Hospital Payroll Costs, Productivity, and Employment Under Prospective Reimbursement

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This paper reports preliminary findings from the National Hospital Rate-Setting Study regarding the effects of State prospective reimbursement (PR) programs on measures of payroll costs and employment in hospitals. PR effects were estimated through reduced-form equations, using American Hospital Association Annual Survey data on over 2,700 hospitals from 1969 through 1978. These tests suggest that hospitals responded to PR by lowering payroll expenditures. PR also seems to have been associated with reductions in full-time equivalent staff per adjusted inpatient day. However, tests did not confirm the hypothesis that hospitals reduce payroll per full-time equivalent staff as a result of PR.

Introduction

In 1972, Congress amended the Social Security Act with the passage of Section 222(A) which encourages States to establish prospective rate-setting programs for hospital reimbursement. The burden of hospital cost inflation on State and Federal health expenditures provided the impetus for this legislation.

State agencies empowered to set prospective reimbursement (PR) rates have some control over how much hospitals may earn from certain patient revenue sources during the next year. Traditional retrospective reimbursement, which is determined by charges incurred in the previous year, pays either all or a prescribed fraction of any cost increases claimed by a hospital. Prospective reimbursement makes hospitals liable for cost increases above the levels approved prior to expenditure. To protect its financial position under PR, a hospital must either generate enough additional nonpatient revenue to cover unanticipated cost increases or find ways to contain operating costs. PR can be judged successful if costs decline without a reduction in health care quality or access.

The National Hospital Rate-Setting Study (NHRS)—funded in 1978 by the Health Care Financing Administration—has begun to analyze State PR programs to determine whether or not PR affects hospital cost-cutting behavior. Preliminary findings, reported in a paper by Coelen and Sullivan (1981), suggest that it does. Total *per diem* expenditures decreased as much as 10.5 percent in Maryland after the institution of a mandatory version of PR in 1976. Post-PR costs declined in all programs studied. The smallest effect was 2.7 percent for the version of New York's program that was instituted in 1971. On the other hand, NHRS's preliminary evidence also indicates that hospitals in some States may have responded to PR by increasing the volume of inpatient admissions and days (Worthington, 1980), and by reducing levels of services (Cromwell and Kanak, 1980).

A study of PR effects on payroll and labor productivity provides a useful supplement to the analysis of PR and costs. Payroll is a major line item making up over one-half of total expenditures for most hospitals. In addition, labor costs tend to be easier to adjust in the short run than fixed costs of buildings and equipment. Hospitals may cut labor costs by reducing staff, by finding ways to make existing staff more productive, and by resisting pressures to increase wages. Thus, a study of staffing composition and productivity, through the integrated set of tests in this paper, helps describe one facet of the hospital response to PR. All of the preliminary NHRS studies, including results for payroll costs and employment reported here, test simple hypotheses about hospital responses to PR. In later work by the NHRS, hypotheses that were strongly supported in preliminary analyses will be explored in greater detail.

The following discussion begins with a brief review of previous research into PR effects on payroll cost and employment and then describes the formal characteristics of State programs. Four research hypotheses follow, with a specification of the analysis variables constructed to test these hypotheses. After a description of methodology and data sources, the results of the tests are presented and discussed.

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Research on Hospital Labor Costs and Prospective Reimbursement

The literature on hospital labor expenditure analyzes the components of labor cost defined in the hypotheses of this paper: productivity, earnings (wages) per employee, and staff skill-mix.

Productivity

The evidence on levels of hospital productivity under PR is not conclusive. Some studies (Spectrum, 1978: [Indiana], and Applied Management Sciences, 1975: [Western Pennsylvania]) argue that PR raises productivity. A study of the downstate New York program suggests that PR arrested a decline in productivity (Dowling *et al.*, 1976). The Abt Associates' 1976 study of upstate New York (Cromwell *et al.*, 1976), however, finds a negative estimate of the PR effect on productivity. Though the estimated effect was statistically insignificant, Geomet's 1974 New Jersey study reached the same conclusions.

Earnings (Wages) Per Employee

Researchers readily perceive a PR effect on earnings but do not agree on whether the effect is positive or negative. Most studies associate PR either with lower earnings per full-time equivalent (FTE)[1] (Sloan and Steinwald, 1978; Sloan and Steinwald, 1979; and Spectrum, 1976) or with slower annual rates of wage inflation (Applied Management Sciences, 1975). Early New York studies, however, found higher wage levels (Cromwell *et al.*, 1976) and more rapid wage inflation (Dowling, 1976) in hospitals covered by PR.

Skill-Mix

Few studies have analyzed hospital staffing patterns; only one looked at PR effects on skill-mix in hospitals. Jensen *et al.* (1980) show that ratios of registered to licensed practical nurses declined but that ratios of registered nurses to other types of staff increased.

