A PROCEEDURE FOR PROJECTING HOSPITAL RECURRENT COSTS*

The rapid growth of recurrent expenditures in the health sector represents a serious problem for health policy makers in developing countries. Coupled with this problem is the fact that the greatest absolute growth commonly occurs in the area of hospital care. This note develops a simple method to project hospital costs. The method takes the hospital bed as the proxy for the quantity of total services delivered in hospitals. It assumes that the costs of hospital services will follow past trends over the planning horizon of several years.

Factors Affecting Costs

Hospital costs rise as a result of three factors: (1) an expansion of hospital services, measured by the number of hospital beds; (2) an increase in the intensity of care (both inpatient and outpatient), measured by the cost per hospital bed (in constant prices); (3) inflation in the prices of hospital inputs.

Estimating and combining these three factors form the core of the procedure for projecting hospital costs. This procedure is outlined below using data from the Ministry of Public Health and Social Assistance (henceforth called the Ministry) of Honduras, Central America. Historical trends in recurrent costs for the period 1976 to 1980 are determined and are then used as a basis for arriving at projections for 1983.

In this note, the procedure is applied to hospitals operated by the Ministry in Honduras. This perspective excludes private sector hospitals, as well as public sector hospitals outside the Ministry (e.g., those under the social security system) as these hospitals operate under separate budgets and have their own sources of revenue. Hence care must be taken in estimating the number of beds and cost per bed to ensure that the

+In theory, the procedure may be applied to hospitals operated by the (cont. page 2)
hospital services under analysis are defined consistently throughout the procedure.

**STEP 1. Estimate the total number of hospital beds.**

Estimates of the total number of hospital beds may be expressed as one of the following: (1) the total number of staffed beds (the actual number of beds available for inpatient use), or (2) the total approved bed figures (the potential capacity of each institution) commonly used by the health ministry in budgets and statistical reports. Both are generally accepted as suitable measures of the total number of hospital beds. However, note that where there is high demand for hospital care, the total number of staffed beds may exceed the total approved bed figures. In such cases, the former may be a more realistic estimate.

Whichever measure is used, the historical data on the number of beds should (preferably) be for at least five years and should be consistent with the years in which cost data are available.

**STEP 2. Estimate the cost per hospital bed.**

The cost per hospital bed is calculated from

\[
\text{Cost per Bed} = \frac{\text{Total Cost}}{\text{Total Hospital Beds}}
\]

Total cost refers to the total amount of operating expenditures for all Ministry hospital services. Ideally, it is expressed as the amount actually expended by hospitals. Although this measure is more precise, often, actual expenditures are not readily available. In their place, one may estimate them by the annual budget for hospital services. Because of systematic differences between budgets and actual expenditures, the two types of data should not be mixed in a single series. If the

+ (cont. from page 1) private sector if these are reimbursed by the government. Otherwise, the procedure is of little relevance since private hospitals operate independent of each other and are largely not under government control.
budgets and the actual expenditures have increased at similar rates, the annual budget is an adequate approximation for total cost.

There are added refinements to the estimation of cost per hospital bed that are useful for projections. These are not performed in the Honduras example but are, nonetheless, presented here for completeness:

(1) Total costs may be disaggregated into inpatient and outpatient service costs and, thus, allow a more detailed analysis of costs for each major type of care. This step may be undertaken if hospitals report disaggregated data and if estimates are available to project the volume of inpatient and outpatient services. It is useful if planners envision major shifts in the balance between inpatient and outpatient services compared to historical data.

(2) Hospital beds may be disaggregated by type of hospital (e.g., into categories of district, regional or national hospitals) or by size of hospital. Higher levels and larger sizes tend to correspond to higher costs per bed, a pattern present in the U.S. This refinement is desirable whenever substantial differences in costs exist between levels (or sizes) and costs are relatively homogeneous within levels (or sizes).

