

NATIONAL HOSPITAL INPUT PRICE INDEX

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The national community hospital input price index presented here isolates the effects of prices of goods and services required to produce hospital care and measures the average percent change in prices for a fixed market basket of hospital inputs. Using the methodology described in this article, weights for various expenditure categories were estimated and proxy price variables associated with each were selected.

The index is calculated for the historical period 1970 through 1978 and forecast for 1979 through 1981. During the historical period, the input price index increased an average of 8.0 percent a year, compared with an average rate of increase of 6.6 percent for overall consumer prices. For the period 1979 through 1981, the average annual increase is forecast at between 8.5 and 9.0 percent.

Using the index to deflate growth in expenses, the level of real growth in expenditures per inpatient day (net service intensity growth) averaged 4.5 percent per year with considerable annual variation related to government and hospital industry policies.

The rapid increase in hospital expenditures in the last decade has promoted considerable research into the economics of the hospital industry. The rapid rate of increase generally can be attributed to several interacting factors. These include increases in ancillary

services, changes in the quality of care provided, changes in overall operating efficiency, changes in case mix, increases in utilization, and changes in the prices of inputs required to produce hospital care. This last factor, the effect of prices, is examined here through a national hospital input price index.

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Input price indexes are becoming an increasingly important tool in making financial and policy decisions in the hospital sector. These indexes can be used to assist in forecasting increases in both total hospital expenditures and individual expense categories. Financial intermediaries and insurance companies use input price indexes to determine interim

hospital payments, which tend to minimize final settlement payments, while hospital rate-setting programs use input price indexes to prospectively set hospital rates.

A variety of State and local hospital input price indexes have been developed. In general, these indexes have from 10 to 50 expenditure categories. For each category, proxy price variables are usually selected from the Consumer and Producer Price Indexes and the rates of increase of individual prices are forecast using alternative approaches. For example, the Rhode Island program uses experts from Arthur D. Little to forecast the components. The New York Department of Health assumes that each component will increase at the same rate as it did last year. The New Jersey Hospital Association uses a Delphi technique. Blue Cross of Western Pennsylvania uses time series analysis. The Associated Hospital Service of New York, the Massachusetts Rate Setting Commission, and the Connecticut Commission on Hospitals and Health Care use regression analysis.

In the last few years, the Medicare program has been setting prospective limits on hospital costs reimbursed under the program. The Hospital Cost Containment legislation establishes prospective allowable rates of increase. To improve the method of determining allowable expenditure limits under these programs, a national hospital input price index was needed. This article presents such an index.

Methodology

The primary purpose of a hospital input price index is to separate out pure price changes for a fixed market basket of inputs from all

other factors that contribute to increases in hospital expenditures. 1/ 2/ Four interrelated tasks involved in developing an input price index are

- o delineating expenditure categories,
- o choosing data source(s) to estimate relative weights of expenditure categories,
- o choosing historical wage-price proxy variables to associate with each expense category, and
- o forecasting wage-price proxy variables.

Expense Categories

Several criteria are used to choose expenditure categories. First, all categories should be mutually exclusive of each other and exhaustive of all cost components. Second, the data must be recent. Third, the composition of expense categories should be homogeneous within categories and heterogeneous between categories. Cost center categories from hospital accounting records are not well suited to meet this criterion because expenses are classified by departments, and within departments, there is a mixture of various labor and nonlabor inputs. Input price indexes require expenses to be classified by specific commodities and services since detailed price indexes can only be associated with particular commodities or services. Finally, the number of expense categories should be large enough to accurately capture the inflationary processes, but be small enough so that managing the index is timely and efficient.

Data Sources

Using the above criteria, various data sources were examined, including the American Hospital Association's annual survey, monthly panel survey, and hospital administrative services ongoing survey; Medicare cost reports; various State "market baskets"; and the input-output data on the hospital industry developed by the U.S. Department of Commerce. Since no single national data source met all the criteria, a combination of data sources was used.

The American Hospital Association's annual survey was used for the major expense categories. 3/ Its six broad categories and their relative weights are shown below

Community Hospitals	
<u>Expense Category</u>	<u>Percentage distribution (relative weights)</u>
Total	100.00
Payroll	51.69
Employee benefits	7.22
Professional fees	4.98
Depreciation	4.01
Interest	2.01
Other	30.09

Using these six categories as the framework, we examined subcategory weights from various sources applying the four criteria discussed earlier. The 23 subcategories chosen are listed with their weights in table 1. For data sources used

to estimate the weights, see technical note A.

A comparison of selected weights from the national hospital input price index with weights from five other market baskets indicates a marked similarity (see table 2). Factors contributing to variations include diverse cost structures of providing care, different years for calculating weights, alternative expenditure definitions, sampling variability, and measurement errors.

Wage-price Proxies

Choosing appropriate wage-price proxies for each expense category necessarily involves professional judgment concerning the strengths and weaknesses of each proxy variable. Five criteria are used in choosing price proxies.

The first criterion is relevance. The price variable should be chosen so as to accurately represent price changes for specific goods or services within the expense category. Since hospitals purchase some commodities and services at the wholesale level and others at the retail level, the proxy variable should correspond with the appropriate stage of distribution.

The second criterion is low sampling variability. If the proxy wage-price variable has a high sampling variability or inexplicable erratic patterns over time, its value is greatly diminished as it is unlikely to accurately reflect price changes occurring in its associated expenditure category. Low sampling variability may conflict with relevance. Typically, the more specifically the price variable is defined in terms of type of service, commodity, or geographic area, the higher its sampling variability.