These studies of PR labor cost effects conclude that hospitals act differently after PR is established. However, most studies assess State PR programs without accounting for changes made over time which have tightened the rate-review process. They used different measures of productivity and earnings and tested hypotheses with a variety of statistical models. The advantage of the NHRS study lies in its scope (many separate State programs can be compared, using standardized measures and methods) and in its time coverage (most programs were begun or strengthened in the period 1974-1976, leaving two to three years of subsequent PR experience for analysis).

Rigor and Effectiveness of PR Programs

The literature demonstrates that the size and direction of estimated PR effects vary considerably among States. In part, this variation is due to differences in rigor and effectiveness among State programs.

Table 1 condenses and simplifies characteristics of 10 State PR programs for which this paper presents statistical tests. In general, the cost-containment effects of PR should be most effective with programs under mandatory budget review and compliance and which set explicit payment rates; programs that control total rather than per unit revenues or charges, based on a thorough review of departmental costs; programs that cover all payers rather than a few; and programs that impose utilization controls to limit hospitals' ability to raise revenues by increasing lengths of stay. In addition, automatic screens that identify "excessive" increases in wages, fringes, employment, and payroll costs should promote control of employment costs.

The information in Table 1 suggests that New York, Maryland and Minnesota have most of the characteristics associated with rigorous, effective PR programs. Arizona, Indiana, and Kentucky rely on voluntary measures and limited payer coverage and appear to be least rigorous. The mix of characteristics in the other States precludes any reasonable ranking.

In practice, two States with identical PR program characteristics may operate quite differently. Informal bargaining between rate-setters and hospitals, with interim changes in rate decisions, may weaken a process that appears to be mechanical and final. Agreements between union groups and rate-setting commissions on collectively bargained wage raises may pass through as allowable charge rate increases, as in New York. On the other hand, Maryland's rate-setting agency works informally with the parties involved during negotiation to promote wage settlements that are "acceptable" from the public point of view.[2] Union activity complicates an already complex, dynamic, political process. Unions, hospital administrators, and rate-review authorities are drawn, by the requirements of PR, into general or sequential bilateral bargaining. The resolution of disputes may then occur through heightened conflict and third-party intervention (mediation or arbitration).

[1] "Full-time equivalent" in this paper follows the American Hospital Association's definition. Each full-time employee counts as one FTE, and each part-time employee counts as one-half FTE.

[2] Information on labor-related activities of various State rate-setting agencies may be found in case studies compiled by the National Hospital Rate-Setting Study (Hamilton *et al.* 1980).

TABLE 1

Prospective Reimbursement Program Characteristics[1]

State	Authority and Enforcement	Revenue Review	Payer Coverage	Utilization Control	Labor Screens and Guidelines
New York	Mandatory review and compliance; legal sanctions, set payment rates	Set *per diem* (Medicaid and Blue Cross); charge increase (others); review routine and ancillary costs	All but Medicare	Occupancy, length of stay	Voluntary wage increase guidelines
Maryland	Mandatory review and compliance; legal sanctions	Set department unit revenue; review department level revenue	All payers	None	Voluntary wage increase guidelines
New Jersey	Mandatory review and compliance; legal sanctions, set payment rates	Set per diem; review department level costs	Medicaid Blue Cross	None	Voluntary wage increase guidelines
Washington	Mandatory review and compliance; legal sanctions, set payment rates	Set total patient revenue; review department level costs	All payers	None	Screens on wages, employment and labor cost
Connecticut	Mandatory review and compliance; legal sanctions	Set total patient revenue; review department level costs	Commercial and self-pay	None	Voluntary wage increase guidelines
Massachusetts	Mandatory review and compliance; Medicaid payment rates, weak legal authority over charge-based payers	Set Medicaid *per diem*, charge-based total patient revenue; review capital and operating budgets	Medicaid, commercial, and self-pay	Occupancy (Medicaid)	Voluntary wage increase guidelines
Arizona	Mandatory review, voluntary compliance; no legal sanctions	Set total patient revenue and some charge rates; review aggregate costs	Blue Cross, commercial, and self-pay	None	None
Minnesota	Mandatory review, voluntary compliance; no legal sanctions	Set total patient revenue; review aggregate costs	Blue Cross, commercial, and self-pay	None	Screens on wages, employment, and labor costs
Indiana	Voluntary review and compliance	Individual contracts; budget review	Blue Cross	None	None
Kentucky	Voluntary review, mandatory compliance	Individual contracts; budget review	Blue Cross	None	None

[1]Program details are not included for Western Pennsylvania, one of the original core study areas, which proved to show no statistically significant PR effects in any part of the labor analysis. Two secondary States, Indiana and Kentucky, demonstrated significant PR effects, and their program characteristics are included.

