensive treatment regimens. Again, the relative importance of the various reasons for the higher costs observed in teaching hospitals is difficult to identify precisely. However, there is no question that hospitals with teaching programs have higher patient care costs than hospitals without.

The Department believes that recognition of these indirect costs should be accomplished through a lump-sum payment, separate and distinct from the base rate. This adjustment will be computed using methods that are similar to the methods currently used to adjust the old routine and new total cost limits for the indirect costs of graduate medical education. The hospital's cash flow will be preserved by some sort of periodic payment.

The Secretary's proposal established a fee schedule for hospital services. The Diagnosis Related Groups, the DRGs, were the recommended unit of payment and the prices set for the DRGs were based on an estimate of the average cost of each DRG. The DRG payments were to cover the operating costs of providing inpatient hospital services to Medicare beneficiaries. DRG prices would vary with hospital wages in the area, hospital location (urban/rural) and the extent of teaching. (Although the actual payment for the indirect teaching adjustment is to be made as a lump sum, it is useful for discussion purposes to think of it as an adjustment to the rate). The DRG payments were to cover the operating costs of providing inpatient hospital services to Medicare beneficiaries.

The Secretary originally proposed that after adjusting for hospital wages and location, the DRG payment should increase by 5.79 percent for each .1 increase in the number of residents per bed. As before, this adjustment factor had been estimated statistically. However, in this case, there was a difference between the factors that were controlled for in estimating the adjustment factor and those factors the Secretary recommended be taken into consideration in setting the rate. This point, which is very important, is further developed below.

In determining the statistical relationship between hospital operating costs per discharge and residents per bed, analysts controlled for hospital case mix, area wages, bed size, and the size of the geographic area in which the hospital was located.[8] The statistical results indicated that controlling for the other factors included in the analysis, the Medicare operating cost per case increased approximately 5.79 percent with every .1 increase in the number of residents per bed. The analysis also indicated that Medicare costs increased with hospital bed size and that the costs of hospitals located in Metropolitan Statistical Areas (MSAs) with over a million population were much higher than those in rural or in smaller urban areas. Thus, the Secretary's decision to vary the price paid for each DRG only with the hospital's case mix, residents per bed, area wage level and location (based on a simple urban/rural split) meant that *large* hospitals located in *large urban* areas would be relatively adversely affected by the payment system. These characteristics, however, are exactly the characteristics of hospitals with large graduate medical education programs. Of the 329 non-federal hospitals that are Council of Teaching Hospitals (COTH) member hospitals, 74 percent have more than 399 beds (compared to 7 percent of the 5,655 nonmember hospitals), and 61 percent are in urban areas with populations of 1,000,000 or more (compared to 23 percent of nonmember hospitals).

The extent to which certain types of hospitals would be adversely affected by the proposed system, was vividly indicated in an impact analysis prepared by the Congressional Budget Office (CBO). CBO presented preliminary information on the characteristics of hospitals that would gain or lose under the Secretary's proposed plan. These estimates are presented in Table I. Here it is shown that 70 percent of the hospitals with over 300 beds, 57 percent of urban hospitals and 71 percent of teaching hospitals would be adversely affected.

The negative effect of the proposed system on the nation's teaching hospitals was larger than was desirable or politically tolerable. In response to this problem, the Assistant Secretary for Planning and Evaluation of the Department of Health and Human Services suggested that the adjustment for medical education be doubled from 5.79 (the original proposal) to 11.59 percent for each .1 increase in the resident to bed ratio. This was an expedient proposal which, as will be argued below, temporarily "solved" the problem of the teaching hospitals without addressing a major source of the problem; that is, that the Secretary's proposal did not adjust adequately for the differences in the market areas in which those hospitals were located.

Before passing the prospective payment legislation, the Congress accepted the suggestion of the Assistant Secretary and made several other changes to the Secretary's proposed plan. The most important of these was the introduction of a phase-in period during which the DRG prices paid to a given hospital would move from being based almost entirely on its own historical operating costs to being based on the average costs in urban or rural areas; that is, to move from a hospital specific rate to a national urban or rural rate. Under the fully implemented system, these

Table 1
Estimated Average Penalties and Bonuses Under the Administration's Proposed DRG-Based Payment System By Type of Hospital[a]

