



MEASURING PUBLIC HOSPITAL COSTS: EMPIRICAL EVIDENCE FROM THE DOMINICAN REPUBLIC

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Abstract—Effective analysis of hospital performance requires the existence of accurate cost and output data. However, these are missing ingredients in most developing countries due to lack of information systems or other sources of data. Typically, expenditures are substituted for actual costs in analyzing hospital finance. This paper presents a methodology and analysis of the actual costs of inpatient, emergency, and outpatient services in a Dominican hospital. Through applying a set of survey instruments to a large sample of patients, the study measures and costs all hospital staff time, in-kind goods (drugs, medical supplies, reagents, etc.), overhead, and the depreciated value of plant and equipment related to the treatment of each patient. The results are striking. The budget is over 50% higher than the actual costs of services, reflecting the high cost of waste, down time, and low productivity. For example, high fixed costs translate into immunizations that on the average cost over 20% more than outpatient surgical interventions. The most disturbing finding is that although physicians represent the bulk of personnel spending, the surveys could account for only 12% of the contracted time of staff physicians, including time dedicated to treatment, supervision, administration, and teaching. As a proportion of the hospital total budget, personnel spending represents a high 84%. Yet staff costs for patient treatment never exceed 12%. These results suggest gross inefficiency, chaotic medical care organization, and poor hospital management. Copyright © 1996 Elsevier Science Ltd

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Concern for rising costs has driven widespread health care reform in developed countries, and few OECD countries have not either considered or taken on an overhaul of their health care systems. Ignorance of costs, rising expenditures, and concerns regarding quality have been addressed aggressively by OECD governments, and in little over a decade better information has allowed improved service, more effective use of public resources and better rationing of care, which together have changed the face of health care [1-3].

The need for systemic health reform is gradually spreading throughout the developing world as well. In Latin America, Brazil restructured its system during the 1980s, Chile designed an innovative system in the 1970s that is currently under scrutiny for reform, and Colombia has designed a system-wide shift. A major concern among developed countries is rising costs of public systems, as well as inefficiency and inadequate incentives that prevent the rationale allocation and use of public resources. Historically most public health care systems in the developing countries adopted the public provision and payment model with all its attendant problems, which become magnified under the lax rules and oversight in developing countries. As a result, reform and change in developing countries require more and better

information on the level and structure of health care costs, the relative efficiency of current delivery modes, and on how to measure and ensure a basic level of quality.

In the OECD countries much of the attention in controlling costs has focused on hospitals, which account for roughly half of all expenditures. Hospital costs, however, are difficult to measure unless specific, disaggregated data on hospital performance are collected and analyzed. Indeed, historically much of the OECD country hospital data were derived from expenditures on specific hospital functions (e.g. pharmaceuticals, nursing) or departments (e.g. surgery, obstetrics), much as the majority of developing country hospitals still do. Such aggregation does not allow estimation of per patient or per diagnosis costs, nor does it allow hospitals to determine efficiency levels or how to address waste. Effectively it tracks expenditures but does not allow measuring the cost of specific services or diagnoses.

Cost data provide the essential ingredient to guide policy as well as manage hospitals. Costs should play a role in allocative efficiency, that is, in the allocation of resources across hospitals. This is particularly acute when governments shift from allocating hospital budgets on criterion such as utilization, costs and case mix rather than historic levels, the practice

in most developing countries. Moreover, cost data offer the only accurate means for addressing technical efficiency. Without concrete evidence on where resources are spent and on what, it is difficult to improve technical efficiency, control expenditures judiciously or make managers accountable.

The most comprehensive cost data come from the United States where efficiency concerns within the publicly financed Medicare program for the elderly led to pioneering methods for measuring costs on a diagnosis basis. The Diagnostic Related Group (DRG) system has permitted controlling Medicare expenditures for inpatient services through incentives to providers to eliminate unnecessary procedures, tests or hospitalizations for eligible patients.* An important by-product of DRGs is the continual measurement of the cost of each diagnosis so that the government has a basis for reimbursing providers for their services to patients.

Through: a careful definition of the basic clinical inputs (including medical services, consumables, drugs, diagnostic tests) needed to diagnose and treat a specific diagnosis; and estimating the cost of the associated time and services implied by those inputs, the resource costs needed to treat the average case (diagnosis) can be calculated. Indeed, because the approach does not rely solely on patient records and self-reported physician and other medical staff time use, but rather on recorded observation, it offers a means of circumventing inadequate or nonexistent information systems to measure costs.

This study has developed a variant of the resource cost method for measuring hospital costs. The methodology adapts the general approach to the circumstances of a public hospital in the Dominican Republic, a facility that resembles other public facilities both in the Dominican Republic and elsewhere in the developing world. A set of surveys and other instruments are used to estimate the cost of hospital care and assess the efficiency of hospital services. The study provides cost estimates for outpatient, inpatient and emergency care, taking into account case mix, clinical norms, indirect and imputed costs, as well as depreciation of physical infrastructure and equipment.

As is the case in much of the developing world, the bulk of hospital care in the Dominican Republic is provided through a network of public facilities that are neither accountable to patients nor to the government. Information systems, where they exist, are in their infancy, and few public hospitals have even a rudimentary management information system in operation. Hospital costs are virtually unknown, efficiency of little relevance to hospital directors, and

quality unmonitored. However, since the 1980s concern within the public and private health communities in the Dominican Republic has emerged regarding the fairness of the public hospital system, the randomness of user fees in hospitals, the possible waste of public resources, and the observed lapses in quality [4-7]. This in turn has led to interest in issues of cost, efficiency and quality, the issues addressed by this survey. The focus of this study is on costs and efficiency.

Existing hospital costing approaches. As noted above, public hospital cost data from developing countries are largely nonexistent, and current methodologies of limited use for either policy or management. Barnum and Kutzin [8] divide existing studies into "step-down" or cost finding analyses, and accounting-statistics studies. The first examine ex-post hospital expenditures as they relate to different areas of hospital production. The second relies on generally available hospital information reported to the central government. The former are the most relevant to costing hospital services. The latter are too general.

Recent cost finding efforts by Mills *et al.* [9], Russell *et al.* [10] and Raymond *et al.* [11] in Malawi, St. Lucia, and Belize, respectively, adopt a step-down methodology which allocates direct and indirect expenditures across cost centers. Each has applied a method that only captures financial costs. It divides the hospital into cost centers and effectively analyzes where resources are distributed, but without regard to how they are applied. The final "cost" is then the allocation of the total budget, plus other identifiable transfers. These studies are useful tools for managers in documenting how resources are being allocated within the hospital, but are limited in that they are not tied to specific inputs or to the production of any service. The expenditures are clear, but the cost of providing a service cannot be measured, and nothing can be concluded regarding the relative efficiency or inefficiency of service provision. The clinical composition of the patients presenting (case mix), quality and relative efficiency measures are missing.