Although formal program characteristics do not fully define effectiveness, they supplement statistical findings and help pinpoint areas that need further research. If a voluntary PR program is demonstrably more effective in reducing employment costs than the most rigorous mandatory program, then more institutional detail or a more refined statistical model is needed to explain this anomaly.

Hypotheses

Research Hypotheses

If prospective reimbursement encourages hospitals to cut costs, the following "story" suggests some testable hypotheses that relate PR to employment, productivity, and payroll:

- Hospitals decide to cut total costs.
- Hospitals elect to concentrate on *unit labor costs*, (payroll per adjusted patient day[3]) in making the cut. This appears logical because staff reductions may be more easily achieved than reductions in overhead costs such as utilities and interest payments. Moreover, payroll comprises over half of most hospital expenditures, and reductions here will have an important effect on total costs.
- Cost reductions occur through some or all of the following measures:
  —cutting back staff, keeping wages and "output" (measured in this study as adjusted patient days) constant;
  —increasing the number of adjusted patient days supplied by existing staff, keeping wages and the resource intensity of an average patient day constant;
  —cutting or restraining the rate of increase in wages.
  The first two steps increase *labor productivity* by increasing the output (patient days) produced by a given input (an FTE staff person). Without wage change, higher productivity results in lower unit labor cost (more days for the same dollar value of payroll). The last step reduces *payroll* for existing staff by cutting wages or earnings without changing productivity.
- As adjustments occur, the *composition of hospital staff* may change. Staff reductions are least likely to hit the core medical staff. For example, the proportion of registered nurses on hospital payrolls is likely to rise. The justification for this argument is based on circumstantial evidence. Hospitals have historically complained of RN shortage, even as the supply has increased. In a cost-cutting "crunch," it is reasonable to suppose that administrators will try to protect RN jobs while achieving economies through reductions in staff thought to be less critical to the hospital's medical care function.

The four hypotheses tested in this paper are:

- *unit labor costs* decrease in hospitals under prospective reimbursement;
- *labor productivity* increases in hospitals under prospective reimbursement;
- *payroll per employee* decreases in hospitals under prospective reimbursement; and
- *hospital staff composition* changes, showing a larger proportion of registered nurses in hospitals under prospective reimbursement.

Measurement of Analysis Variables

The analysis variables that will be used to test the four hypotheses of this study are:

Unit Labor Cost. Ideally, labor cost should combine payroll with a measure of hospital output to capture the multiproduct nature of hospital activity (patient care, teaching, research, and community service). A multiproduct output index is not available which necessitates the use of adjusted patient days (total inpatient days plus "day equivalents" of outpatient visits),[3] a measure of output frequently used by researchers and the hospital industry. Unit labor cost is measured by *total payroll*[4] *per adjusted patient day.*

Labor Productivity. Productivity measures the output that can be produced from a given amount of input. An "ideal" measure of productivity would compare levels of staff and other inputs, such as equipment and supplies, to an index of output. Many economic studies use only labor productivity because labor's input, in terms of full-time equivalents or total person hours, can generally be measured more easily than can inputs of capital or supplies. For this paper, evidence for a labor productivity effect is demonstrated if a full-time equivalent staff person produces more adjusted patient days under PR.

A stronger test of rate-setting's productivity implications would control for changes in the *quality* of patient days, because hospitals might achieve apparent productivity gains by admitting less costly cases or by speeding up the *process* of care at the possible expense of unfavorable *outcomes*. Tests that integrate productivity findings with studies of PR effects

[3]The American Hospital Association's weight assumes that approximately three outpatient visits are equivalent in resource requirements to one inpatient day.

[4]"Payroll" excludes staff physicians' salaries. Hospital employment of physicians does not relate systematically to cost or levels of patient care activity, because most physicians' services in U.S. hospitals are provided by private fee-for-service practitioners. Including salaried house staff would seriously misstate the "actual" physician inputs in hospitals. A separate analysis of American Hospital Association staff physician data will be conducted at a later stage in the NHRS study. Fringe benefits are also excluded from the measure of payroll used here.

on case-mix, lengths of stay, and quality of care will be conducted later in the NHRS study. We have, however, alluded to preliminary findings regarding volume effects in order to qualify the evidence from our estimated productivity effects.

A *full-time equivalent staff per 1,000 adjusted patient days* will be the preliminary measure of productivity. Higher FTE requirements per day mean lower labor productivity.

Payroll Per Employee. The price for labor is best measured by job-specific wage rates. Hospital wage data are collected and published,[5] but the geographical coverage and timing are inadequate for statistical tests of the PR hypothesis. Payroll-per-worker data must be substituted for wages, but total payroll can be affected by changes in the kinds of employees on staff whether or not there is a change in wage rates. With this caveat in mind, labor's price is measured in this paper as *payroll per 1,000 FTEs*.