Timeliness or availability of actual published data is the third criterion. This is especially important when retroactively correcting previously forecasted budgets. For this reason, monthly and quarterly data take priority over annual data.

The fourth criterion is the length of the time-series data. New price-wage series, while appearing useful, may later prove invalid or have high sampling variability.

Availability of accurate and up-to-date forecasts of the price variables is the final criterion. Since price indexes are often used to set prospective reimbursement limits, access to detailed wage-price forecasting capabilities is important.

An economic consulting company, Data Resources, Inc., ^{4/} provided all forecasts used here, except for "malpractice insurance premiums," which was for forecast by HEW.

The definitions of expense categories and price proxies employed for each are described in technical note B.

Findings

Using the methodology described above, a hospital input price index was developed for the historical period 1970 through 1978 and for the projected period 1979 through 1981. Deflation of hospital expenditures by the index converts expenditures into real terms and permits determination of the relative contributions of price and net service intensity. Projection of the price variables associated with each category provides a forecast of growth in the major portion of hospital expenditures.

Price Increases

The annual percentage change for each category of the hospital input price index is shown in table 3 for the historical period 1970 through 1978 and for the projected period 1979 through 1981.

Between 1970 and 1978 the hospital input price index rose at a faster rate than prices of the general economy, increasing an average of 8.0 percent a year compared with 6.6 percent for the Consumer Price Index (CPI). The increase in the hospital input price index ranged from a low of 5.8 percent in 1972 during the Economic Stabilization Program to a high of 10.6 percent in 1975. In all but 2 years, 1973 and 1974, the index increased faster than the CPI.

The most rapidly increasing category, malpractice insurance, averaged a 39 percent increase a year throughout the 9-year period, including a 100 percent rise in 1975 alone. Other categories that experienced relatively rapid rates of annual growth include employee benefits (19 percent) and fuel oil and coal (13 percent).

It should be noted, however, that for some of these items, such as food, fuel, and wages, price changes may vary across the country. The items' relative weights may vary by geographic area and by type and size of hospital. Research is continuing in these areas.

The hospital input price index, using employee compensation price variables external to the hospital industry, ^{5/} is expected to increase slower than the CPI in 1979, but faster in 1980 and 1981. The 1979 projected increase is lower than the forecasted increase in the CPI because wages, which contribute 52 percent to the index, are forecast

to increase at a lower rate than the prices of commodities. The hospital input price index is projected to increase 9.0 percent in 1979 and 8.5 percent in both 1980 and 1981.

Intensity Increases

When increases in hospital expenses per day or per admission are deflated by the growth in input prices, the residual provides a measure of the growth in "net service intensity." Service intensity includes number and/or skill levels of employees and the number of services (e.g., x-rays, lab tests, and tests requiring sophisticated equipment) used per day or per admission. "Net" service intensity excludes changes in intensity resulting from productivity changes.

As shown in table 4, the annual rate of increase of net service intensity has varied considerably in recent years. The long-term average (1970-1978) is 3.5 percent per admission and 4.5 percent per inpatient day. The average, however, is directly influenced by governmental and industry policies. The deceleration in the rate of increase during the period 1970 through 1972 may reflect a combination of secular declines associated with the post-Medicare era and the early impacts of the Economic Stabilization Program (ESP) which began in August 1971. Phase IV of ESP (1973-74) appears to have significantly reduced the rate of net service intensity. Following the lifting of controls, hospitals were able to recapture in the following 3 years nearly all of the foregone net service intensity.

In April 1977 the Carter Administration announced a program to contain hospital costs and the hospital industry responded with the

Voluntary Effort to control costs. Data from 1978 show that the rate of real growth is again below the long-term average, perhaps due to the threat of mandatory controls.

With the availability of this input price index, it is possible to better determine the portion of costs controllable by hospitals and the portion outside of hospital control, to set prospective reimbursement rates based on more accurate projections of price change, and to better understand the hospital financial position in general.

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Footnotes

- 1/ The index, like the Consumer Price Index (CPI), is a Laspeyres index. See U.S. Department of Labor, Bureau of Labor Statistics, The Consumer Price Index: Concepts and Content Over the Years, Report 517, revised edition, May 1978.
- 2/ This general objective has some exceptions. For example, in the cases of fringe benefits and hospital malpractice insurance premiums, quality and quantity changes in the "price" variables were allowed. To do otherwise would implicitly attribute such quality and quantity changes to "intensity" of care.

- 3/ For survey questionnaire and definitions of expense categories, see American Hospital Association, Hospital Statistics, 1978 ed., Chicago, Ill., 1978, pp. XXV-XXVIII.
- 4/ Data Resources, Inc., Quarterly Econometric Model of the U.S. Economy, 29 Hartwell Avenue, Lexington, Massachusetts 02173 (forecast: control 042379); also, Data Resources, Inc., Cost Forecasting Service, 1750 K Street, N.W., Washington, D.C. 20006 (forecast: CFS792).
- 5/ See technical note B for rationale on using external price variables for employee compensation.