	All Hospitals		Hospitals That Would Gain		Hospitals That Would Lose	
	Percent Distribution of Hospitals	Aggregate Effect as Percent of Reimbursements[b]	Percent Distribution of Hospitals	Aggregate Effect as Percent of Reimbursements[c]	Percent Distribution of Hospitals	Aggregate Effect as Percent of Reimbursements[d]
All Hospitals	100	0[e]	61	+23	39	−12
Bed Size						
Less than 100	49	+23	80	+35	20	−10
100–299	34	+2	50	+21	50	−11
300+	17	−6	30	+17	70	−13
SMSA						
SMSA	52	−4	43	+20	57	−13
Non-SMSA	48	+19	81	+29	19	−6
Region						
Northeast	15	−4	45	+19	55	−12
North Central	28	−4	60	+21	40	−13
South	37	+8	72	+26	28	−9
West	20	−2	57	+23	43	−13
Teaching Status						
Teaching	18	−7	29	+18	71	−13
Nonteaching	82	+7	69	+24	32	−10
Ownership						
Nonprofit	57	−2	55	+20	45	−12
Government	31	+9	78	+29	22	−12
Proprietary	12	−1	48	+22	52	−13

SOURCE: Preliminary CBO estimate based on Medicare Cost Reports for 1980.

a. Assumes an average payment level needed to keep outlays at the same level as under TEFRA in fiscal year 1984. Average gains and losses are incremental to those under TEFRA, which are assumed to be the average for each group. Effects of phase-in and adjustments for exceptionally costly cases are excluded, but an adjustment for teaching hospitals is included.
b. Average calculated for all hospitals.
c. Average calculated for hospitals that would gain.
d. Average calculated for hospitals that would lose.
e. Because aggregate reimbursements were assumed to be the same as under TEFRA, increases in payments to some hospitals would be exactly offset by decreased payments in others.

Source: Nancy M. Gordon, statement before the Subcommittee on Health Committee on Ways and Means, U.S. House of Representatives February 14, 1983

rates would vary only with those factors recommended by the Secretary, the resident to bed ratio and area wage rates. However, both the House and the Senate in their committee reports commented on the increased resident to bed adjustment. The Senate stated:[9]

> This adjustment is provided in the light of doubts. . . about the ability of the DRG case classification system to account fully for factors such as severity of illness of patients requiring the specialized services and treatment programs provided by teaching institutions and the additional costs associated with the teaching of residents. . . the adjustment for indirect medical education costs is only a proxy to account for a number of factors which may legitimately increase costs in teaching hospitals.

The regulations implementing this legislation made the following statement with respect to the resident to bed adjustment:[10]

> Section 1886(d)(5)(B) of the Act provides for additional payments to be made to hospitals under the prospective payment system for the indirect costs of medical education.

This cryptic comment could imply that the Department views the additional payment as primarily an additional outlay to cover the indirect costs of medical education and not to compensate for the weaknesses in the DRG system.

At this point, however, it is useful to leave the legislative and regulatory environment and to consider the adjustment, and what it represents, in more detail.

The Indirect Teaching Factor: What Does it Really Measure?

Nationally, the observed operating costs of hospitals with large graduate medical education programs are considerably higher than those without such programs. The important question is why are their costs higher? Are the costs of teaching hospitals higher because these hospitals treat sicker and more complicated patients who are more costly to treat? Are the costs of these hospitals higher because they tend to be located in the central cities of large metropolitan areas where it is more expensive to provide hospital services, or are their operating costs higher because it is more costly to treat patients in these hospitals? In this section these issues are addressed.

A preliminary answer to these questions is given by reexamining the results of the statistical analysis done by HCFA.[11] HCFA analysts studied the factors associated with Medicare costs per case. They ascertained that costs rose proportionately with the Medicare Case Mix Index (a measure of the costliness of a hospital's case mix as measured by DRGs)

and the average wages paid to hospital employees in the SMSA in which the hospital was located. They also determined (other things being equal) that relative to hospitals located in rural areas, hospital costs in urban areas with less than 250,000 people were only slightly more costly, that hospitals located in areas with between 250,000 to a million people were 2.6 percent more costly and those located in areas with over a million population were 10.9 percent more costly. They determined that costs increased, but less than proportionately, with hospital bed size. Since major teaching hospitals have higher measured case mix indices, are located in SMSA's with high wage rates, are located in the largest metropolitan areas and are bigger, these factors will account for much of the higher observed Medicare operating costs per case in these hospitals.

Nevertheless, controlling for these factors, Medicare operating costs per case increased approximately 5.79 percent for each .1 increase in the number of residents per bed and it is this relationship that has been labelled the indirect cost of teaching.

Before continuing, it is necessary to stress that the estimate of the "indirect costs of teaching" is obtained statistically. The estimated relationship between Medicare operating costs and residents per bed will depend on what other factors are controlled for and how well they are measured. It is likely that some of the effect on costs attributed by the statistical analysis to residents is due to other variables which are not included in the analysis.[12] One indicator of the sensitivity of the estimated size of the indirect teaching adjustments to the nature of the control variables can be given here. If the analysis of Medicare operating cost per case is repeated excluding bed size and SMSA size as control variables and using a simple urban/rural split, then the estimated relationship between costs and each .1 increase in residents per bed increases from 5.79 to about 9 percent. Some of the factors that may cause the measured association between operating costs and residents to be biased upwards are now examined.