Composition of Hospital Staff. Hospitals may change staff composition either to emphasize certain services or to reduce or increase specialization in the occupational structure as a tool for reducing or increasing volume. It is difficult to identify particular occupations most likely to be protected in a cost-cutting period. It was argued earlier that hospitals' preferences should be to protect the jobs of nursing staff, given a perceived shortage of registered nurses. For this reason, the preliminary measure of staff composition we shall examine is *RN full-time equivalents per total full-time equivalent staff.*

Methodology and Data

The objective of the analysis presented is to identify the overall effect, if any, that PR programs have on hospital payroll costs, staffing, and productivity. The analysis also measures the relative effects of different State programs. As noted earlier, identifying these effects helps determine how hospitals reduce total costs when faced with PR constraints.

The following estimates derive from estimations of regression equations that explain variations in costs in terms of PR and other variables. This model estimates what effect PR has on various measures but does not provide information on why these effects occur.

We shall estimate the effect of PR on *levels* of payroll per day, FTEs per day, and other analysis variables. An alternative specification, to be explored later, will estimate PR effects on the *rates of change* in these variables. In general, our task is to distinguish shifts that are not attributable to changes in measureable characteristics of sample hospitals, differences among market areas, differences among States not captured by other variables, and a time trend assumed to be identical for all hospitals.

[5]U.S. Department of Labor, Bureau of Labor Statistics. *Industry Wage Survey: Hospitals and Nursing Homes* (various years).

The form of the equation used most nearly resembles a "reduced form" model, in which analysis variables are related to exogenous explanatory variables. Although this approach means that we forego an explanation of the structure of the hospital cost/productivity system, we gain a clearer test of PR's effects, as Coelen and Sullivan (1981) point out in some detail.

The general estimating equation is specified as follows:

$$Y = a_0 + a_1DS + a_2DA + a_3DSA + bX$$

In this equation, Y and X measure the analysis variable and a vector of hospital/area explanatory variables respectively. DS measures "State effects" that are not captured by the X variables. DA measures any trend in Y not associated with PR or any of the X variables. Finally, DSA measures the PR effect on Y for hospitals in a given State, identifying any shifts in the level of Y in the PR State, after a particular version of PR was introduced, that are not explained by the Xs, the time trend (DA), or the underlying unmeasured characteristics of the State (DS). In fact, the coefficient, a_3, measures the size of this shift.

This specification generalizes easily to account for the existence of multiple programs and even multiple versions of programs. Each program needs one set of DS, DA, and DSA variables. To reflect the introduction of a new version of a program, new DA and DSA variables are needed, but the DS variable used to denote the hospitals in the old version of the program will serve for the new version. If two programs are implemented at the same time, the same DA variable will serve for both. The coefficient of each DSA variable estimates the impact of the corresponding PR program.[6]

Table 2 presents and defines all explanatory variables used in the estimating equations. Note that the time trend variable DA has been measured in the series of year dummies, D70-D78. State effects (DS) are measured by D_{ss}. Finally, the PR effect, DSA, has been measured by D_{ssyy} which is identified by State and by the year in which a new PR program, or a modification of an old program, was implemented.

[6]As Coelen and Sullivan (1981) note, "The use of both study/control and pre/post data provides a much stronger evaluation design than would standard use of only study/control or only pre/post comparisons. Since numerous factors influencing hospital behavior are known to vary geographically, since data cannot be obtained on many of these (e.g., physicians' attitudes, incidence of certain illnesses) at reasonable cost, and since interstate variations in some of the variables are likely to be correlated with presence/absence of PR programs, a simple study/control comparison is almost certain to yield biased results. Nor is a pre/post comparison an adequate design, since unmeasured (omitted due to lack of data) variables are also likely to change over time. The four-way design used here does not require spatial or temporal constancy of omitted variables. It requires only that there be *no change in the difference* in omitted variables that is correlated with the implementation of reimbursement controls."