Full cost accounting effectively averages total expenditures across admitted patients. Costs are thereby equated with expenditures. Hence "costs" rise with expenditures and/or with a decline in the number of patients admitted. But what has changed in the provision of services is not known or taken into account. By the same token, when budgets are cut, "costs" decline. Without more detailed information on what the budget is for, and therefore what is being purchased by the hospital, these costs convey very little and can be misleading.

Two studies, in Canada [12] and Colombia [13], have attempted to measure costs appropriately. Pineault *et al.* compare clinical outcomes and costs of care between patients treated on an outpatient and

*Despite the slower growth in Medicare payments, hospital costs per Medicare discharge have risen.

inpatient basis for three surgical procedures.* Shepard *et al.* measure indirect and direct costs (excluding the costs of diagnostic tests) of a single surgery in two Colombian health facilities (an intermediate health unit and a hospital) and compare the cost, quality and effectiveness of care in each of the two settings.

Both studies estimate the costs of alternative surgical treatment(s) using a methodology similar to that applied here. Their drawbacks are the small number of specific treatments that are costed out, which do not permit generalizing cost estimates. Although both are methodological advances in measuring costs in public facilities, where cost data are generally scarce, and Shepard *et al.* compare relative efficiency, they offer limited information regarding hospital costs other than those for surgery. As a result, their policy implications are limited. The findings are useful for fine tuning how a hospital provides some surgical services and in demonstrating the greater efficiency of outpatient surgery, but they cannot provide more general guidance to policymakers and hospital directors.

This study goes beyond estimates of surgeries to measuring costs of all types of hospital services (inpatient, outpatient, emergency, and surgery). It adopts the approach of resource costing, adapting it to the circumstances of the Dominican Republic. The method requires compilation of detailed information on the sample hospital regarding:

- how it functions, including services provided, staff assigned to or hired by the hospital;
- financial resources (budgetary, extra budgetary, and goods transfers such as drugs, consumables, etc.)†
- expenditure patterns and levels for all purchases, including drugs, consumables, food, electricity, etc.

This information provides a context for the set of surveys undertaken to determine what patients receive. Through:

1. time and motion studies;
2. the recording of *all* resources (goods and services) received by the patient; and
3. the subsequent costing of those inputs, the resource costs of treating a particular patient can be estimated. And since each patient's diagnosis is also recorded, average resource costs by diagnosis can be determined.

The methodology was designed to address the limitations of existing approaches to cost measurement, to compensate for the complete lack of data in Dominican public hospitals, and to produce findings

that inform policy on key issues regarding hospital performance and productivity. A general public hospital in the Dominican Republic is used for empirical estimation.

The Dominican context

The Dominican Republic is a Caribbean island of about 6 million people with a per capita income in 1988 of U.S.\$720. Unemployment was about 30% in 1985 according to the Central Bank, but has reportedly risen more recently. Infant mortality is estimated at between 80 and 84 per thousand live births, with most deaths due largely to preventable causes [14]. Health care services are available in both the private and public sectors, with the latter made up of State Secretariat of Public Health and Social Assistance (SESPAS) hospitals and clinics, and social security (IDSS) and armed forces and national police (ISSFAPOL) facilities. Care is provided free of charge to all patients, although only SESPAS facilities are open to all citizens as enrollment in special public insurance plans is not a prerequisite as is the case with IDSS and ISSFAPOL.

SESPAS organization and financing of hospital care. SESPAS provides care for the population it serves through 34 general and specialty hospitals and 392 health centers and clinics owned, operated, and largely financed by the government. SESPAS provides monthly budgets for these facilities, centralizes and controls the hiring of all medical and nonmedical personnel, and directly pays the salaries of hospital staff. Thus, individual facilities have little or no control over the number or mix of personnel.

In addition to the budgets provided by SESPAS, facilities also receive in-kind transfers of essential pharmaceutical and supplies through a SESPAS sub-organization entitled Program of Essential Medicines, or PROMESE. This suborganization is charged with the purchase and distribution of drugs and medical/surgical supplies to SESPAS facilities. Ordering and distribution of drugs is largely undertaken without input from hospital users. The drugs and supplies are purchased from local distributors or manufacturers in bulk, reportedly at bulk-rate prices, although the latter cannot be verified with current record keeping practices.

Additional, albeit sporadic, support for SESPAS facilities has come from the Office of the President, which has made special drugs and funds available; donor projects; and other miscellaneous sources. In addition, many facilities have charges for non-inpatient services despite the official government policy that health care is to be provided free of charge to SESPAS patients [4, 5].

Hospitals are financed by SESPAS through provision of monthly transfers meant to cover all variable (non-personnel) costs. Budget allocations are primarily based on the prior year's allocation. Data on other allocations from the central government are rare. PROMESE does not maintain records on what

*Pineault *et al.* [12] also measure patient perceptions, but this goes beyond the issues of concern here and are not discussed.

†All costs are recurrent as capital costs are separate transactions.

supplies or drugs individual hospitals have received, and information on prices paid by PROMESE are difficult to obtain.

SESPAS facilities do not collect cost information. The hospital administrators know the monthly subsidy received from SESPAS for nonpersonnel expenditures, but rarely have information on what monthly expenditures are, even by major expenditure category (e.g. food, supplies, administration, etc.). Patient record information is spotty at best, so that frequently administrators do not even know how many patients they treat each year. As a result, SESPAS is unable to develop budgets for its individual facilities, which relate in any way to the actual operating expenses in the facility. Most importantly, there is no means to gauge the efficiency or effectiveness of resource use.

The current system has few incentives and fundamental distortions in the organization and financing of health care. The effects of these policy decisions and their implementation are measured and discussed here through the examination of quality and the costs of quality in a SESPAS hospital.

Survey site: Aybar hospital. Aybar Hospital is a 271-bed teaching facility in a poor barrio of Santo Domingo. The main hospital was constructed in 1945. The facility has four operating theaters, 23 outpatient consultation rooms, and an emergency wing. Twenty-nine specialty services are provided, including particular strength in ophthalmology and gastroenterology. Aybar Hospital is representative of Dominican secondary care facilities in Santa Domingo, all of which have teaching functions. It was selected because of the interest of the facility director and its reputation as a functioning hospital.

Aybar has 230 physicians, including residents and interns. Nurses (208), laboratory technicians (19), administrative staff (41) and others (61) make up the staff of about 560 [15, 16]. Based on the results of this survey, it serves about 78,000 emergency patients and 125,000 outpatients per year. Approximately 2000 operations are performed each year.