1. **Errors In the DRGs.** The Medicare Case Mix Index used in the analysis was based on data that had been reported to HCFA in 1981—the 1981 MedPAR file. The diagnostic information reported to HCFA was often flawed,[13] and research by Pettengill and Vertrees indicates that errors in patient classification tend to compress the estimated values of the individual hospital case mix indices.[14] Thus the measured index of a hospital with a costly case mix is likely to be too low relative to its true value while the measured index of a hospital with a much less costly mix of patients will be too high. If the case mix indices of the teaching hospitals, particularly those with large teaching programs were underestimated, then some of the effect on operating costs that was in fact due to case-mix would be attributed to the resident to bed ratio.

It appears in fact that the case mix indices of many

of the large teaching hospitals were underestimated.[15] Hence, if the analysis were to be repeated today, using more accurate data, the estimated statistical association between Medicare operating costs and the resident to bed ratio should decrease.

2. **DRG prices:** The current set of DRG prices (or relative cost weights) are derived using an algorithm developed by HCFA. To set prices, HCFA estimated the average cost of each DRG by adjusting the average billed charge for each DRG with information from the hospital cost reports. Essentially ancillary costs were distributed across the DRGs on the basis of charges adjusted by departmental cost to charge ratios, and routine and special care costs by their length of stay. The data bases used to calculate these prices were the 1980 Medpar File and the 1980 Medicare Cost Reports.

It is very likely that the relative prices calculated by HCFA are compressed. In other words, the prices of the high cost DRGs are low relative to the actual cost while those of the low cost DRGs are likely to be overpriced.[16] Three factors contribute to this compression. First, there is, as noted above, significant error in the MedPAR data base—thus the estimated cost of a given DRG will be based on patient charges for both patients who are accurately coded in a DRG and those who are inaccurately coded. Second, the price setting algorithm implicitly assumes that the per diem routine costs and per diem special care costs are the same for each DRG. However, to the extent that the level of routine and special care costs are affected by case-mix, this algorithm will lead to a relative underpricing of the high cost DRGs (and overpricing of the low cost ones).[17] Finally, there is considerable anecdotal evidence that, at least until recently, hospitals subsidized the prices of specialized high cost procedures.[18] To the extent this practice is pervasive, the adjusted cost for the truly high cost patients who are likely to use high cost services will be set relatively low.

The compression of the DRG prices will lead to an underestimation of the size of the case-mix index in hospitals that treat a high proportion of high cost patients while it will lead to an overestimation of the size of the case mix index in hospitals with proportionately more low cost cases. Again if the magnitude of the case mix indices of hospitals with large teaching programs are underestimated, then some of the effect on operating cost that was in fact due to case-mix would be attributed to the resident to bed ratio. Much of the source of error in the DRG prices should be eliminated if the prices are reestimated using more accurate diagnostic codes.

3. **Limitations in the DRGs:** The DRGs classify patients into one of 468 groups for payment purposes. Data used to group patients into DRGs are restricted to information that is readily available on the hospital discharge abstract.

Grouping variables include principal diagnosis, surgical procedures, complicating or comorbid conditions (based on secondary diagnoses), age and discharge status. Some of the DRGs are collections of more homogeneous patients than other DRGs. The coefficient of variation (a rough measure of homogeneity) of patient lengths of stay or charges within DRGs ranges from under .4 to over 1.6 with the coefficients of variation of the surgical DRGs being considerably smaller than those of the medical DRGs.[19] While part of the observed variation is attributable to coding errors and part due to varying levels of inappropriate care, some of it is due to the fact that some DRGs are aggregations of patients with very different resource needs. The less homogeneous the patients are within a given DRG, the more likely it is that hospitals will not get a random mix of patients within that DRG.

A number of people, including the Secretary in the *Report to Congress* and the Senate Finance Committee, argue that the teaching hospitals do not serve a random sample of patients within each DRG. They argue that teaching hospitals are likely to attract the sicker and more severely ill or the more difficult to diagnose patient. Research by Horn and by Knaus, et al provides support to these arguments.[20] However, research by Coffey and Goldfarb suggests that, based on disease staging, teaching hospitals do not treat a more severely ill patient population. To the extent that the DRGs fail to classify patients accurately and to the extent that the more costly patients within a DRG are treated by hospitals with large teaching programs, then some of the effect on operating costs that is due to patient mix will be attributed to the number of residents per bed.