Table 1 -- Community hospital relative weights by categories of expense, 1977

Expense Category	Relative Weight, 1977
Total	100.00
Payroll expenses and employee benefits	<u>58.91</u>
Payroll expenses (wages and salaries)	51.69
Employee benefits	7.22
Professional fees	<u>4.98</u>
Medical	4.46
Other (legal, auditing, consulting, etc.)	0.52
Capital	<u>6.02</u>
Depreciation	4.01
Building and fixed equipment	2.58
Movable equipment	1.43
Interest	2.01
Working capital	0.41
Capital debt	1.60
Hospital malpractice insurance premiums	<u>2.00</u>
Food	<u>3.13</u>
Purchases at early stages of distribution	1.57
Purchases at later stages of distribution	1.56
Fuel and other utilities	<u>2.42</u>
Fuel oil and coal	0.94
Electricity	0.67
Natural gas	0.50
Water and sanitary services	0.31
Other	<u>22.54</u>
Drugs	2.48
Chemicals and cleaning products	1.88
Surgical and medical instruments and appliances	1.78
Rubber and miscellaneous plastics	1.62
Business travel and motor freight	1.51
Apparel and textiles	1.45
Business services	4.12
All other miscellaneous expenses	7.70

National Hospital Input Price Index

Table 2 -- Comparison of weights for various hospital market baskets

Expense Category	National Hospital Input Price Index	American Hospital Association (note a)	Greater New York, Associated Hospital Service (note b)	Maryland Health Services Cost Review Commission (note c)	New Jersey Department of Health (note d)	Voluntary Budget Review Organization of Maine (note e)
Total	100.0	100.0	100.0	100.0	100.0	100.0
Payroll expenses (wages and salaries) and professional fees	56.7	57.1	56.0	60.7	62.5	62.3
Employee benefits	7.2	7.4	6.7	3.3	8.3	6.8
Capital	6.0	7.8	6.6	6.3	NA	4.2
Hospital malpractice insurance premiums	2.0	2.0	0.7	0.8	NA	0.3
Food	3.1	4.0	3.3	2.2	3.5	3.7
Fuel and other utilities	2.4	5.5	1.1	1.9	2.9	1.4
Other	22.6	16.2	25.6	24.8	22.8	21.3

a/ The American Hospital Association, unpublished data, January 1979.

b/ Michael Gort, et.al., Report on the Hospital Price Index for Greater New York, prepared for the Associated Hospital Service of New York, State University of New York at Buffalo, 1975, Table 4, Group 4 Hospitals.

c/ Maryland Health Services Cost Review Commission, unpublished data.

d/ John C. Rossman, et.al., An Economic Factor for the Hospitals of New Jersey, Hospital Association of New York State, Inc., December 1977, Supplement. Weights for depreciation, capital debt, and malpractice insurance are omitted from the total so all other weights are proportionally higher.

e/ Voluntary Budget Review Organization, Augusta, Maine, unpublished data, March 1979.

National Hospital Input Price Index

Table 3 -- Percentage change in the National Hospital Input Price Index, by expense category, 1970-81.