The occupancy rate is estimated to be between 90 and 100% depending on the specialty with some ward occupancies over 100% not uncommon. The survey estimated the overall average length of stay at 9 days, but lengths of stay vary, with internal medicine estimated at 24 days and surgery at eight. The hospital believes that about 25% of drugs are paid for by patients because the hospital either is not supplied with the drug(s) or does not have the resources to buy them [15]. The study results suggest that the overall figure is closer to 50%, with outpatients buying most drugs from private outlets but few inpatients purchasing their own drugs.

The official budget of the hospital in 1989 was D.R.\$531,334 (U.S.\$84,607) per month. The non-salary portion of the monthly budget was D.R.\$113,573 (U.S.\$18,084). Salaries amount to 79%

of the total monthly transfer, are managed and paid by SESPAS, and are outside the hospital's control. The value of additional transfers from PROMESE or the President's special fund are not known for the reasons indicated above.

Controlling the hospital is difficult, because staff do not report to nor are they beholden to hospital management. With staff assigned and deployed from the center, hospital managers have little or no control over staff performance or location. Shortages exist in equipment for both diagnosis and treatment and reliable supplies are few. Much of this is due to nonavailability from PROMESE and other central government sources, as well as to the inadequacy of the operating budget to meet the needs of the patient volume. Thus the facility is hamstrung by rigid bureaucratic arrangements.

These circumstances do not differ from those of other hospitals in the Dominican Republic and are similar to observations for facilities in other developing countries. Indeed, the reaction of prominent physicians to the findings of this study was relief: it documented their concerns and perceptions [17].

Medical staff characteristics and earnings. Because medical staff constitute such a larger proportion of the hospital's SESPAS budget and medical qualifications are important measures of quality, a brief description of the medical staff, their characteristics, and earnings are provided here.

Salaries for specific types of workers are set with minimal differences across employees. Employees receive no fringe benefits outside of meals in the hospital. Rigidity in salaries prevents adjustments for staff education or experience. Therefore the earnings of physicians with 20 years of experience is identical to that of a new medical graduate. More importantly, rewards for good performance either through bonuses or promotion are impossible under this simplistic system of employment. In short, no incentives exist for productivity or performance.

Aybar had 56 interns assigned to the hospital during the study period. Interns are not paid, although they are provided meals. Interns are in their last year of undergraduate training in medicine. Unemployment among physicians is high in the Dominican Republic. Interns are virtually unemployable as medical staff and employment prospects outside of medicine are poor given an unemployment rate of around 30%. Hence a shadow wage for medical staff is not appropriate.

The physician-nurse ratio of 235:208 is inefficient given patterns observed in other countries where nurses outnumber the more costly physicians. Low levels of compensation and limited potential for upward mobility offered by this system provide a perverse set of incentives for medical staff. These incentives are further distorted by the fact that personnel are paid regardless of whether they perform their duties. And good performance is not

rewarded. Thus, the issue of personnel is a serious one for the hospital, particularly as it relates to both hospital costs and quality of care [18].

Methodology

The study methodology followed a complete overview of major Dominican hospitals [15], which summarized the characteristics and known shortcomings of these facilities based on interviews with hospital directors, a review of hospital records and inventories, and a summary of reported patient case mix.

The results of the survey suggested the total lack of any information systems, irregular patient records, limited accounting and incomplete financial accounting. Records of goods received from the central government were also lacking. Based on these findings, a comprehensive set of surveys was designed in collaboration with government officials, a team of Dominican physicians and selected individuals from the sample hospital. The following surveys were applied:

- patient interview;
- time and motion study of all medical staff providing care to each included patient in outpatient, inpatient and emergency services;
- survey of all consumables (e.g. X-ray film, needles, bandages) received by the patient;
- survey of all ordered diagnostic tests (of the laboratory, pathology services, X-ray services and

specialty services) and drugs, and follow up registries to determine compliance with orders;

- provider interview;
- surgical survey costing out 23 surgical procedures;
- review of hospital records, and cross checks with public and private suppliers, to determine budgetary flows, transfer of goods from the central government to the hospital, purchases from private sources (e.g. food, drug, reagents);
- survey of prices from local vendors for purchased goods of the hospital, and to price in-kind transfers from the central government;
- indirect cost estimates of equipment, laundry, food service, etc., including depreciation where relevant;
- set of clinical norms defining necessary inputs for diagnosis and treatment of six pathologies.

The survey instruments for outpatient, emergency and inpatient services were pre-tested and revised prior to their application. The first five surveys were applied to sampled patients by following the patient through their stay in the hospital, the remainder were carried out in cooperation with the hospital management. The process used to estimate resource costs for outpatients and emergency patients is shown in Fig. 1. The surveys were applied to samples of inpatients, outpatients and emergency patients, with different instruments designed for each of the three

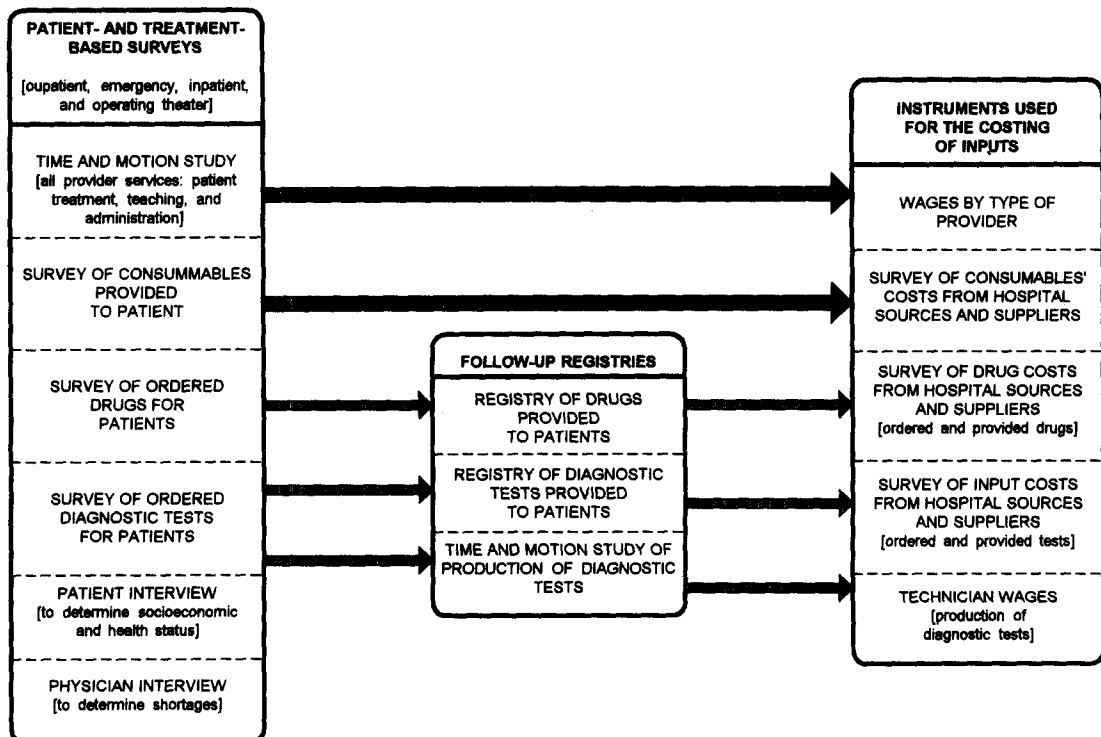


Fig. 1. Summary of surveys and instruments used in collecting resource inputs and costs.