TABLE 2

Definitions of Explanatory Variables

Time/State:	
D70-D78	Dummy variables: equal 1.0 in year indicated by the two digits (e.g., 1970 for D70) *and* all later years; equal 0.0 for earlier years
Dss	Dummy variables: equal 1.0 for all years if hospital is in State ss; 0.0 otherwise (ss indicates the two-letter abbreviation of the State)
Hospital Characteristics:	
(Production)	
DBED1-DBED3	Dummy variables: 1.0 for all years for hospitals in size category indicated by number (1 = over 400 beds; 2 = 250-399 beds; 3 = 100-249 beds); equal 0.0 otherwise
DGOV	Dummy variable: equals 1.0 if hospital is operated by nonfederal government agency; 0.0 otherwise
DMEDSCHL	Dummy variable: equals 1.0 if hospital has been affiliated with a medical school for 8 out of the 10 years studied; 0.0 otherwise
DNURSCHL	Dummy variable: equals 1.0 if hospital has been affiliated with a school of nursing for 8 out of the 10 years studied; 0.0 otherwise
DPROF	Dummy variable: equals 1.0 if hospital is organized as a for-profit institution; 0.0 otherwise
(Location)	
CRIME	Crimes per 100,000 population in county in 1975 ($\bar{x}$ = 4171)
DSMSA	Dummy variable: equals 1.0 if hospital is located in SMSA; 0.0 otherwise
P	Population in county ($\bar{x}$ = 490,131)
POPDENS	Population (in 100s) per square mile in county ($\bar{x}$ = 19.6)
TEMP	30-year mean temperature in county ($\bar{x}$ = 52.8)
Population Characteristics (Demand):	
(Demographic)	
BIRTH	Births per 10,000 population in county ($\bar{x}$ = 1.544)
EDUC	Median years of educational attainment for county population ($\bar{x}$ = 11.7)
INCOME	Personal income *per capita* in county ($\bar{x}$ = 4411)
PGT65	Percent of population in county over 65 years ($\bar{x}$ = .1182)
WHITE	Percent of population in county comprised of whites ($\bar{x}$ = .9223)
(Insurance)	
AFDC	Percent of population on AFDC (Medicaid) in county ($\bar{x}$ = .0408)
COMADJ	Proportion of population covered by commercial (including Blue Cross) insurance in county ($\bar{x}$ = .7957)
POPT18	Proportion of population enrolled in Medicare Part A in county ($\bar{x}$ = .1137)
(Physicians)	
MDPOP	Active patient-care physicians *per capita* in county ($\bar{x}$ = 0.0012)
SPMD	Percent of physicians in county who are specialty physicians ($\bar{x}$ = .491)
Market Characteristics:	
(Labor)	
DFTESHR	Dummy variable: equals 1.0 if hospital's FTE share is greater than 0.5; equals 0.0 otherwise
OTHRMON	Dummy variable: equals 1.0 if FTE share of another hospital in county is greater than 00.5; equals 0.0 otherwise
UNEMRPT	Proportion of labor force in county which is unemployed
UNION	Dummy variable: equals 1.0 if hospital employees are covered by a collective bargaining agreement; 0.0 otherwise
WAGE	Average annual earnings of persons employed in service industry in county ($\bar{x}$ = 7,048)
(Product)	
BEDPOP	Total number of beds *per capita* in short-term hospitals in county ($\bar{x}$ = 0.005)
NHBPC	Total number of nursing home beds *per capita* in county ($\bar{x}$ = 0.0078)
NHOSP	Total number of short-term hospitals in county ($\bar{x}$ = 13.4)

(continued)

TABLE 2 (continued)

Definitions of Explanatory Variables

Regulatory:	
CNss	Dummy variable: equals 1.0 for those years in which Certificate of Need review was in effect in State ss; 0.0 for other years and for hospitals in other States (ss is two-letter abbreviation for the State)
DPSRO	Dummy variable: equals 1.0 for all years for any hospital with binding PSRO review (either delegated or nondelegated); 0.0 otherwise
PSRO	Dummy variable: equals 1.0 for only those years in which a hospital was covered by binding PSRO review; 0.0 otherwise
Dssyy	Dummy variables: equals 1.0 for hospital in State ss in years yy and later; 0.0 otherwise (ss is the two-letter abbreviation for a State; yy indicates the first fiscal year during which PR [or a version of PR] was in place).

Other explanatory variables were selected to control for hospital or area influences on costs, employment, and staffing that might confound the estimation of PR effects. Only variables thought to be independent of PR influence were included, in order to avoid bias associated with simultaneous relationships between the dependent and explanatory variables. Thus, a hospital's ownership status (nonprofit, profit), a variable included in the equation, would not change in response to PR, but ownership might be a factor that influences how hospitals adjust to PR. Admission levels can be affected by PR if hospitals try to generate more revenue by increasing the number of inpatient admissions and days.

All explanatory variables not categorical in nature (taking on a value of zero or one) are measured in log form. Since no prior hypotheses exist about the relative importance of different explanatory variables, regressions were estimated in stepwise fashion. Variables that show the most significant statistical relationships occur first. Variables not significant at the 10% level were dropped in this process. Runs attempted with all variables included did not alter the substance of our findings.

The sampling frame from which the 2,693 hospitals used in this study were drawn is a subset of the 8,160 hospitals for which data exist for at least one year between 1970 and 1977 in the annual survey of the American Hospital Association (AHA). Hospitals were omitted from the frame if they: were operated by a Federal agency, were not classified as general-service hospitals, were located outside the 48 contiguous States and the District of Columbia, or had median annual average length of stay (between 1970 and 1977) in excess of 15 days.[7] A 25-percent random sample was selected from the entire frame, and a supplement was drawn to provide a census for the nine study States/areas and for six other States with Statewide mature PR programs including Colorado, Indiana, Kentucky, Nebraska, Rhode Island, and Wisconsin. A total of 2,558 hospitals comprise the sample which includes some that opened or closed during the 10-year sample period, 1969 to 1978. The maximum sample size available for analysis comprises 23,576 hospital years.