4. **Factor Pricing:** The level of hospital costs is affected by the amount that hospital administrators pay for their "factors of production"—nurses, supplies, drugs, electricity and so forth. In the statistical analysis of the factors affecting Medicare costs per case, the only factor price that was taken into consideration was hospital wages—using a single wage index for an SMSA or for the rural areas of a state. However, there can be considerable variation in wages within an SMSA. The wages of workers who work in the central city are often higher than those in the suburban ring. For example, in a study of hospital costs in five metropolitan statistical areas it was found that wages were an average 17 percent higher in the county that formed the metropolitan core than they were in the suburban ring.[22] Thus, to the extent that hospitals with large teaching programs are more likely to be located in the central city, the estimated effect of residents per bed on Medicare operating costs will be slightly overestimated.

As noted above, labor is not the only factor of production which is used in the production of inpatient services. Food, energy, drugs, and so forth are also used. While some of these products are purchased in national markets, others are purchased locally. Regional price indices for factors of production other than labor are not currently available. However, cost

of living indices published for the major cities indicate that the price of food and electricity vary regionally, with higher prices often found in the Northeast.[23] Given that 39 percent of COTH member hospitals are located in the Northeast compared to 13 percent of nonmember hospitals, the omission of factor prices other than labor may lead to a slight upward bias in the estimated effect of residents per bed on costs, although this bias would be very small.

5. **Indirect Teaching Costs:** The indirect costs of teaching may be defined as those additional costs that are incurred by a hospital because it is engaged in graduate medical education and because it has a large number of residents directly involved in patient care. These costs do not include the easily identifiable direct costs such as the salaries paid to the teaching physician and the salaries of residents themselves.

The true indirect costs are inherently difficult to identify—which is the reason that statistical analysis is used to estimate them. However, one major source of these costs is the increased use of ancillary services in the provision of patient care. Almost all investigators have concluded that, controlling for the patient diagnosis, more ancillary services are provided in teaching hospitals.[24] One study, for example, found that the average charge for patients with congestive heart disease was 14 percent higher in teaching units than in private units with most of the difference attributed to the increased use of ancillary services.[25] A second study found that, within the study hospital, service charges were 60 percent higher on the teaching floors than on the nonteaching floors. (The researchers believed that the patients were comparable.)[26] Still a third study, which compared patient care patterns in a teaching hospital with those of a nonteaching hospital, found that charges were higher in the teaching hospital with most of the difference being attributable to the greater frequency of diagnostic testing.[27] The list could go on.

This increased use of ancillary services is primarily due to four factors: (1) the residents' relative inexperience and the fact that some of the extra testing represents learning by doing; (2) the tendency in teaching hospitals to try to make a more accurate diagnosis for both educational purposes and to satisfy the more academically minded physicians' "need to know" even in those circumstances where treatment will not be modified by the finding;[28] (3) the increased availability of state of the art testing facilities; and (4) the fact that very sick patients may be treated much more aggressively in these institutions.[29]

The increased use of ancillary services is thus highly correlated with the number of residents per bed. However, it must be pointed out that the increased use of ancillary costs will not be directly translated into a proportionate increase in ancillary costs since the marginal cost per test is generally low.

There are no doubt other costs that teaching hospitals incur because they have large teaching programs. These include factors such as more extensive and much more expensive medical record keeping, more complete medical libraries and so forth. In addition, because they have large teaching programs, these hospitals may feel that they are under more pressure to introduce state of the art technology with its higher costs.

These five factors are not the only ones that influenced the 1981 estimated statistical relationship between residents per bed and costs, but they are surely the most important ones. Thus it is likely that, if a better case mix classification system were available, if better cost weights were calculated and if more attention were paid to the different factor markets, the estimate of the association between Medicare costs per case and residents per bed would be less than "5.79" percent. How much less it is hard to say, but it would be surprising if it fell below 5 percent.

The Indirect Costs of Medical Education Considered Further

The term "indirect costs of medical education" has become increasingly murky over time. The discussion above should suggest that there are at least three ways in which this term is used. One is a *concept* which suggests that even after the direct costs of education are taken into account, the costs of providing patient care—to similar type patients—will be higher in hospitals with large graduate medical education programs. The second is an *estimate.* It is an estimate of the relationship between costs and residents per bed after controlling for other factors that are expected to influence hospital costs. The *estimated* relationship of the pure indirect effect of graduate medical education will depend on the other variables included in analysis; both the type of variables and how they are measured.

The third is a payment which is added to the standard DRG payment in order to both pay for the indirect costs of graduate medical education and to compensate for problems with the current DRG classification system. In practice this payment also compensates for some of the limitations in the current method of adjusting for factor price differences across geographic areas. The size of the payment is related to the estimated statistical relationship between costs and the resident to bed ratio. In fact, the estimated relationship is doubled.