category of patients. Inpatient tracking was complemented by observation and daily collection of information entered on patient charts. A registry to capture patient flow on the wards was included in the survey to allow calculation of occupancy rates.

The total sample size was 4254 patients divided in the following manner: 3554 outpatients; 1616 emergency patients; 61 inpatients, and 23 surgeries.

Survey of patients. The first five surveys listed above and a set of complementary registries were applied at Aybar Hospital during the period 17 April through 28 April 1989, a time period selected for its representativeness. The questionnaires were used to collect information on patient socioeconomic characteristics, patient care time by medical staff, and use of consumables, drugs, diagnostic tests and operating theater. Special registries were placed in service areas not used by the sampled patients (e.g. first aid, immunizations), or in locations that were required to follow up on physician orders. A set of questions directed at the attending physician confirmed diagnosis and provided information on shortages (of equipment, instruments, consumables or drugs) and their impact on medical decisions.* All questionnaires were pretested by a team of Dominican physicians. Data collectors were all graduated physicians.

The sampled patients include the following: all patients entering emergency service over a 1-week period; a sample of outpatient visits during that week, those not included in the outpatient survey were inventoried;† and new inpatients admitted to five of the hospital's 18 wards during a 2-week period (three surgical wards and two ophthalmology wards). Inpatients were tracked daily after the termination of the survey until their discharges, to avoid truncating the goods and services received by admitted patients and to measure average lengths of stay.

Time allocation of all physicians and nurses providing care to or for patients was included in the emergency, outpatient, and inpatient surveys. Data collectors recorded the amount of medical attention and administration for the patient, as well as the supervision and observation of/by medical staff (to capture teaching and learning). In addition, the level of staff providing services to patients was recorded to allow differentiation in physician and nurse service costs. Among inpatients, time and motion studies conducted over one week provided the basis for extrapolating an average amount of medical attention for subsequent periods.

A separate set of questionnaires was used for drugs, diagnostic tests, and surgery. Where drugs were ordered, prescribed, given to the patients (to take at home) or applied to the patient, the drug and the hospital's source were recorded. Who paid for inpatient drugs and the drugs administered in emergency services were included to allow costing of donated drugs. Subsequent follow-up and matching with registries—set up by the project at all sources of pharmaceutical (subsidized sale of pharmaceuticals at "Botica Popular"; pharmacy in the hospital) and all diagnostic test sites—provided information on whether the hospital filled prescriptions, followed orders properly or complied at all.

A registry to capture patient flow on the wards was included in the survey to allow calculation of occupancy rates. Registries in the first aid and immunization rooms captured patients using only those services and the time use of nurses, and a registry of social workers summed the number of daily patient visits.

Twenty-three surgical operations were surveyed, with an attempt to gain at least two wound, appendicitis, cataract, hysterectomy, and hernia operations so that some rough average for operations in general, and specific kinds of procedures in particular, could be costed out. The level and function of personnel in the operating room and the amount of time of all and any staff were recorded along with the use of equipment, instruments, consumables, drugs, and pharmaceutical products.

Collection of prices. No price information existed in the hospital prior to the study. Price information for drugs and consumables the hospital received from the central government and for goods the hospital purchased outside the facility at wholesale and retail outlets was collected directly from the source or imputed. Inventories of stocks were usually available. How much the government paid for those products, and the unit cost of items obtained in bulk, were obtained from the multiple suppliers of the hospital.

In order to allocate the value of any particular input to an individual patient, unit costs of all possible inputs were calculated. For example, all drug prices for different concentrations and presentations (liquid, tablet etc.) from the various sources used by the hospital (PROMESE, the drug procurement parastatal; SESPAS; Office of the President; private distributors; and private pharmacies) were collected. The unit cost of each lab, X-ray, pathology, and special diagnostic test was calculated individually by adding the following:

1. the appropriate fraction of technicians' time for preparation and administration based on a time and motion study;
2. the amount of consumables required (e.g. reagents, EKG paper, X-ray film);
3. equipment used; and
4. other inputs.

*The Spanish language questionnaires are contained in Appendix A of Ref. [19].

†Originally all outpatients were to be surveyed; however, the concentration of consultations in the early hours of the day due to physicians' schedule preferences, forced physicians to double and triple up in consultation rooms. Thus, the enumerators surveyed as many patients as possible, and only counted the overflow whom they did not have time to include in the survey.

Prices were obtained from: searching PROMESE records for what was paid for different products, reviewing SESPAS financial records, studying receipts in the hospital's accounts, interviews with pharmaceutical companies and their distributors, interviews with medical equipment distributors, interviews with distributors of special items such as oxygen, and private pharmacists. In all, prices for 154 consumable items and 1002 drugs were obtained.

Data collection. Data collectors (enumerators) were dispatched to different sites with a stack of questionnaires, and followed between one and three patients at a time. Data collectors were equipped with a stop watch for each patient. Time allocation by staff and use of all equipment, consumables and orders for tests or drugs were recorded by that data collector, and attending medical staff interviewed. Supervisors reviewed completed forms after every shift, and filled out the codes for diagnoses, symptoms, drugs, and other goods.

Each patient entering Aybar hospital was assigned a number and an enumerator to track the services received from the hospital in one of the following: outpatient; wards; and emergency. Each data collector had a clipboard with the questionnaires on it and as many stop watches as patients they could follow at one time. Since there was significant waiting periods, data collectors could effectively keep track of three to four patients at once. Physician supervisors coordinated the enumerators and were available at all times to back them up.

Those patients who had other services indicated (drugs, tests) had a questionnaire filled out with the appropriate name and identification number. Those numbered questionnaires were used to determine if tests were actually completed (and if not, why not), and if ordered drugs had been obtained. Registries at each site for tests or drugs were used to determine whether the ordered item(s) had been obtained and the value of the service or product. Thus collection of compliance relied on information obtained separately from the time and motion study.