Raw data on hospital characteristics were obtained from the American Hospital Association's unedited computer tapes. These data were edited and cleaned by Abt Associates staff, following procedures discussed in greater detail by Coelen and Sullivan (1981). Data on other explanatory variables were selected from a variety of sources including AMA publications (numbers of physicians), *Sales and Marketing Management* (income), census publications (population), and *Employment and Training Report of the President* (unemployment). Regulatory variables were taken from information collected by Policy Analysis, Inc. for a contract for Health Resources Administration (certificate of need), the Health Standards and Quality Bureau (professional standards review organization [PSRO] review), and case studies of the National Hospital Rate-Setting Study (PR characteristics). Area variables for each hospital were defined for the county or State in which the hospital operated.

[7] The AHA defines short-term hospitals as those having an average length of stay of less than 30 days per admission. It is very likely, however, that hospitals with long lengths of stay (20-30 days) provide different types of care and operate on a different implicit production function than do hospitals with short lengths of stay (3-10 days). To maximize the homogeneity of the NHRS sample without excluding a large group of hospitals, short-term is defined in this study as length of stay of fewer than 15 days. The median of mean length of stay across years is used to define short-term.

Effects of Prospective Reimbursement on Payroll and Employment

This section presents the results of hypothesis tests for the individual States. Based on this study's findings, a strong case emerges for the argument that hospitals cut payroll costs in response to PR, in part, by raising employee productivity.

Tables 3 through 5 show estimated levels of the different analysis variables for three years: 1969 (the first year for which the data exist), 1975 (a year around which several new or redesigned State PR programs were established), and 1978 (the last year for which the data exist). Two types of data are shown: levels and annualized percentage changes. The series for all States show average levels, corrected for changes in those hospital and area characteristics included in the estimating equations. Estimated levels for each State include the percentage effects of PR, shown in parentheses next to each State name. For example, payroll per day in Arizona was 6 percent lower after PR was implemented in 1974 (Table 3). Each table also includes annualized changes for the entire period, and separately, for the pre- and post-1975 periods. These rates were not estimated statistically, but were computed from the estimated levels.[8]

Labor Cost: Payroll Per Adjusted Patient Day

Labor cost estimates yielded the largest number of significant PR effects found in this analysis. All confirm the hypothesis that hospitals respond to PR by lowering payroll expenditures.[9] Some diversity among States exist in the size of these effects, as Table 3 shows.

[8]Only States with PR effects that proved to be significant at the 5 percent level or better were included in the tables, as footnotes indicate. This is an exacting standard, and the direction of estimated PR effects that were not significant at this level is noted. Also provided is R^2 for each of the estimating equations. Further information on these regressions is available from the authors.

[9]The alternative explanation, that quantity and quality of patient days may have changed rather than the "productivity" of hospital labor, should be noted.

TABLE 3

Payroll Per Adjusted Patient Day: Levels for All States and Estimated Prospective Reimbursement Effects in Individual States[1]

State/Year (Percent Change Due to PR)	Levels for Selected Years (Dollars Per Day)			Annual Percent Change		
	1969	1975	1978	1969-1975	1975-1978	1969-1978
All States[2]	34	56	72	+8.7	+8.7	+8.7
Arizona 1974 (−.06)	40	62	81	+7.6	+9.3	+8.2
Connecticut 1975 (−.08)	40	60	78	+7.0	+9.1	+7.7
Indiana 1960 (−.08)	31	51	66	+8.7	+9.0	+8.8
Kentucky 1975 (−.06)	29	44	57	+7.2	+9.0	+7.8
Massachusetts 1976 (−.06)	39	64	79	+8.6	+7.3	+8.2
Maryland 1976 (−.10)	37	61	71	+8.7	+5.2	+7.5
New Jersey 1977 (−.03)	32	51	64	+8.1	+7.9	+8.0
New York 1976 (−.11)	35	57	66	+8.5	+5.0	+7.3

[1]Each PR State with a statistically significant (5 percent level) PR effect on payroll per adjusted patient day is listed with the year the PR program was established and with the estimated percent effect of PR on the level of payroll per day. Effects not significant at the 5 percent level included: negative effects for Minnesota (1978) and Washington (1978), positive effects for Washington (1976), and an effect too small in size and statistical significance to be reliable for New York (1971). The R^2 for the payroll per day regression equation was .76.

[2]Figures for the individual States include estimated PR effects.