Expense Category	Relative Weight 1977	Historical Percentage Changes									Forecasted Percentage Changes a/ b/		
		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Total	100.00	7.5	6.4	5.8	6.0	10.1	10.6	8.8	8.1	8.4	9.0	8.5	8.5
Payroll Expenses and Employee Benefits	58.91	9.0	8.1	7.8	5.8	7.8	10.1	10.0	8.7	8.8	8.5	9.7	9.0
Payroll Expenses (Wages and Salaries)	51.69	7.5	6.4	6.7	5.3	7.5	9.3	9.0	8.0	8.4	7.9	8.5	8.3
Employee Benefits	7.22	32.8	31.5	19.1	11.0	11.2	17.3	18.4	14.0	12.0	12.6	12.9	13.6
Professional Fees	4.98	7.4	6.9	3.5	3.6	9.0	11.9	10.8	9.1	8.8	9.6	9.6	8.3
Medical	4.46	7.5	6.9	3.1	3.3	9.2	12.3	11.3	9.3	8.9	9.8	9.7	8.2
Other	0.52	6.7	7.1	6.6	6.2	8.0	8.3	7.3	7.6	8.1	8.5	8.9	8.9
Capital	6.02	8.6	3.1	3.6	6.2	9.0	5.1	4.2	5.6	7.9	9.2	4.6	5.6
Depreciation	4.01	4.5	5.2	5.5	5.5	6.7	9.0	8.8	8.5	9.0	8.8	7.6	8.0
Building & Fixed Equipment	2.58	5.7	6.5	6.8	7.1	8.9	11.0	10.1	9.4	9.6	9.1	7.9	8.7
Movable Equipment	1.43	2.8	3.4	3.5	3.2	3.4	5.7	6.6	6.9	7.8	8.2	7.1	6.8
Interest	2.01	15.1	0.0	0.5	7.4	12.5	-0.8	-3.4	0.2	5.9	10.1	-1.6	0.0
Working Capital	0.41	14.0	-21.7	-17.3	25.4	49.7	-6.9	-23.3	-6.5	21.2	36.6	-1.2	2.7
Capital Debt	1.60	15.6	9.0	5.8	3.2	2.0	1.8	4.1	2.1	1.9	2.0	-1.7	-1.0
Hospital Malpractice Insurance Premiums	2.00	29.9	27.8	15.2	21.3	87.5	100.0	33.3	20.0	15.0	15.0	10.0	10.0
Food	3.13	5.0	2.6	4.8	17.9	14.6	7.6	0.2	5.2	9.4	12.0	8.2	7.5
Purchases at Early Stages of Distribution	1.57	4.4	2.2	5.5	22.6	15.4	6.8	-2.5	4.5	8.9	12.3	7.9	7.4
Purchases at Later Stages of Distribution	1.56	5.5	3.1	4.2	13.2	13.8	8.4	3.1	6.0	9.9	11.7	8.4	7.6
Fuel and Other Utilities	2.42	4.6	7.2	3.4	8.1	28.4	11.8	9.2	12.2	7.8	10.5	11.0	9.7
Fuel Oil and Coal	0.94	3.9	6.2	0.5	15.3	58.4	8.1	7.2	13.3	6.0	15.6	13.0	10.7
Electricity	0.67	3.3	6.7	4.9	4.9	18.3	13.1	6.4	6.6	7.5	3.9	8.3	7.3
Natural Gas	0.50	5.4	7.2	5.2	4.4	12.7	19.8	16.6	19.1	9.9	12.0	11.9	10.3
Water and Sanitary Services	0.31	7.7	10.8	3.8	5.4	6.0	9.8	11.1	10.8	10.7	7.1	8.9	10.2
Other	22.54	4.5	3.4	2.4	4.8	12.5	10.2	6.5	6.0	6.7	9.0	7.6	7.7
Drugs	2.48	-0.1	-0.4	0.1	0.8	4.3	8.6	6.3	4.2	5.1	7.8	6.0	8.0
Chemicals and Cleaning Preparations	1.88	2.4	1.9	0.0	5.6	33.5	23.5	3.2	3.0	3.2	8.1	7.5	6.3
Surgical and Medical Instruments and Appliances	1.78	5.2	4.5	2.3	5.2	16.1	15.9	7.7	7.6	10.0	9.9	7.0	7.1
Rubber and Miscellaneous Plastics	1.62	2.9	0.7	0.2	2.9	21.1	10.3	6.0	5.3	4.3	9.3	7.8	7.0
Business Travel and Motor Freight	1.51	5.2	5.2	1.1	3.2	11.2	9.4	9.9	7.1	4.7	10.3	9.4	9.0
Apparel and Textiles	1.45	1.0	1.8	4.2	9.0	12.3	-0.8	7.4	3.9	3.8	4.3	3.3	6.9
Business Services	4.12	8.1	5.6	3.8	4.2	9.4	9.6	8.2	7.7	8.6	9.0	8.6	8.4
All Other Miscellaneous Expenses	7.70	5.9	4.3	3.3	6.2	11.0	9.2	5.7	6.5	7.7	9.8	8.1	7.7
Consumer Price Index, All Items, All Urban		5.9	4.3	3.3	6.2	11.0	9.2	5.7	6.5	7.7	9.8	8.1	7.7

a/ Data Resources, Inc., provided all forecasts presented here, except for "malpractice insurance premiums," which was forecast by HEW. See text footnote number 4.

b/ Historical employee compensation variables for 1970-78 are internal to the hospital industry:
 Wages - average payroll expense per full-time equivalent community hospital worker (American Hospital Association)
 Employee benefits - employee benefits per full-time equivalent community hospital worker (American Hospital Association)

Forecasted employee compensation variables for 1979-81 are external to the hospital industry:
 Wages - average hourly earnings of service industry workers (Bureau of Labor Statistics)
 Employee benefits - supplements to wages and salaries per employee on nonagricultural payrolls (Bureau of Economic Analysis and Bureau of Labor Statistics)

See technical note B for further information.

National Hospital Input Price Index

Table 4 -- Historical percentage increases in net service intensity per admission and per inpatient day, calendar years 1970-78

Calendar Year	Adjusted Expense		National Hospital Input Price Index	Net Service Intensity	
	Per admission a/	Per inpatient day a/		Per admission	Per inpatient day
1970	12.3	13.9	7.5	4.5	6.0
1971	10.2	12.3	6.4	3.6	5.5
1972	8.8	10.4	5.8	2.8	4.3
1973	8.0	9.2	6.0	1.9	3.0
1974	10.9	12.2	10.1	0.7	1.9
1975	16.4	16.2	10.6	5.2	5.1
1976	15.0	15.0	8.8	5.7	5.7
1977	12.2	14.4	8.1	3.8	5.8
1978	11.8	12.1	8.4	3.1	3.4
Average Annual Percent Increase 1970-1978	11.7	12.9	8.0	3.5	4.5

a/ Data from the American Hospital Association, National Hospital Panel Survey.

Technical Note A

Data Sources Used to Estimate
Relative Weights

<u>Item</u>	<u>Data Source</u>
<u>Payroll expenses</u> (wages and salaries)	American Hospital Association, <u>Hospital Statistics, Annual Survey,</u> Chicago, Illinois, 1978.
<u>Employee benefits</u>	Same as above.
<u>Professional fees</u>	Same as above. Item was split into (1) medical and (2) other (legal, auditing, consulting, etc.) using relation- ships in several data sources. Two important sources were the Gort <u>et.al.</u> study for Upstate New York* and unpublished data from the Maryland Health Services Cost Review Commission
<u>Depreciation</u>	Same as above. Item was split into (1) buildings and fixed equipment and (2) movable equipment, using relationships from the American Hospital Association's Nonlabor Input Price Index.**
<u>Interest</u>	Same as above. Item was split into (1) working capital and (2) capital debt using relationships from the Greater New York Study by Gort <u>et.al.</u> ***

* Michael Gort, et.al., The Hospital Price Index for Upstate New York Blue Cross Plans 1974-1976, State University of New York at Buffalo, January 1976, table 2.