Thus, unless the differences are important enough to warrant disaggregation of costs, government hospitals are treated as a single entity. Table 1 sets out the calculation of estimated cost per bed in Honduras on a historical basis. In this case total cost is expressed as the annual budget for hospitals. The budget in col. (2) is divided by the number of beds in col. (3) to give the budget per bed in col. (4), expressed in Lempiras, the Honduran currency.
Table 1  Trends in Hospital Costs in Honduras, 1976 to 1980

<table>
<thead>
<tr>
<th>Year</th>
<th>Hospital Budget (in current lempiras)</th>
<th>Number of Beds</th>
<th>Budget Per Bed (current prices)</th>
<th>Relative Consumer Price</th>
<th>Real Budget for Bed (constant lempiras)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>18,885,435</td>
<td>2,971</td>
<td>6,357</td>
<td>1.000</td>
<td>6,357</td>
</tr>
<tr>
<td>1977</td>
<td>21,531,400</td>
<td>3,117</td>
<td>6,908</td>
<td>1.085</td>
<td>6,367</td>
</tr>
<tr>
<td>1978</td>
<td>27,880,139</td>
<td>3,082</td>
<td>9,046</td>
<td>1.147</td>
<td>7,887</td>
</tr>
<tr>
<td>1979</td>
<td>33,502,096</td>
<td>3,521</td>
<td>9,515</td>
<td>1.250</td>
<td>7,612</td>
</tr>
<tr>
<td>1980</td>
<td>40,857,000</td>
<td>3,579</td>
<td>11,416</td>
<td>1.375</td>
<td>8,303</td>
</tr>
</tbody>
</table>

Average Annual Geometric Rate of Growth 21.3%  4.8%  15.8%  8.3%  6.9%

*The exchange rate has remained fixed over this historical period at 1 Lempira = US $0.50.*

STEP 3. Convert the cost per hospital bed into constant prices.

The budget per bed in col. (4) of Table 1 is based on current prices i.e., it is expressed in the actual lempiras and prices that were current in each historical year. Since the buying power of a fixed amount of money may change from year to year (generally declining), the budget per bed in col. (4) needs to be corrected for inflation (i.e., converted into constant prices) by using a price index.* To convert the budget per bed into constant prices, it is assumed that the prices for hospital inputs increase at the same rate as the general Consumer Price Index (CPI).† The CPI is chosen as the price index for which data can generally be obtained most reliably, and should serve as a reasonable proxy for price changes of hospital inputs.

<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
<th>Rise (%) over Preceding Year</th>
<th>Relative Consumer Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>154.7</td>
<td>8.5</td>
<td>1.000</td>
</tr>
<tr>
<td>1976</td>
<td>167.9</td>
<td>8.5</td>
<td>1.085</td>
</tr>
<tr>
<td>1976</td>
<td>177.5</td>
<td>5.7</td>
<td>1.147</td>
</tr>
<tr>
<td>1976</td>
<td>193.3</td>
<td>8.9</td>
<td>1.250</td>
</tr>
<tr>
<td>1980</td>
<td>212.6</td>
<td>10.0b</td>
<td>1.375</td>
</tr>
</tbody>
</table>

*Estimate
†Projection made during 1980 based on rising energy prices and double-digit inflation in the U.S., one of Honduras' main sources of imports.
‡Calculated as follows: (index for that year)/(index for 1976).


To make this conversion, first obtain the CPI for the years in the historical series. The CPI is then normalized to a base period in order

*A price index refers to the current price of a market basket of goods and services, expressed as a percentage of the price of the same market basket during a defined base period. By convention, the base year price index is designated as 100. For example, the price of a market basket of goods in the base year is $300 in the base year, say 1976. If the price of the market basket increases to $400 in 1978, then the price index for 1978 is 133 (i.e., 400/300).
+The CPI is usually reported as a monthly index. The monthly values are averaged to obtain a figure for the year. CPI figures are collected by the central bank or a statistical bureau.
to get the relative consumer prices for each year. Figures for Honduras are shown in Table 2, using 1976 as a base of 1.000. The last entry in col. (4), for example, means that in 1980 consumer prices were 1.375 times as high as those in 1976.

The budget (cost) per bed in real terms (in constant prices) is calculated from

\[
\frac{\text{Budget (cost) per Bed (in constant prices)}}{\text{Relative Consumer Price}} = \frac{\text{Budget (cost) per Bed in Current Prices}}{\text{Relative Consumer Price}}
\]

(2)

The results for Honduras are given in col. (6) of Table 1.* They show that the cost per bed has been rising 6.9% per year above inflation (i.e., in real terms). Possible explanations for this real rise in cost per bed in Honduras include a general trend towards increasingly sophisticated (and expensive) care in Honduran hospitals and the rising intensity of use of the hospitals' physical plant, as evidenced by increasing occupancy rates and number of outpatient visits.