The largest PR effects are observed in New York and Maryland which have State programs that are identified as potentially rigorous and effective (based on formal characteristics). The overall percentage change in payroll per day from 1969-1978 in both these States was lower than the average for all States. This results from a significant drop in the annual increase from 1975 to 1978. In fact, both New York and Maryland began the study period in 1969 with payroll costs higher than the average, but ended with lower than average costs. They are the only States in the study group to make this shift. Three other States (Arizona, Connecticut, and Massachusetts) remained above average in payroll costs though they approached the mean of all States over the study period. Three States with below average costs (Indiana, Kentucky, and New Jersey) finished the period with costs further below average.

Evidence from States with less significant PR effects lends support to these findings. For example, Minnesota and Washington implemented programs in 1978 that had negative effects on payroll costs. The positive PR coefficient for Washington's 1976 program does not seriously challenge these findings because the program was revised and strengthened in 1978. Although New York and Maryland hospitals showed the largest PR-related payroll reductions, the relationship between program rigor and measured effect is tenuous. New Jersey, a State with mandatory review and compliance and with authority to set payment rates, reduced payroll costs by 3 percent after instituting PR. Arizona, with voluntary compliance and no legal enforcement powers, showed a reduction of 6 percent.

Labor Productivity: FTE Staff Per Adjusted Patient Day

Solid evidence exists that hospitals curbed payroll costs per day by reducing staff per adjusted patient day. The data in Table 4 show that though the number of FTE staff needed to produce a given number of days increased, this rise occurs more slowly in States with significant PR effects.

Once again, New York's PR programs show dramatic changes in the relationship of the initial program (1971) to the strengthened version (1976). Although the single largest estimated effect—a drop of 10 percent in FTE requirements—occurred in the Maryland program, the combined effects of the two New York

TABLE 4

FTE Staff Per Adjusted Patient Day: Levels for all States and Estimated Prospective Reimbursement Effects in Individual States[1]

State/Year (Percent Change Due to PR)	Levels for Selected Years (FTEs Per 1,000 Days)			Annual Percent Change		
	1969	1975	1978	1969-1975	1975-1978	1969-1978
All States[2]	6.8	7.8	8.3	+2.3	+2.1	+2.2
Arizona 1974 (−.07)	6.8	7.3	7.7	+1.2	+1.8	+1.4
Connecticut 1975 (−.06)	7.1	7.7	8.2	+1.4	+2.1	+1.6
Kentucky 1975 (−.05)	6.3	6.9	7.3	+1.5	+1.9	+1.6
Massachusetts 1976 (−.03)	7.5	8.6	8.9	+2.3	+1.1	+1.9
Maryland 1976 (−.10)	7.1	8.2	8.7	+2.4	+2.0	+2.3
New York 1971 (−.03) 1976 (−.08)	7.1	7.9	7.7	+1.8	−0.9	+0.9

[1]Each PR State with a statistically significant (5 percent level) PR effect on FTE staff per adjusted patient day is listed with the year the PR program was established and with the estimated percent effect of PR on the level of FTE staff per day. Effects not significant at the 5 percent level included: negative effects for Indiana (1960), Minnesota (1978), New Jersey (1977), and Washington (1978); and a positive effect for Washington (1976). The R^2 for the FTE staff regression equation was .32.

[2]Figures for the individual States include estimated PR effects.

programs produce the only reduction in FTE requirements after 1975. New York began the period with higher than average FTE levels per day and ended with levels well below the average. Connecticut was the only other State to effect this change. However, Connecticut's 1978 FTE level (8.2) cannot be distinguished statistically from the average (8.3).

Estimated effects that did not clear the 5 percent significance screen strengthen our findings. Indiana (1960), Minnesota (1978), New Jersey (1977), and Washington (1978) show reductions in FTE requirements associated with PR. Once again, the counterintuitive positive effect estimated for Washington's 1976 program tells little, given the opposite result obtained for the 1978 program.

Price: Payroll Per FTE Staff

The consistent findings reported for tests on the payroll and FTE per day hypotheses cannot be duplicated for payroll per FTE. About one-half of the States with significant PR effects show the hypothesized reduction in payroll per FTE; the other half shows equally significant increases in payroll per FTE. Increases in payroll per day can be caused by wage increases (measured by payroll per FTE), increases in FTE requirements, or both. Since payroll per day increased for all States by 8 to 9 percent per year, payroll per FTE unsurprisingly increased by about 6 percent a year. The rest of payroll cost increases (2 to 3 percent) comes, as shown in Table 4, from a rise in FTE requirements per day.

Although all PR States (Table 5) except Washington and Minnesota grew at rates below the average, only Minnesota altered its relative position. It ended the period with a payroll per FTE level higher than average after beginning the study at average. State programs not included in the table offer no help in defining a direction for the PR effect. Arizona's payroll per FTE showed a PR-related increase, and New Jersey's showed a decrease. Kentucky (1975), Maryland (1976), and Washington (1978) provided no usable results. New York's performance, though consistent with the hypothesis based on the 1976 program, varies over the whole period. Maryland, another State rated potentially "effective" in PR cost-control characteristics, furnished no usable results. No pattern emerges among State programs that suggests that program characteristics affect payroll per FTE outcomes.