** American Hospital Association, Nonlabor Input Price Index (NLIPI). Unpublished data provided to HEW by American Hospital Association, Office of Research Affairs.

*** Michael Gort, et.al., Report on the Hospital Price Index for Greater New York, prepared for the Associated Hospital Service of New York, State University of New York at Buffalo, 1975, table 4.

Hospital malpractice
insurance premiums

American Hospital Association,
Selected Hospital Topics Survey for
1977. Unpublished data from the Office
of Research Affairs.

Food

American Hospital Association,
Hospital Administrative Services
Survey. Unpublished data for 1977 from
the Office of Research Affairs.

Michael Gort, et.al., Report on the
Hospital Price Index for Greater New
York, prepared for the Associated
Hospital Service of New York, State
University of New York at Buffalo, 1975,
Table 4.

The weight for nonlabor dietary expenses
was derived from the American Hospital
Association's Hospital Administrative
Services Survey. The weight for
cafeteria expenses was derived from the
Gort et.al., study for Greater New
York. Food was split between purchases
at early stages of distribution and
purchases at later stages of
distribution using the relationship in
the American Hospital Association's
Hospital Input Price Index.*

Fuel

American Hospital Association,
Hospital Administrative Services
Survey. Unpublished data for 1977 from
the Office of Research Affairs.

Fuel and other utilities was partitioned
into four components (a) fuel oil and
coal, (b) electricity, (c) natural gas,
and (d) water and sanitary services
using relationships from input-output
data on the hospital industry developed
by the U.S. Department of Commerce.**

* P. Joseph Phillip, Hospital Input Price Index, Office of Research Affairs,
The American Hospital Association, November 1978, table 9.

** The Bureau of Economic Analysis, Inter-industry Economics Division,
supplied unpublished worksheets on the hospital industry to HEW. These
worksheets for 1972 show the value of input consumption by hospitals for
each industry that supplies raw materials and services to hospitals. Each
input industry expense amount was aged from 1972 to 1977 using historical
price changes for the detailed expense categories. Relative expenditure
weights were then calculated for the various categories.

Other

The "other" category is a residual divided into 8 categories based on the input-output data from the Bureau of Economic Analysis.* These categories include: (a) drugs, (b) chemicals and cleaning products, (c) surgical and medical instruments and appliances, (d) rubber and miscellaneous plastics, (e) business travel and motor freight, (f) apparel and textiles, (g) business services, and (h) all other miscellaneous expenses.

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- * The Bureau of Economic Analysis, Inter-industry Economics Division, supplied unpublished worksheets on the hospital industry to HEW. These worksheets for 1972 show the value of input consumption by hospitals for each industry that supplies raw materials and services to hospitals. Each input industry expense amount was aged from 1972 to 1977 using historical price changes for the detailed expense categories. Relative expenditure weights were then calculated for the various categories.

Technical Note B

Choice of Price Proxies

Payroll expenses (wages and salaries)

- A. Internal wage variable (used for historical period in table 3) Percent change in average payroll expense per full-time-equivalent worker employed by community hospitals.

Data source American Hospital Association, National Hospital Panel Survey. See "Hospital Indicators" in mid-month issues of Hospitals.

Frequency Monthly

Payroll expenses (wages and salaries) include all expenses defined as payroll by the American Hospital Association in their annual survey. Remuneration for salaried physicians, residents, and interns is included in payroll expenses while remuneration for physicians who bill the hospital for their fees is not. Their fees are included in the cost category "professional fees, medical."

Average payroll expense per full-time-equivalent worker employed by community hospitals is used to approximate wage rate changes internal to the hospital industry. The American Hospital Association calculates this variable by dividing total payroll expense by the number of full-time equivalent workers. Two part-time workers are defined to be equal to one full-time worker. The percent change in this "wage" variable deviates from a pure price change in that it includes the effects of skill mix shifts, overtime pay, and the part-time/full-time adjustment is crude. Currently data does not exist to statistically control for the above effects on a continuing basis.

- B. External wage variable (used for forecasted period in table 3) Percent change in average hourly earnings of production and nonsupervisory workers on private nonagricultural payrolls, service industry.

Data source U.S. Department of Labor, Bureau of Labor Statistics Employment and Earnings, Table C-2.

Frequency Monthly

For items over which hospitals have some degree of control, a price proxy that is external to the hospital should be used for some purposes, such as prospective rate setting. The choice for the variable should be consistent with efficient resource allocation within hospitals as well as between hospitals and the rest of the economy. The wage variable needs to be external to the hospital industry, yet reflect basic forces of supply and demand impinging on workers of the skill-mix levels hired by hospitals. Movements in the wage variable should be equitable relative to other workers in the economy with similar skill levels and workloads.

Average hourly earnings increases in the service industry as a whole historically provide a reasonable choice for an external proxy wage variable.

The service industry is broad-based. Health services workers comprise approximately 30 percent of all service workers and hospital workers are about half of all health services workers.* Average hourly earnings of service workers and of hospital workers were nearly the same for the period 1970 to 1978 as shown in the table below. In only 2 of the 9 years shown, 1973 and 1974, was the absolute differential in hourly earnings more than 6 cents. Year-to-year percent increases were quite similar, with the major exception of 1975 when there was apparently a catch-up for hospital employees due to the prolonged impact of the Economic Stabilization Program in the hospital industry. Over the period 1970 through 1978, hourly earnings of hospital workers had an average rate of increase of 7.7 percent compared to 7.5 percent for all service industry workers.