Surgery questionnaires were filled out based on observation and interviews with the surgeon(s) performing the operation. These were not linked to the patients on the wards. However, averages by diagnosis were applied to the relevant inpatients.

Fixed or indirect costs. The indirect costs measured overhead departments (administration, laundry, maintenance, etc.) as well as other fixed hospital costs such as building and equipment depreciation. The study applied a stepdown method to assign indirect costs to direct service departments (such as laboratory, operating theater, wards, etc.) (See Ref. [19] for details on the allocation method used for the stepdown process.) The method is similar to the methodology applied in the hospital cost studies discussed earlier that used this approach to estimate total hospital costs.

The stepdown method involves the allocation of expenses from the "indirect service" departments to each other and ultimately to the direct service departments. Aybar Hospital was divided into 35 departments or cost center, 17 of which are indirect service departments and 18 are direct cost centers.

Data for the analysis entailed, among other things:

1. measuring the square footage of the entire hospital;
2. performing a detailed equipment inventory of 3616 items for the entire hospital and obtaining the source, date of acquisition and price of 1373 pieces of equipment; and
3. counting or measuring the intensity of activity in indirect and direct cost centers (e.g. volume of laundry, value of food).

Blueprints, orders, and invoices for purchases provided the basis for estimation.

Findings: variable and total costs

The presentation of the cost estimates of health care services in Aybar Hospital are divided into components. First, the overall costs of patient treatment are estimated and the indirect and direct costs are compared. Following this, the costs in outpatient, emergency, inpatient departments, and in surgery are presented. The last section discusses the distribution of costs across types of inputs.

Total costs are defined as the sum of variable and fixed costs as follows:

$$TC = Z(S_1P_i + D_2P_i + AS_3P_i + C_4P_i) + (TO + Dep)_i = 1 - 4$$

where TC is total cost and i is the four hospital services.

Variable costs are captured as follows:

- P price;
- S medical staff patient care;
- D administered or provided drugs;
- AS ancillary services;
- C consumables;
- TO total overhead; and
- Dep depreciation of buildings, equipment, and other infrastructure

Table 1 summarizes the average and total per patient and weekly costs of patient treatment, broken down for emergency, outpatient, inpatient, and surgery services. The average costs are per patient costs based on the following samples: all outpatients (including immunization and first aid), all emergency patients, roughly 22% of inpatients and 56% of all weekly surgeries.

The first row of Table 1 provides a sum of estimated hospital-wide costs of treatment including overhead costs; average per visit and total weekly costs are shown in columns 3 and 4. Average total costs, including both overhead and depreciation, are shown in columns 5 and 6. These figures encompass

Table 1. Average per patient and weekly costs of outpatient, emergency, and inpatient services of Aybar Hospital, 1989 (1989 D.R.\$)

Service	Sample size	Average variable cost plus overhead		Average total cost*	
		per Patient per day (D.R.\$)	Total weekly (D.R.\$)	per Patient per day (D.R.\$)	total weekly (D.R.\$)
Hospital-wide†	4254	26.24	111,622	29.86	127,012
Outpatient‡	2554	10.90	27,836	13.60	34,723
Emergency	1616	19.26	21,126	20.11	32,499
Inpatient	61	22.17§	42,057	22.52	42,720
Surgery	23	461.00¶	10,603	487.00	17,070

*Includes all variable and fixed costs including depreciation.

†Total hospital-wide costs per week are based on average cost data produced by the survey and adjusted for inventoried outpatient, unsurveyed inpatients, and the total estimated average number and value of surgeries per week. Costs do not include maternity, which opened just prior to the beginning of the survey. Total average cost is total hospital-wide daily costs based on the number of outpatients, emergency patients and beds, or 4253 patients rather than the 3514 sampled patients.

‡Outpatient costs are per visit costs. The outpatient figures are adjusted for the cost and number of patients receiving vaccinations and injections. Those users were surveyed separately.

§The reported average cost is a per day cost based on length of stay data from the sampled population and adjusted for bed capacity.

¶Average cost per surgery.

Note: U.S.\$1 = D.R.\$6.33 (4/89).

Table 2. Summary data on monthly indirect cost allocation to selected direct service centers (1989D.R.\$)

	Overhead (%)	Building depreciation (%)	Equipment depreciation (%)	Total (D.R.\$)
<i>Ancillary service direct cost centers</i>				
Laboratory	25.8	7.7	66.6	10,297
Radiology	25.8	7.3	66.9	13,547
Pathology	2.3	5.8	70.8	5139
Operating room	48.4	4.7	46.9*	48,530
<i>Inpatient direct cost centers</i>				
Surgery wards	85.5	6.8	7.7	51,834
Internal medicine wards	85.6	10.0	4.5	49,845
Ophthalmology wards	83.2	12.5	4.3	8281
Pediatric wards	77.1	18.3	4.5	17,966
<i>Outpatient direct cost centers</i>				
Clinic	56.1	14.3	29.7	45,171
Emergency	62.2	14.9	22.9	14,558
Other direct cost centers	61.9	8.8	29.3	72,345
Total	64.5	9.5	26.0	337,512

*Approximate breakdown according to service: maternity: 13%; gastroenterology: 16%; general surgery and ophthalmology: 71%.

Note: U.S.\$1 = D.R.\$6.33 (4/89).

costs of medical and other staff time, diagnostic tests, drugs, consumables, surgeries, and indirect costs. Teaching costs associated with patient care are included as part of personnel costs.

The weekly hospital variable costs are D.R.\$111,622,* and the daily per patient cost D.R.\$26.24. These figures represent all variable and fixed costs of patient treatment. Costs of administration, operation of the generating plant, maintenance and repairs, pharmacy operation, cafeteria and kitchen services, and social work services, among others, are included along with the medical and other time and services patients received. If depreciation is included the total weekly cost is D.R.\$127,012.

The monthly personnel and operating budget was D.R.\$657,560. This is the amount spent by the government on Aybar Hospital. This amount, however, is almost 50% higher than the actual costs

of service delivery measured by this study. The difference is waste, down time or other extra-hospital activities. It suggests a high degree of inefficiency as well as low staff productivity. Although direct correspondence between the two would not be expected—partly because in-kind transfers are not captured in the budget—such a large discrepancy indicates serious managerial problems. Given that personnel represents 84% of the total monthly budget, low productivity must be part of the problem. This is discussed further below.