Under the current prospective payment system, as noted above, the adjustment is tied to the size of the relationship between Medicare operating costs per case and residents per bed obtained from an analysis in which MSA size, hospital bed size, MSA wages or state rural wages and the Medicare case-mix index are used in the analysis. The payment adjustment is obtained by *doubling* the estimated size of the relationship. With the exception of these payments, the

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level of the payment that a hospital receives for a given DRG will depend on its location (urban, rural) and area wages.

The design of the current prospective system and the payment adjustment for the indirect costs for medical education is inherently flawed. It is flawed first because it uses inadequate methods to adjust for differences in the economic environment in which hospitals provide care. In addition it is flawed because it ties the increased payments to teaching hospitals—payments designed to compensate them for unmeasured differences in their patient population—to the number of residents per bed and because the payment adjustment is *higher* than the estimated cost relationship between residents per bed and costs.

The design of the system leads to a somewhat inequitable allocation of Medicare payments among hospitals.

Suppose there is a large community with two 1200 bed hospitals. One hospital has 400 residents in training, while the other has 120. The first hospital will receive 20.8 percent more per DRG than the second although they are probably treating the same kinds of patients and pay the same amount for nurses, etc. On the other hand, two urban teaching hospitals located in the same MSA with the same size graduate medical program will receive the same payment per DRG although the one located in a suburban county probably faces lower labor costs than the one located in the central city.

These flaws, which have lead to a large payment to hospitals under the rubric "indirect costs of medical education," are likely to give rise to three quite different kinds of responses.[30]

First, given the intention of Medicare to limit the overall payments to hospitals, the relative financial advantage of institutions with large graduate medical education programs is likely to be perceived as unfair by other hospitals. Thus, these hospitals are likely to attack the double teaching adjustment in the same way that the Federation of American Hospitals attacked the federal Medicare waivers to the four rate setting states.[31] The reduction in Medicare payments to hospitals with large teaching programs would be offset by payments to those with none. Recently released data by HCFA is likely to encourage this response. HCFA reported in testimony to the Subcommittee on Health of the Senate Finance Committee that, "Our simulation indicates that approximately $204 per case would be withheld from all hospitals so that all teaching hospitals could receive an average of approximately $613 per case for indirect medical education."[32] These numbers, however, exaggerate the extent to which payments for indirect medical education affect the distribution of Medicare payments among hospitals for a given Medicare budget. If there were no payments for the indirect medical education adjustment, then the standardized DRG payments for all hospitals—including those

hospitals with major graduate medical education programs—would increase and significantly larger DRG payments would flow to teaching hospitals, though the distribution of the payments among teaching hospitals might be different.

Second, separating the adjustment for the "indirect teaching costs" from the actual DRG rate and paying it as a lump sum makes the payment vulnerable as a source of federal budget savings. Thus it is only a matter of time before there is a pressure not only to reduce the size of the adjustment but also to coordinate the adjustment with federal manpower policies. For example, residents in specialties that are considered to be in excess supply could be eliminated from the count of residents used as the basis for the adjustment.

Third, other things being equal, residents are now a significant source of income. Given that residents salaries are included in the direct medical education pass through, hospitals may have strong incentives to try to increase their number of residents.[33] One way that a hospital can attract more residents is to increase their salaries, and thus it can be expected that there will be upward pressure on such salaries as the market begins to work. (This incentive, however, will be dampened if there is increased price competition among hospitals as a result of private sector initiative such as the promotion of HMOs or preferred provider organizations.)

A significant reduction in the size of the adjustment, however, will not eliminate those problems that generated the doubling in the first place.

The doubling arose because under the Secretary's original proposal, hospitals with large graduate medical education programs would have been disproportionately "penalized." From the perspective of time, it is clear that it is not understood that the reason for their being disproportionately penalized under that proposal was as much due to the failure of PPS to adjust for factor cost differences as it was to the inadequaceies of the case-mix classification system. One consequence of the doubling is that the "true indirect costs" of graduate medical education are exaggerated and that the political debate over the issue has become distorted.

Possible Evolution of the Prospective Payment System

In order to rectify some of the problems discussed above, it is ncecessary to make some changes in the design of the prospective payment system. These changes should make the system more equitable and help promote the efficient delivery of hospital services. It should be noted that many of the steps needed to implement these changes are already on the HCFA agenda.[34]

The first step is the most obvious one and one that HCFA can be expected to take. As soon as HCFA has at least 6 months of discharge data reported under PPS, it should recalibrate the DRG cost weights and

then recalculate each hospital's Medicare case-mix index. Since the reporting of diagnostic information was meaningful during that time period, the amount of error embedded in the data should decrease. Thus the DRG cost weights should improve and the estimated individual hospital's case-mix index be more accurate. Then HCFA should reestimate the teaching adjustment factor. One would expect that with more accurate case-mix data, the estimated value of the association between Medicare costs and the resident to bed ratio would decrease.