Employee Benefits

A. Internal price variable (used for historical period in table 3) Percent change in employee benefits per full-time-equivalent worker employed in community hospitals.

Data sources

Beginning 1976, American Hospital Association, National Hospital Panel Survey. See "Hospital Indicators" in mid-month issues of Hospitals. Prior to 1976, American Hospital Association, Hospital Statistics, Annual Survey, Chicago, Illinois. Unpublished data provided to HEW by the Office of Research Affairs.

Frequency

For panel survey data, quarterly; for annual survey data, annually.

Employee benefits include employer-paid fringe benefits for social security, group insurance, retirement, and other fringe benefits. The percent change in employee benefits per full-time-equivalent worker is not a measure of pure price change since it includes changes in the quantity and quality of fringe benefits per worker as well as price changes. Given the data sources available it is difficult, if not impossible, to separate the individual impacts of quantity, quality and price. Even if the separate effects could be factored out, it is useful for some purposes to have a measure of their combined effect since a significant portion of fringes are mandated by government regulations.

B. External Price Variable (used for forecasted period in table 3) Percent change in supplements to wages and salaries per employee on nonagricultural payrolls.

* U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, March 1979, table B-2.

Average hourly earnings of
nonsupervisory workers on private nonagricultural
payrolls, services and hospitals, 1970 - 1978**

Calendar Year	Services		Hospitals ***	
	Hourly Earnings	Percent Increase	Hourly Earnings	Percent Increase
1970	\$2.81	-	\$2.79	-
1971	3.04	8.2	3.01	7.9
1972	3.27	7.6	3.22	7.0
1973	3.47	6.1	3.40	5.6
1974	3.75	8.1	3.65	7.6
1975	4.02	7.2	4.02	9.8
1976	4.31	7.2	4.35	8.2
1977	4.65	7.9	4.66	7.1
1978	4.99	7.3	5.05	8.4
Average annual percent increase 1971-78		<u>7.5</u>		<u>7.7</u>

** U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, March 1979, tables C-1 and C-2. Table C-2 gives only 1978 data for average hourly earnings of hospital workers. Earlier years were obtained from The Bureau of Labor Statistics.

*** Nonsupervisory hospital workers are 91 percent of total private hospital employees. See Ibid., table B-2.

Data Sources For supplements to wages and salaries - U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, table 7 (T.13) July issues have detail on components. See tables 3.11 and 6.13 in July 1978 issue.

For number of employees on nonagricultural payrolls - U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, tables B-1 and B-4.

Frequency For supplements to wages and salaries, quarterly; for number of employees on nonagricultural payrolls, monthly.

Supplements to wages and salaries has two major categories of benefits, employer contributions for social insurance and employer contributions to private pension and welfare funds. Employer contributions for social insurance include Federal, State and local social insurance funds. These funds are for old-age, survivors, disability and hospital insurance; State unemployment insurance; workmen's compensation; and other programs. Employer contributions to private pension and welfare funds include pension and profit-sharing, group health insurance, group life insurance, workmen's compensation, and supplemental unemployment. Supplements to wages and salaries includes an irrelevant third component "other" which was less than one percent of the total in 1977.

In calendar year 1977 employee benefits were 12.8 percent of community hospital employee compensation.* For the service industry, supplements to wages and salaries were 11.3 percent of employee compensation and for all domestic industries supplements to wages and salaries were 14.7 percent of employee compensation in 1977.** The percent change in supplements to wages and salaries per employee on nonagricultural payrolls provides an external indicator of fringe benefit cost pressure on a per employee basis.

Professional fees: medical

External price variable Percent change in physicians' services component of Consumer Price Index for All Urban Consumers.

* American Hospital Association, National Hospital Panel Survey.

** U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, July 1978, tables 6.5 and 6.6.

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 23.

Frequency Monthly

The medical professional fees cost category primarily represents fees billed to hospitals by radiologists, pathologists, and anesthesiologists. It excludes salaried staff physicians as well as interns and residents. The physicians' services component of the Consumer Price Index is used to approximate percent changes in the fees of radiologists, pathologists, anesthesiologists, and other medical or dental providers.

Professional fees: other (legal, auditing, consulting, etc.)

External price variable Percent change in hourly earnings index for production or nonsupervisory workers on private nonagricultural payrolls, total private.

Data Source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 18.

Frequency Monthly

The cost category "professional fees: other" includes fees for legal, auditing, consulting, and so forth types of services. As such this cost category reflects salaries of accountants, attorneys, and consultants as well as expenses for travel, research assistants, clerical assistants, and overhead. No published relevant series on other professional fees is available nationally on a timely basis. The proxy chosen is the hourly earnings index for production or nonsupervisory workers on private nonagricultural payrolls for the total private economy. This index excludes the effects of fluctuations in overtime premiums in manufacturing and changes in the proportion of workers in high-wage and low-wage industries.

Depreciation - buildings and fixed equipment

External price variable Percent change in implicit price deflator, investment, private nonresidential structures. (5-year quarterly moving average, lagged.)

Data source U. S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, table 19 (7.1).