TABLE 5

Payroll Per FTE Staff: Levels for All States and Estimated Prospective Reimbursement Effects in Individual States[1]

State/Year (Percent Change Due to PR)	Levels for Selected Years (Dollars Per 1,000 FTEs)			Annual Percent Change		
	1969	1975	1978	1969-1975	1975-1978	1969-1978
All States	5.0	7.1	8.6	+6.0	+6.6	+6.2
Connecticut[2] 1975 (−.04)	5.6	7.7	9.3	+5.4	+6.5	+5.8
Indiana 1960 (−.05)	4.7	6.4	7.7	+5.3	+6.4	+5.6
Massachusetts 1976 (−.02)	5.4	7.6	9.1	+5.9	+6.2	+6.0
Minnesota 1978 (−.03)	5.0	7.1	8.9	+6.0	+7.8	+6.6
New York 1971 (.03) 1976 (−.03)	5.2	7.6	8.9	+6.5	+5.4	+6.2
Washington 1976 (.02)	5.6	7.9	9.8	+5.9	+7.4	+6.4

[1]Each PR State with a statistically significant (5 percent level) PR effect on payroll per FTE staff patient day is listed with the year the PR program was established and with the estimated percent effect of PR on the level of payroll per FTE staff. Effects not significant at the 5 percent level included: a positive effect for Arizona (1974) and a negative effect for New Jersey (1977). Effects too small in size and statistical significance to be reliable included Kentucky (1975), Maryland (1976), and Washington (1978). The R^2 for the payroll per FTE staff regression equation was .79.

[2]Figures for the individual States include estimated PR effects.

Skill-Mix: Registered Nurses Per FTE Staff

The hypothesis that hospitals will use relatively more RNs when forced to economize in payroll or staff was not firmly supported by the tests made. Three of the four States with significant PR variables showed above average rates of growth in RNs per FTE, but the estimated PR effects ranged from 8 percent fewer RNs per FTE in Indiana to 7 percent more in Kentucky. PR-related changes in RN proportions are dramatic in New York. Both 1971 and 1976 versions associated with increases in the level of RNs per FTE. The effect raises the average New York RN share of employment from 2 percent below average for all States to near equality. Maryland, another State described as rigorous in PR regulation, shows no significant RN effect.

Discussion and Conclusions

Results of tests on the payroll per day and FTE per day hypotheses support the argument that, under PR, hospitals cut payroll costs and increase productivity. However, price and skill-mix hypotheses, tested in regressions of payroll per FTE and RNs per FTE, show few statistically significant PR effects and great inconsistency in the size and direction (that is, positive versus negative) of these effects. Hospitals are subject to area wage movements, which are likely to be influenced as much by labor supply forces as by PR cost-cutting influences on hospital labor demand. RN proportions may also reflect area supply factors more than hospital demand. Evidence from hospital staffing studies supports the argument that hospitals' proportional use of RNs relates significantly to local RN supply, measured as RNs per 1,000 population (see Jensen *et al.*, 1980).

Payroll cost findings support earlier NHRS tests of PR effects on total unit costs (expense per patient day) reported by Coelen and Sullivan (1980). All States with significant reductions in payroll costs associated with PR also showed significant reductions in total costs. However, relative magnitudes could not be directly compared. For example, New York, which had an estimated 11 percent payroll cost reduction due to PR, showed a 3 percent total cost reduction. Maryland's total and payroll cost reductions both amounted to 10 percent.

We noted earlier the argument that apparent changes in "productivity" may be due to alterations in the amount and quality of services provided. Other preliminary NHRS findings suggest that hospitals may respond to PR by altering volume and service provision. According to Worthington (1980), Maryland and New York showed significant increases in occupancy rates and average inpatient lengths of stays that were associated with PR. Both findings are consistent with decreased total and payroll costs per day. Adoption rates of all types of hospital services dropped in New York after 1971 (community and quality enhancing services)[10] and 1976 (complexity enhancing services). One can argue that retarded service adoption is consistent with cost-containment, and might be associated with FTE staff reductions.

We cannot resolve the question of quality versus productivity effects of PR based only on the reduced form analysis in this paper. This preliminary work suggests, however, that hospitals have responded to PR in ways that could result in more efficient operation. A more complete explanation of interactions among costs, volume, service intensity, and other areas potentially affected by PR is part of the NHRS agenda for future research.

[10]See Cromwell and Kanak, 1980. Berry's (1973) three-way classification of hospital services was used in this study. The first group of services hospitals add include seven to enhance quality of care. Then eleven services that expand the complexity of treatments offered may be added. Finally, some hospitals add services oriented toward the community.

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