STEP 4. Project the Cost Per Bed

The projected cost per bed is given by

\[
C_{B_0} (1 + r)^t
\]

(3)

where

- \(C_{B_0}\) is the cost per bed at a future time, \(t\);
- \(C_{B_0}\) is the cost per bed for the base year;
- \(r\) is the historical rate of growth (above inflation) in cost per bed;
- \(t\) is time interval in years between the base year and the projection year.

It is assumed that projections over the short-term (e.g. 5 years) will follow past trends. Substituting the Honduras data in (3), the cost per bed in 1983 is:

* Col. (6) converts budget per bed into real budget per bed, i.e., in terms of "lempiras of unchanged 1976 purchasing power." For example, the 1980 current budget per bed is converted into constant prices by dividing it with the relative consumer price, thus: 

\[
\frac{11,416}{1.375} = \$8.303
\]

per hospital bed.
$$CB_{1983} = CB_{1980} (1 + r)^3$$
$$= 11,416 (1 + .069)^3$$
$$= 11,416 (1.22)$$
$$= 13,946 \text{ Lempiras.}$$

**STEP 5. Project Total Hospital Cost.**

To avoid the complex task of making assumptions about future inflation, future costs are expressed in constant prices as of the year from which projections are based. Future costs are estimated by multiplying unit cost times quantity:

$$\text{Projected Total} = \text{Projected Future Cost} \times \text{Projected Future Number of Beds}$$

The projected number of hospital beds is generally obtained from the agency responsible for constructing health facilities. Alternate sources are estimates using past construction rates or estimates based on stated (desired) hospital bed to population ratios (often stated as Plan targets).

By using the cost per bed as the basic unit, the procedure allows for the projection of recurrent costs under different assumptions of expansion or contraction of hospital services. It is therefore possible to compare the recurrent cost implications of alternative plans. Table 3 illustrates this process for the Honduras data. Case 1 gives the 1980 budget as the baseline. Case 2 assumes a restrictive policy, i.e., no new beds are added. Costs still rise because the real cost per bed will be higher in 1983 due to rising intensity. Case 3 assumes a moderately restrictive plan wherein hospital beds under construction or with financing already arranged and groundbreaking imminent are added in 1980 to the base year figures. These represent a net increase of 561 beds, based on 7 new "area" hospitals of 50 beds each (including one replacement) and 2 replacement "regional" hospitals (San Pedro Sula increased from 265 to 500 beds, and Comayagua
raised from 82 to 100 beds). Finally, Case 4 assumes the opening of all hospital beds under consideration by the agency that constructs health facilities for the Ministry — an additional 7 area hospitals of 50 beds each in addition to the beds in Case 3 — or 911 beds above Case 1.

Table 3. Hospital Costs in Honduras 1980 and 1983, in constant 1980 Lempiras

<table>
<thead>
<tr>
<th>Case</th>
<th>Number of Beds</th>
<th>Budget per Bed (in 1980 Lempiras)</th>
<th>Total Hospital Budget (in 1980 Lempiras)</th>
<th>Cumulative Projected Percentage Growth since 1980 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(1980)</td>
<td>3,579</td>
<td>11,416</td>
<td>40,857,000</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>3,579</td>
<td>13,946</td>
<td>49,913,000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4,140</td>
<td>13,946</td>
<td>57,736,000</td>
<td>41.3</td>
</tr>
<tr>
<td>4</td>
<td>4,490</td>
<td>13,946</td>
<td>62,618,000</td>
<td></td>
</tr>
</tbody>
</table>


To better appreciate the recurrent cost implications of the foregoing assumptions, let us examine hospital costs within the context of the total budget for the Ministry. In 1980, hospital services already accounted for 54.5% of the Ministry's total budget of L. 74,930,000. A policy of maximum expansion (Case 4) requires an increase of L. 22 million over the 1980 levels. The increase would be an amount larger than the entire budget for ambulatory care in 1980. Even the most restrictive policy still generates an additional requirement of L. 9 million for hospital services in 1983, an amount equivalent to the Ministry's sanitation program for 1980. These cases illustrate a very real health problem health policy makers face — the high cost of maintaining hospital services leaves little scope for expansion of other areas or the development of new programs. This problem is particularly serious in most developing countries where attempts are being made to redress past imbalances between curative and preventive health care.