Frequency Quarterly

Accounting for "price" changes associated with depreciation is difficult from statistical, conceptual, and data collection points of view. Hospitals depreciate buildings and fixed equipment on an original cost basis. Changes in tax laws and accounting methods can greatly effect

such depreciation "costs." Since new construction for expanding facilities and for replacement of existing facilities takes place at different rates for different hospitals, each hospital is in a unique situation.

Instead of ignoring the depreciation of building and fixed equipment category in this factor price index, a workable alternative based on economic replacement prices rather than accounting depreciation "costs" is employed. The percent change in the implicit price deflator for investment in private nonresidential structures is used as the external "price" proxy. To partially reflect that new construction is distributed over time, a 5-year quarterly moving average (lagged) of price changes is used.

Depreciation - movable equipment

External price variable	Percent change in implicit price deflator, investment, private nonresidential producers' durable equipment (5-year quarterly moving average, lagged).
Data source	U.S. Department of Commerce, Bureau of Economic Analysis, <u>Survey of Current Business</u> , table 19 (7.1).
Frequency	Quarterly

The same problems associated with quantifying "price" changes for depreciation of building and fixed equipment discussed above are relevant for depreciation of movable equipment. Price changes associated with expansion and replacement of movable equipment are approximated with percent changes in the implicit price deflator for investment in private nonresidential producers' durable equipment. Again, a 5-year quarterly moving average (lagged) of price changes is used to reflect the time structure of the movable equipment investment process.

Interest: working capital

External price variable	Percent change in prime rate on short-term business loans charged to large business corporations, percent per annum (four-quarter moving average, lagged).
Data Source	Board of Governors of the Federal Reserve System, Banking Section, Division of Research and Statistics, <u>Federal Reserve Statistical Release, G. 13, "Selected Interest Rates and Bond Prices."</u>
Frequency	Daily

All debt, short-term and long-term, has a specific maturity structure and is contracted at interest rates in effect at the time of incurring such debt. The time-structure of current debt obligations and associated

contracted interest rates are unique to each hospital. As an approximation of the changing impact of interest costs for working capital for the "average" hospital, the percent change per annum in the prime rate on short-term business loans charged to large business corporations is used. A four-quarter moving average (lagged) of interest rate changes partially reflects that interest costs are contracted over time. It is assumed that the prime rate sets the level of the entire structure of short-term interest rates and that percent changes per annum for the prime rate are relevant to hospitals. Since short-term interest rates are more volatile than long-term rates, it is important that they be treated separately.

Interest: capital debt

External Price Variable	Percent change in yield on domestic municipal bonds, percent per annum, <u>Daily Bond Buyer (20 Bonds)</u> , (Five-year quarterly moving average, lagged).
Data source	U. S. Department of Commerce, Bureau of Economic Analysis, <u>Survey of Current Business</u> , Finance Section (security markets, bonds). BEA publishes the yield on the Thursday nearest the end of the month.
Frequency	Weekly

Long-term debt is contracted over time at interest rates in effect at the time of incurring the debt. The impact of changing long-term interest rates on costs for the "average" hospital is approximated by the percent change in the yield on domestic municipal bonds. For reasons discussed earlier, a five-year quarterly moving average (lagged) of yield changes is used. It is assumed that the percent change in the yield on domestic municipal bonds is related to the percent change in long-term interest rates relevant to hospitals.

Hospital malpractice insurance premiums

Internal price variable	Percent change in hospital malpractice insurance premiums.
Data source	Unpublished data provided to HEW by the American Hospital Association, Office of Research Affairs.
Frequency	Annual

The costs associated with professional liability in hospitals are difficult to quantify both in cross-section and time-series. Hospitals deal with professional liability risks in numerous ways. Hospitals may self-insure, pay on a claims-made basis, or purchase professional liability insurance for a fixed or changing level of coverage. Since professional liability expenses have been increasing at a rapid rate in recent years, it is necessary to have a separate expense category in

spite of the poor quality data. The AHA-derived historical time-series imbedded in this input price index is the only data source known to be available. It is an attempt to quantify the annual percent change in hospital professional liability insurance premiums over time. As with all insurance premium data it is not possible to statistically isolate pure price effects from changes in quality and quantity.

Food

External price variables A. Percent change in processed foods and feeds component of Producer Price Index (Code #02).
 B. Percent change of food and beverages component of Consumer Price Index for All Urban Consumers.

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, Tables 22 and 26.

Frequency Monthly

The cost category for food was derived from nonlabor expenses for dietary and cafeteria cost centers. As such it includes a small but unknown amount of inputs other than food, such as napkins, flatware, and glassware. Hospitals purchase food at an intermediate stage of distribution. Consumer and Producer Price Indexes are averaged to approximate changes in the prices paid. The food and beverages component of the Consumer Price Index and the processed foods and feeds component of the Producer Price Index are given equal weight. Some hospitals use outside contract food preparation services. Price changes for this segment are partially captured by the "foods away from home" component of the Consumer Price Index for foods and beverages. The Producer Price Index for processed foods and feeds contains a small portion, 8 percent, of irrelevant manufactured animal feeds.

Fuel oil and coal

External price variable Percent change in the implicit price deflator, consumption of fuel oil and coal.

Data source U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, Table 26 (7.11).