Average costs are the best measures for making comparisons across services. Average outpatient and emergency costs (excluding depreciation and unadjusted for case mix) are D.R.\$10.90 and D.R.\$19.26 per visit, respectively. Outpatient care is roughly half of the average daily inpatient cost of D.R.\$22.17 (or D.R.\$199.52 per inpatient stay), and all three are dwarfed by the average cost of a single surgery at D.R.\$461.00.† The corresponding total costs including depreciation are D.R.\$13.60, D.R.\$20.11, D.R.\$22.52, and D.R.\$487.00 for outpatient, emergency, inpatient, and surgery services, respectively. These results are consistent with findings in OECD countries that ambulatory care is on average a lower cost mode of treatment. Similarly, preventive

*The exchange rate in April 1989 was U.S.\$1 = D.R.\$6.33.

This is the exchange rate used throughout the paper.

†Inpatient costs are based on resource use in surgical and ophthalmology wards and do not include internal medicine patients. Since surgeries are costed out separately in this study, internal medicine costs may exceed the average cost estimates here due to costly drug therapies.

Table 3. Total weekly and average per patient costs for outpatient services by selected specialty (1989 D.R.\$)

Specialties	Number of patients	Average per patient cost (D.R.\$)	Total weekly cost* (D.R.\$)
Urology	23	15.62	359
Cardiology	133	15.37	2044
Orthopedics	32	14.60	467
Gynecology	67	13.70	959
Gastroenterology	70	13.70	959
Epidemiology	67	13.67	929
Psychiatry	25	11.16	279
Ophthalmology (consultant)	101	10.22	1032
General medicine	533	9.85	5249
Ophthalmology (minor surgery)	48	9.80	471
Pediatrics	172	9.41	1619
Obstetrics	104	8.98	934
Vaccinations/injections	174	8.84	1538
Neurology	30	8.27	248
Endocrinology	34	7.80	265
General surgery	28	7.28	204
Total average	2554	10.90	27836

*Excludes depreciation costs.

Note: U.S.\$1 = D.R.\$6.33 (4/89).

Table 4. Total and average costs by type of emergency (1989 D.R.\$)

Type and location	Number of patients sampled	Average cost (D.R.\$)	Total cost* (D.R.\$)
Internal medicine	661	21.37	14,125
First aid	475	28.18	13,387
Pediatrics	469	7.25	3400
Injection	1	5.18	5
Unspecified	10	20.94	209
Total	1616	19.26	31,126

*Excludes depreciation.

outpatient care that substitutes for curative hospital services, especially surgical procedures, can offer considerable savings for hospitals.

Comparison in Table 1 of the total costs with and without depreciation costs indicates the share of costs depreciation represents. Table 2 provides a breakdown of the fixed costs of hospital and outpatient services, as well as their allocation across overhead, building depreciation, and equipment depreciation. The indirect costs of overhead services are divided across direct services. For example, cleaning service costs are divided according to the size (square footage) of each area requiring cleaning services; in laundry, the volume of linens provided is divided among cost centers (e.g. none for outpatient), and so on.

Sharp differences in overhead costs (column 1) are due to uneven use of specific inputs. For example, the high costs on wards reflect their intensive use of hospital indirect services such as electricity, laundry, food service, and cleaning. These costs are embedded in each of the cost centers indicated in Table 2.*

Although fixed costs add to the cost of hospital operation, not accounting for them underestimates the true cost of services. This applies to depreciation as well as overhead, because depreciation captures the costs of replacing equipment and maintaining the physical plant. Fixed costs represent a vital component of inpatient costs since a number of

services provided to the patient are delivered through indirect means.

Outpatient Services. The volume of outpatient services by selected specialty are indicated in Table 3. The number of patients in each specialty range from two for psychology to 533 for general medicine (the 936 patients include the inventoried patients). The average costs per visit range from a low of D.R.\$7.28 for general surgery to a high of D.R.\$104.79 for a psychology consultation. The reasons for the variation in costs are largely the cost differential of physician services and the amount of time spent with the patient. Zero costs of interns and low cost resident services lead to perverse results. A good example is that the cost of general surgery (D.R.\$7.28) is less costly than an immunization (D.R.\$8.89). Part of this is due to the fact that the volume of services for vaccinations is low and paid nursing staff provide immunizations for 5–6 hr per day. Interns and residents provide the bulk of general surgery visits.

The high average cost of psychology consultations can be attributed to high drug prescription costs. The small sample allows one individual's high drug bill to affect the average cost. This is a danger in any of those specialties where fewer than five or six patients were treated. The sample size is particularly sensitive where the type and value of care fluctuates across patients. Some outpatients receive expensive drugs, and expensive equipment is used for diagnosis and treatment; others receive only a short consultation with an intern or resident (Table 3).

*See Appendix C in Ref. [19] for additional details on fixed costs and the costing methods and components.

Table 5. Total and average daily costs by ward for inpatient services (1989 D.R.\$)

Ward	Number of patients	Average length of stay	Average cost per patient* (D.R.\$)	Average cost per day (D.R.\$)	Total cost* (D.R.\$)
Men's surgery ward No. 1	9	4	231.41	57.85	2083
Men's surgery ward No. 2	19	8	177.17	22.15	2366
Women's surgery	18	11	264.66	24.06	4764
Men's ophthalmology	9	14	158.75	11.34	1429
Women's ophthalmology	6	8	88.17	11.02	529
Sample LOS total	61	9	199.52	22.17	12,171
Hospital LOS total†	271	9	199.52	22.17	54,070
Hospital weekly total†	271	7	155.19	22.17	42,057

*Costs exclude depreciation and are based on patients' lengths of stay (LOS). These costs do not include the cost of surgery. †Hospital LOS and weekly totals are based on the average cost per day/patient and assume 100% occupancy, i.e. 271 patients in 271 beds.
Note: U.S.\$1 = D.R.\$6.33 (4/89).

Emergency services. Table 4 summarizes the total and average costs for emergency. Average or per visit costs vary considerably by type of emergency. First aid (which also includes follow-up care for first aid patients) is the most costly service at D.R.\$28.18 per patient. This can be explained by the serious cases seen and treated in first aid and the fact that minor surgery is also performed in "first aid". Injections and pediatrics are very low cost with per visit costs of D.R.\$5.18 and D.R.\$7.25, respectively. Total costs are similar for internal medicine and first aid and represent about 85% of all costs, but only about 70% of the volume of services. This difference is due to the low cost (10% of total cost) and relatively high volume of use (30% of all patients) of pediatric services. The unspecified emergency patients have multiple problems with long stays in the emergency room, and are therefore costly services to provide.

Inpatient services. Table 5 provides the total and average per patient and daily costs for inpatients by ward. Surgery costs, which are an important part of inpatient costs, are not presented with the inpatient services, but are dealt with separately. The total cost figures for each ward are not necessarily representative because they are a function of the number of patients admitted to the ward during the course of the survey. Two inpatient totals are provided in the last three rows of the table. These figures provide average and total costs based on lengths of stay of the 61 sampled patients; and, an extrapolated hospital total calculated from bed capacity, the sampled popu-

lation's length of stay and average costs for all outpatients.