The second step is to modify the structure of the current DRGs. Some of the current DRGs are too heterogenous to be used in a payment system. In addition, the associated failure of the DRGs to adjust for severity will become more pernicious as the hospital specific component of the prospective payment system is phased out. Two short term possibilities should be explored. The first is to experiment with modifying the current DRG system based on information from other case mix classification systems based on discharge diagnosis such as staging[35] or patient management categories.[36] Second, the phase-in period would help to alleviate problems due to the classification system only if the actual case-mix of a given hospital were reasonably stable over time. In the long run, a new approach to classifying patients may be desirable. Research on reliable methods of severity measurement and on the development of classification systems that provide more clinically specific categories should be a top priority.

The third step is to improve the method used to estimate the DRG relative cost weights. Particular effort will have to be directed towards methods for allocating the routine and special care costs across the DRGs. (The other two factors that were identified above as causing problems with the current DRG cost weights—errors in patient discharge codes and cross price subsidization—should fall in importance over time as a result of both the Medicare PPS and increased competition among hospitals due to changes in private financing.)

The fourth step is to determine why hospital costs are so much higher in the larger Metropolitan Statistical Areas. As noted earlier, controlling for wages, residents per bed and the Medicare case-mix indices, HCFA analysts found that Medicare costs per case varied significantly with the size of the urban area. They found that hospital costs in urban areas of over a million population were 10.9 percent higher than hospitals located in rural areas; while hospitals located in urban areas with 250,000 to 1 million people, and those in urban areas with less than 250,000 population were 2.6 and .1 percent respectively more expensive. Subsequent research indicated that hospital costs in SMSAs with over 2.5 million people are significantly higher than those of hospitals located in areas from 1 to 2.5 million people.[37] Some of this cost differential may be due to unmeasured case mix differences. Most however, is likely to be due to the fact

that the majority of hospitals in larger urban areas are located in the central city portion of the MSA and need to spend more on security and employee wages generally. Whatever the reason, if the size of the urban area is not taken into consideration, then *all* hospitals in those areas will be relatively adversely affected. One way to adjust for those differences, would be to treat each MSA as a separate group for rate setting purposes or to expand the number of locational factors used to set the national rates from two (urban/rural) to possibly 5 groups based on SMSA size. The first approach would be administratively complex while the second would exacerbate the boundary problem (hospitals in one MSA could receive significantly lower DRG payments than hospitals in a slightly larger MSA.) A different approach would be to slow down the phase in period.

A fifth step is to improve the information on factor prices. While HCFA is already engaged in a study to improve the wage data, it should also be encouraged to collect data on other factors of production that are purchased in local areas. In addition, the relevant geographic area used to adjust for factor price differences should be reconsidered. Currently, the MSA is the relevant geographic area for determining wage differences. However, as noted above, wages in the core county are often higher than wages in the counties making up the suburban ring. If this wage differential is not taken into consideration, then hospitals located in the core county will be adversely impacted. The problem of defining the relevant market area for assessing factor price differences is especially serious. The current urban subdivisions are defined as aggregates of counties which are historical political artifacts. (Similar problems exist among and within the rural counties of states.) However the setting of different wage indices for different areas within an MSA would again create a major boundary problem. Two hospitals across the street from each other, one in the suburban ring and the other on the perimeter of the core county, could receive quite different payments for a given DRG.

Thus, there are many modifications that will have to be made in the design of the prospective payment system. The first three steps relate to changes that will have to be made in the patient classification system and the mechanism for setting relative payments. The fourth and fifth steps relate to methods for adjusting for geographic variations in factor costs that depend on location. For Medicare, a national system, at least as much attention must be given to the last two steps as to the first three. One way of underlining the importance of the last two steps is that even if it were possible to develop a perfect classification system and an accurate set of relative prices for the DRGs, hospitals in the large MSA's and in the core counties within the MSAs (many of which are teaching hospitals) would be relatively adversely impacted under a national prospective payment system as currently designed.

Hospitals with large medical education programs would be relatively adversely impacted even if they received a payment adjustment for the "true" indirect costs of medical education.

A satisfactory completion of these steps may be impossible and Medicare may seek methods of delegating the payment decisions. Two separate approaches are feasible. First, the federal government could encourage the establishment of state rate setting programs. In this case the methods for paying hospital care would be determined by the states. Second, Medicare could establish capitated systems for Medicare beneficiaries—in which case the organization responsible for providing services would also be responsible for negotiating with hospitals the amounts to be paid for hospital care. Neither of these approaches solves the problems of how to pay hospitals, but they do decentralize the decision to entities that are more able to take local market conditions into consideration.