Frequency Quarterly

This expense category is composed primarily of fuel oil. Neither the Consumer Price Index which measures prices at the residential level nor the Producer Price Index which measures wholesale prices to resellers, is conceptually what is desired. The Department of Energy has a new

series "heating oil prices to ultimate consumers, institutional/utility"* which may be more appropriate for hospitals. Since this series did not begin until June 1976, it is of limited value for quantifying historical trends. The implicit price deflator for consumption of fuel oil and coal was the proxy used. This deflator is derived from the fuel oil component of the Consumer Price Index.

Electricity

External price variable Percent change in the implicit price deflator, consumption of electricity.

Data source U.S. Department of Commerce, Bureau of Economic Analysis. Unpublished data provided to Data Resources, Inc., by the Bureau of Economic Analysis. Historical time-series data are available from the Bureau of Economic Analysis.

Frequency Quarterly

As with fuel oil, it appears that neither the Consumer Price Index nor the Producer Price Index is precisely relevant for hospitals. The U.S. Department of Energy collects statistics on the typical electricity bill in January of each year and on electricity rate schedules. Since data is collected annually, it cannot be used for current monitoring of electricity prices. The percent change in the implicit price deflator for consumption of electricity is used to approximate price changes for electricity. The deflator is derived from the electricity component of the Consumer Price Index.

Natural Gas

External price variable Percent change in implicit price deflator, consumption of natural gas

Data source U.S. Department of Commerce, Bureau of Economic Analysis. Unpublished data provided to Data Resources, Inc., by Bureau of Economic Analysis. Historical time-series are available from the Bureau of Economic Analysis.

Frequency Quarterly

* U.S. Department of Energy, Energy Information Administration, Monthly Petroleum Product Price Report, table 11.

The Producer Price Index for natural gas measures prices at the wellhead. The Consumer Price Index for utility (piped) gas measures prices at the retail level and incorporates regulatory impacts on price structures. Neither is entirely satisfactory. The percent change in the implicit price deflator for consumption of natural gas is used. This deflator is derived from the utility (piped) gas component of the Consumer Price Index.

Water and sanitary services

External price variable Percent change in water and sewerage maintenance component of Consumer Price Index for All Urban Consumers.

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 23.

Frequency Monthly

This cost category comprises water and sewer services purchased from a municipality or utility company. The water and sewerage maintenance component of the Consumer Price Index is used to approximate price changes facing hospitals. Commercial rather than residential rate changes would be preferred if they were available.

Drugs

External price variable Percent change in pharmaceutical preparations, ethical component of Producer Price Index (code #0635)

Data source U.S. Department of Labor, Bureau of Labor Statistics, Producer Prices and Price Indexes, table 6.

Frequency Monthly

Hospitals purchase drugs at the wholesale level rather than at the retail level so a Producer Price Index is appropriate. The pharmaceutical preparations ethical component of the Producer Price Index is used.

Chemicals and cleaning preparations

External price variable Percent change in chemicals and allied products component of Producer Price Index (code #06).

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 26

Frequency Monthly

This cost category includes chemicals, reagents, soaps and detergents that are used for servicing patients, disinfecting, deodorizing, cleaning, and so forth. Chemicals and cleaning preparations are purchased at the wholesale level by hospitals. A broad-based Producer

Price Index, the chemical and allied products component, was chosen to proxy price movements for chemicals and cleaning preparations.

Surgical and medical instruments and appliances

External price variable Percent change in special industry machinery and equipment component of Producer Price Index (code #116).

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 26.

Frequency Monthly

This cost category includes nondepreciable surgical and medical instruments as well as surgical appliances and supplies. To approximate price movements for this category the special industry machinery and equipment component of the Producer Price Index is used.

Rubber and miscellaneous plastics

External price variable Percent change in rubber and plastic products component of Producer Price Index (code #07).

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 26.

Frequency Monthly

A wide array of miscellaneous rubber and plastic products make up this cost category. Examples include rubber gloves, rubber hoses, and disposable plastic bags. Purchases are at the wholesale level and a broad-based Producer Price Index for the rubber and plastics products component is chosen to proxy the price movements.

Business travel and motor freight

External price variable Percent change in the transportation component of the Consumer Price Index for All Urban Consumers.

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 23.

Frequency Monthly

Business travel and motor freight includes hospital-paid employee and patient transportation expenses such as hospital-owned ambulance services, travel for employees to conventions, motor freight, and so forth. Most travel expenses are purchased at the retail level. The transportation component of the Consumer Price Index is used to proxy price changes for travel and motor freight expenses. This broad-based

index is a weighted average of various types of transportation expenses including gasoline, maintenance, and repair.

Apparel and textiles

External price variable Percent change in the textile products and apparel component of the Producer Price Index (code #03).

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 26.

Frequency Monthly

This expense category is composed of approximately equal proportions of apparel such as aprons, uniforms, and gowns and miscellaneous fabricated textile products such as sheets, pillow cases, towels, blankets, and curtains. The textile products and apparel component of the Producer Price Index is used as the proxy price variable.

Business services

External price variable Percent change in the services component of Consumer Price Index for All Urban Consumers.

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 23.

Frequency Monthly

The business service expense category encompasses a broad array of business and personal services such as banking, credit agency, laundry, contract cleaning, telephone, and so forth. Most of these services are purchased at the retail level. The services component of the Consumer Price Index is used to approximate price movements for this expense category.

All other miscellaneous expenses

External price variable Percent change in all items Consumer Price Index for All Urban Consumers.

Data source U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, table 23.

Frequency Monthly

"All other" is a residual expense category whose composition is largely unknown. The all items CPI is used as the proxy.