Average costs are presented per patient and per day to indicate the average cost over the entire length of stay by ward, and the average daily ward cost. The latter figure allows comparisons of costs across wards without the confounding effect of length of stay. The per patient average is important because it conveys not only the level of expenditure but the period over which such expenditures must be made.

Average per patient and per day costs vary considerably across wards. Women's ophthalmology is only D.R.\$88.17 per patient stay whereas women's surgery averages D.R.\$264.66. On a daily basis, these costs are D.R.\$11.02 and D.R.\$24.06, respectively. The average daily column shows that on a per day basis, men's surgery at D.R.\$57.85 is the most expensive. The small sample, however, suggests that the figure should be accepted with caution.

Part of the discrepancy in average per patient costs is due to differing lengths of stay. For example, where ophthalmology is heavily weighted to cataract surgery the lengths of stay for these wards will be relatively short. The need for physician oversight for cataract patients is minimal. In the U.S., for example, cataract surgery is an outpatient procedure. So cataract surgery is not expected to entail a long stay in the hospital. Other eye-related diagnoses may require extended stays, however.

Men's ophthalmology ward per patient cost is almost double that of women, and men's total costs

Table 6. Average costs of surgery for selected diagnoses

Type of surgery	Number of surgeries in sample	Average length of surgery (hr)	Average variable, non-personnel costs of surgery (D.R.\$)†	Average cost of surgery* (D.R.\$)
Wounds	8	2.33	182	517
Hernia	3	1.57	145	450
Appendectomy	2	1.10	105	411
Cataract surgery	4	1.14	42	344
Hysterectomy	2	1.35	195	544
Other	4	1.33	179	497
Average across all surgeries	23	1.45	141	461

*Includes fixed overhead and variable costs, but excludes depreciation. Overhead costs are allocated equally across the total number of monthly surgeries (162.5). An overhead cost of D.R.\$ 273 is added to each surgery; including depreciation adds an additional D.R.\$ 46 to each operation.

†Excludes fixed costs and personnel.

Note: U.S.\$1 = D.R.\$6.33 (4/89).

Table 7. Cost distribution across cost categories for emergency, outpatient, and inpatient services*

Cost categories	Emergency (%)	Outpatient (%)	Inpatient (%)
<i>Variable costs</i>			
Personnel	2.51	11.46	5.12
Drugs	13.88	17.46	42.15
Lab tests	3.66	3.07	3.21
X-ray tests	1.16	1.19	2.93
Pathology tests	0.00	1.71	0.00
Non-invasive tests	0.69	2.77	0.48
Consumables	51.26	3.36	35.20
<i>Fixed costs†</i>			
Overhead	26.84	58.98	10.92
Total	100	100	100

*Surgery is not included here because of the small number of surgeries (23) and the fact that the selected surgeries may not be representative of all surgeries performed at Aybar Hospital.

†Depreciation is not included.

are about three times higher than that of women's ophthalmology. The discrepancy in total cost is due to the characteristics of the sample of patients that arrived at the hospital during the 2 weeks of the inpatient survey. In ophthalmology, males appear to have been, on average, sicker than the women who were admitted, based on length of stay and daily cost figures. Length of stay is only one component of total cost and by itself could be misleading. For example, the highest daily costs are for men's surgery, and it has the lowest ward length of stay at 4 days.

As discussed above, total costs are measured in different ways. These different calculations produce very different totals. The total inpatient costs for the sampled patients is D.R.\$12,171, based on an average length of stay of 9 days. The hospital length of stay total assumes 100% occupancy and a 9 day length of stay, and sums to D.R.\$52,070, about five times the sample total.* For policy and management purposes, the hospital length of stay average and total cost figures are the most relevant because length of stay is a key determinant of inpatient costs. Similarly, the average cost per patient by ward is the relevant measure for planning and budgeting purposes.

Surgery costs. Surgery is a major component of inpatient care, and to some extent, of emergency services. The results from the surgery cost survey are shown in Table 6.†

The cost per surgery also varies considerably, as would be expected, both within and across types of surgery. The table reports average costs of surgery for wounds, hernias, appendectomies, cataracts, hysterectomy and other, an amalgamation of various uncategorized surgeries. Costs are a function of both the length of the procedure, the number of attending medical staff and the use of drugs, consumables and other inputs. The table reports total variable, non-personnel costs to indicate the level and value of these inputs and to place personnel costs in

perspective.

The average cost of a surgical procedure, including overhead costs, amounts to D.R.\$461, which corresponds to one and three-quarter hours of surgery. With depreciation the cost is D.R.\$507. Fixed costs represent 69% of the total cost of an average surgery. Low utilization of surgical theaters and the need to maintain services to them regardless of volume keep costs high. As mentioned above, the fixed (overhead) costs are the indirect services to the operating theaters (e.g. linens, cleaning, maintenance, administration).

The difference between the highest and lowest surgery costs is D.R.\$200.00, which suggests the desirability of using averages based on surgery type rather than an overall surgery average; however, the variability in cost of surgery can vary widely too, as it does for wounds.

Comparing direct and total average costs indicates that fixed costs are the single most important component of surgery costs, and personnel is the lowest component cost. Part of this may be explained by the relatively low earnings of physicians in the public sector and by the predominance of interns and residents on surgical teams, and, as already mentioned, the high cost of maintaining operating theaters well below capacity.

The results reported in the table suggest the importance of surgery costs to the overall cost structure of the hospital. It is the single largest patient expenditure. Thus, it represents a service that should be applied judiciously, and preventive measures applied wherever possible.

Allocation of total costs. Typically, the cost of health care is heavily weighted toward personnel given the labor-intensive nature of the service. In developing countries, where drugs, equipment and consumables are often imported items and foreign exchange is scarce, the cost of nonpersonnel inputs should represent a higher percentage of total costs. This should be particularly true where labor costs are low and physician supply ample, as is the case in the Dominican Republic.

However, the minimal value of personnel, high absenteeism, and heavy reliance on lower level staff

*Occupancy rates obviously vary across wards and time. In addition, occupancy often exceeds 100% occupancy in some wards as gurneys are commonly used to supplement ward beds.

†See Appendix H in Ref. [19] for additional details on the calculation and distribution of surgery costs.

may result in a smaller percentage of patient service costs going to labor. Indeed the study results show that only 12% of contracted physician time is actually provided. Thus, despite the large proportion of the budget that is allocated to personnel, the aforementioned factors cause sharp divergence between costs and public expenditure.