In addition to the five steps just discussed, HCFA should undertake a study which compares the variation in hospital costs per admission with the total cost of an illness episode. It is possible that the higher costs incurred by the ancillary-intensive teaching hospital admission are offset, at least partially, by the use of fewer medical services during the illness (e.g., fewer re-admission or fewer ambulatory care services) or by fewer days of restricted activity for the patient. No study has examined the costs of teaching and non-teaching hospitals in light of the patient's total illness costs; such a study is needed and should be on HCFA's research agenda.

VI. Summary and Conclusions

The adjustment for the higher costs of teaching used in establishing the routine 223 limits was a reasonable step to take in 1980. The label attached to this adjustment, however, was misleading. The adjustment took into account not only the higher costs associated with medical education but also unmeasured cost factors that were correlated with the number of residents per bed. The continuation of an adjustment for indirect costs under prospective payment was also a reasonable step to take in 1983. However the magnitude of the adjustment made in 1983 was less justifiable and of considerably more importance to the hospital industry than the one made in 1980. It was less justifiable because it resulted from a pragmatic decision to double an estimated number, and it was of considerably more importance because the amount of dollars at issue was considerably higher.

The current adjustments are somewhat larger than would be considered equitable when the payment rates for all hospitals are considered together, and they lead to an inequitable distribution of Medicare payments across hospitals, not only between teaching and nonteaching hospitals but also across teaching institutions. However, it must be remembered that the size of the current adjustment is partly a consequence of an initial decision to take only a limited number of geographic factors into consideration in setting the payment rates.

The magnitude of the payments made under the rubric of the indirect costs of medical education is likely to make the adjustment a subject of attack by other hospitals. In addition, these payments are likely to be considered as a potential source of budget savings by the Administration and Congress. Nevertheless unless differences in the types of patients treated and the differences in factor prices in the markets where teaching hospitals are concentrated are taken into consideration, any significant lowering of the resident to bed adjustment may put a disproportionate number of teaching hospitals at significant financial risk. Innovative methods for accounting for these factors must be developed if the prospective payment system is to be sustained. This paper has made some suggestions on how to proceed.

The current experiment in hospital pricing under Medicare and the increase in competition in the private sector represent a radical change in the financing of hospital services. This is an experiment that only America has dared to try. No other country has attempted to develop fee schedules for in-patient hospital care. We are sailing an uncharted sea, and must sail carefully.

FOOTNOTES

1. Federal Register. *Medicare Program; Proposed Schedule of Limits on Hospital Inpatient General Routine Costs for Reporting Periods Beginning on or after July 1, 1980.* Vol. 45, No. 4.

2. This number was derived from information included in a statement by Henry R. Desmaris, Director, Bureau of Eligibility, Reimbursement and Coverage, Health Care Financing Administrator before the Subcommittee on Health, Finance Committee, U.S. Senate October 1, 1984.

3. There was an effort to determine whether the higher routine per diem costs in teaching hospitals were associated with a more costly case-mix. This effort was not fruitful because an appropriate case-mix index was not available.

4. Federal Register. *op. cit.* p. 21584.

5. Alternatives considered and rejected included paying teaching hospitals the same DRG rate as nonteaching hospitals, making the indirect Graduate Medical Education (GME) adjustment a function of the direct GME pass through payment and setting a flat rate per resident per bed.

6. Secretary of Department of Health and Human Services. *Hospital Prospective Payment for Medicare: A Report to Congress.* Washington, D.C., December 1982, pp. 47-48.

7. *Ibid.* pp. 48-49.

8. The actual estimating equation is:

$$lnCPC = 7.32 + 1.011 \ lnCMI + 1.022 \ lnWage$$
$$(29.63)$$
$$+ .579 \ lnR + .119 \ lnBeds + .0007 \ SCV$$
$$(12.72) \qquad (24.43) \qquad (.58)$$
$$+ .026 \ MCV + .109 \ LCV \qquad R = .75$$
$$(5.29) \qquad (60.67)$$

Where

CPC is the Medicare operating cost per case; CMI is the Medicare case-mix index; wage is the wage index; R is Residents per bed; beds is hospital bed size; SCV is urban area with a population of less than 250,000; MCV is urban area with a population of 250,000 to 1,000,000, and LCV is urban area with over 1,000,000 population and ln represents natural logarithm.

9. Senate Finance Committee Report. *Social Security Amendments of 1983.* Report No. 98-23. Washington, D.C. March 11, 1983 p. 52.

10. Department of Health and Human Services, Health Care Financing Administration. "Medicare Program: Prospective Payments for Medicare Inpatient Hospital Services, Interim Final Rule with Comment Period." *Federal Register,* Thursday, September 1, 1983, p. 39778.