Table 7 provides the distribution of costs for each of the three hospital services. As predicted above, personnel does not represent a large proportion of the actual costs of service delivery. For emergency patients, outpatients and inpatients, personnel represents 2.5, 11.5, and 5.1%, respectively, of total hospital costs for those services. This is despite the fact that 84% of the Dominican hospital budget pays salaries.

Outpatient personnel costs are proportionally the highest because higher level physicians provide much of outpatient care. Fixed (or overhead) costs average as major elements (59%) of outpatient service costs, representing over half of all costs. On wards, fixed costs represent a relatively low 11.5% of all costs, which is surprising given the relatively heavy reliance on overhead costs such as food, laundry, and electricity, that are most relevant to inpatients. Within overhead 51% is nonclinical personnel.

Drugs (17.5%) and personnel (11.5%) are the first and second most significant costs for outpatients. Consumables costs are insignificant, representing < 4% of total outpatient costs.

Emergency services require a high proportion of expenditures on consumables (51.3%), with diagnostic tests and personnel a small part of total costs. This is in sharp contrast to outpatient and inpatient services where consumables represent 3.4 and 35.2%, respectively, of total costs. It may be that for inpatient care, and emergency or first aid treatment, consumables are essential. They are less essential, and used less frequently, in outpatient services.

A relatively large proportion of total cost is devoted to drugs in all three services, and are highest for inpatients (42.2%). Because these costs represent what the hospital spent on the patients in each service, the findings indicate that outpatients are the least likely to receive drugs from the hospital, and inpatients most likely to do so. This is consistent with government policy and its commitment to hospital care as opposed to outpatient services. The evidence from the last section on patient characteristics and treatment patterns suggests that because outpatients generally have medications prescribed rather than directly applied, they are less likely to receive free drugs from the hospital. In emergency and inpatient services, prescriptions generally are not filled see Ref. [19] but patients usually are administered drugs indicated by the attending physicians.

Diagnostic tests represent less than 7% of the total cost of any service, with laboratory services the most important of these in terms of costs. Pathology tests are rarely performed and only outpatients appear to

use this service, although it represents < 2% of total outpatient costs. It is not clear from these data whether the relative costs of laboratory services are low or if they are just not used frequently.

In conclusion, the distribution of costs are not surprising. Fixed overhead costs claim the largest part of total resources followed by drugs. The most surprising finding is that outside of outpatient services personnel represents a small fraction of total costs, in contrast to its prominence as a proportion of the budget. These findings are disturbing as they suggest gross inefficiency in the use of overhead and personnel.

Conclusions and policy implications

The measurement and analysis of costs and the implications to be drawn from these results suggest that the Dominican hospital system is ripe for reform. The concerns regarding fairness, resource allocation, access, and quality that underlie current discussions about reform are well founded given the findings of the Aybar Hospital study.

First, the lack of information regarding:

1. resource allocation within the hospital;
2. costs; and
3. output

make effective hospital management and accountability impossible.

Without these elements, publicly provided health services are unlikely to be responsive to needs or to meeting basic standards of care. The system effectively operates on its own with no oversight and very little if any management, partly because very fundamental information, like that produced by this survey, are not readily available. Indeed the very structure of the system prevents sound management and invites abuse. The most striking result of the study is the low productivity and high degree of waste in the system. However, the incentives facing managers and providers—no accountability for physician or nurse performance, no rewards for extraordinary efforts and no punishments for inadequate or nonexistent performance, low and undifferentiated salaries, no management control over staff, no returns for effective or efficient management—lead to poor performance. And since none of the responses to these existing (dis)incentives can be ascertained due to lack of information, problems are not identified and solutions unnecessary.

Second, even with adequate information on costs and output, and management information systems to oversee the hospital, central government hiring of physicians and nurses results in impotent hospital directors and managers. Without the ability to hire, assign, motivate, and reward staff the hospital operates on the whim of medical staff. Low productivity and absenteeism suggested by the study are beyond the control of the hospital director. The

infungibility of budget funds further contributes to the ineffectiveness of management, and reliance on in-kind transfers introduces further rigidity.

Third, expenditures and stepdown analyses do not provide the basis for understanding hospital costs, and convey nothing about efficiency. The inability of these alternative approaches to capture outcome or performance limits their usefulness as hospital management tools or guides to health policy. They simply measure expenditures, which the analysis has shown to be an incorrect estimate of actual costs.

Finally, for Aybar Hospital, it is clear that outpatient services are less costly than inpatient care, in keeping with evidence from elsewhere. It suggests the need to transfer some services to the outpatient department. Cataracts and simple surgeries are the best examples of easily transferable services. Furthermore, the unused fixed costs for operating theaters is costly for the hospital since the overhead for surgery is so high (69% of the total cost).

These conclusions indicate the need for radical restructuring. Among the most important areas for change within hospitals are the following:

- *Make hospital managers accountable, but give them control over resources.* Establishing written contracts with hospital directors and allowing increasing autonomy in management is fundamental to reform. However, contracts without adequate authority is unfair and unworkable. Reforms such as making budgets more fungible, allowing transfers of nonperforming staff, and introducing bonus schemes to provide incentives to staff are examples of possible changes. The information produced by this study exemplifies the need for similar data on an ongoing basis if managers are to be held accountable.

- *Make the wage structure more flexible,* allowing hospitals to adjust wage scales within certain parameters to reward seniority, performance or need in order to attract and maintain adequate staff. This is necessary to address the egregiously low staff productivity documented by the study.

- *Establish management information systems in hospitals* with the necessary support and training, and require hospital managers to use and report on hospital performance. Costs, efficiency, quality, and performance including the elements measured in this study can be monitored and improved through the effective design and use of management information systems.

- *Introduce quality assurance in hospitals as part of a system of accountability.* Information systems and managerial control provide a necessary context for overseeing quality of care. Ensuring quality will also improve efficiency.

- *Develop basic elements of service delivery that improve efficiency.* Simple measures such as individual dosages of medication, regular ordering and inventorying drugs and consumables, efficient use of surgical theaters, and contracting ancillary services

from private providers are examples of possible initiatives. Again, data like those produced under the study, management authority and accountability are needed in conjunction to provide the needed documentation and incentives to identify areas of waste or unnecessary expenditure (e.g. idle operating theaters).

Fundamental reform is needed in the health sector generally. This study has focused on hospitals. Given that about 70% of the health budget is devoted to hospital care, attention to its operation, and allocative and technical efficiency are essential. While the findings offer a range of possible areas for action, it is important that a systemic approach be adopted, because narrow changes will not have a significant impact. The problems are extensive and serious, and deserve concerted efforts to address them. Studies such as this one can provide the raw material for describing current circumstances and prioritizing interventions. However, data are essential to inform ongoing adjustments.

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