11. These results are given in footnote 8 above.

12. The reason for this is quite technical. Statistically, if there is a variable that is excluded from the model that affects hospital costs, and which is also directly related to one of the variables in the model, the coefficient of the included variable will be biased upwards to include the effect of the omitted variables.

13. The Institute of Medicine estimated that approximately 20 percent of the records in the file used by HCFA to construct the case-mix index had an erroneous principal diagnosis at the DRG level. Institute of Medicine. *Reliability of Medicare Hospital Discharge Records.* National Academy of Sciences. NTIS. PB 281680, November 1977.

14. J. Pettengill and J. Vertrees. "Reliability and Validity in Hospital Case-Mix Measurement." *Health Care Financing Review* 4 (2), 1982: 101-127.

15. Personal Communication, James Bentley, Department of Teaching Hospitals, AAMC.

16. Judith R. Lave. "Note on the Compression in the HCFA DRG Prices." Unpublished paper, University of Pittsburgh, 1984.

17. Work by Fitzmaurice indicated that routine per diem nursing salaries, a major component of routine costs per day, are significantly related to the Medicare case-mix index. See M. Fitzmaurice. "A Statistical Analysis of the Medicare Routine Nursing Differential." *Health Care Financing Review.* 5 (1) 1983: 45-64. Additional evidence on this issue is presented in J. Thompson. "The Measurement of Nursing Intensity." *Health Care Financing Review.* In press.

18. Office of Technology Assessment. *Diagnosis Related Groups and the Medicare Program.* Implications for Medical Technology. Washington 1983.

19. Unpublished data. Bureau of Data Management and Strategy. HCFA.

20. S. Horn. "Measuring Severity of Illness: Comparisons Across Institutions." *American Journal of Public Health.* 73(1), 1983:26-31. E.A. Draper, D.P. Wagner, and W.A. Knaus. "The Use of Intensive Care: A Comparison of a University and a Community Hospital." *Health Care Financing Review.* 3(2), 1981:40-64.

21. R. Coffey and M. Goldfarb. "DRGs and Disease Staging for Reimbursing Medicare Patients." Working Paper. National Center for Health Services Research, 1984.

22. J.L. Ashby. *The Inequity of Medicare Prospective Payments in Large Urban Areas.* District of Columbia Hospital Association. September 1984.

23. J.R. Lave. "Hospital Reimbursement Under Medicare." *Milbank Memorial Fund Quarterly.* 62(2), 1984:251-268.

24. The one exception is a paper by Becker and Sloan which reported no difference in the use of ancillary services between teaching and nonteaching hospitals. See. E. Becker and F. Sloan. "Utilization of Hospital Services: The Roles of Teaching, Case-Mix and Reimbursement." *Inquiry.* 20(3), 1983:248-264.

25. M.L. Garg et al. "Reimbursing for Residency Training, How Many Times." *Medical Care.* XX(7), 1982:719-726.

26. E.W. Martz and R. Ptakowski. "Educational Costs to Hospitalized Patients." *Journal of Medical Education.* 53(May) 1978:383-38.

27. S.A. Schroeder and D.S. O'Leary. "Differences in Laboratory Use and Length of Stay Between University and Community Hospitals." *Journal of Medical Education.* 52(5), 1977:418-420.

28. D.B. Reuben. "Learning Diagnostic Restraint." *New England Journal of Medicine.* 310(9), 1984: 591-593.

29. A. Garber, V. Fuchs and J. Silverman. "Case Mix, Costs and Outcomes." *NEJM.* 310(19), 1984.

30. Some of these same issues are described in M.E. Whitcomb. "The Federal Government and Graduate Medical Education." *The New England Journal of Medicine.* 310(20), 1984:1322-1324.

31. Federation of American Hospitals "Potential Inequities of Medicare Waivers" Statement. No date. Washington, D.C.

32. Henry R. Desmaris. *op cit* p. 8.

33. J. Newhouse "Two Prospective Difficulties With Prospective Payment for Hospitals, or It's Better to Be a Resident Than a Patient With a Complex Problem." *Journal of Health Economics.* 2(3), 1983:269-274.

34. S. Jencks et al. "Evaluating and Improving the Measurement of Hospital Case-Mix." *Health Care Financial Review.* Annual Supplement. 1984 in press.

35. J.S. Gonnella, M.C. Hornbrook and D.Z. Louis. "Staging of Disease: A Case Mix Measurement." *JAMA.* 1984.

36. W. Young et al. "Hospital Case Mix: Development and Implementation." Health Care Research Department, Blue Cross of Western Pennsylvania. Pittsburgh 1983.

37. G. Anderson and J. Lave. "The Costs of Teaching Hospitals." Work in Progress.