

Cost accounting in a surgical unit in a teaching hospital – a pilot study

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(Index words: Costs of hospital stay, operating theatre, anaesthesia, selected operations)

Abstract

Introduction Economic constraints remain one of the major limitations on the quality of health care even in industrialised countries. Improvement of quality will require optimising facilities within available resources. Our objective was to determine costs of surgery and to identify areas where cost reduction is possible.

Patients and methods 80 patients undergoing routine major and intermediate surgery during a period of 6 months were selected at random. All consumables used and procedures carried out were documented. A unit cost was assigned to each of these. Costing was based on 3 main categories: preoperative (investigations, blood product related costs), operative (anaesthetic charges, consumables and theatre charges) and post-operative (investigations, consumables, hospital stay). Theatre charges included two components: fixed (consumables) and variable (dependent on time per operation).

Results The indirect costs (eg. administration costs, 'hotel' costs), accounted for 30%, of the total and were lower than similar costs in industrialised nations. The largest contributory factors (median, range) towards total cost were, basic hospital charges (30%; 15 to 63%); theatre charges fixed (23%; 6 to 35%) and variable (14%; 8 to 27%); and anaesthetic charges (15%; 1 to 36%).

Conclusion Cost reduction in patients undergoing surgery should focus on decreasing hospital stay, operating theatre time and anaesthetic expenditure. Although definite measures can be suggested from the study, further studies on these variables are necessary to optimise cost effectiveness of surgical units.

Introduction

Economic constraints remain one of the major limitations on the quality of health care provided even in industrialised nations. In the UK health care spending as a percentage of gross domestic product (GDP) is only marginally above 6%, and less than half that of the USA (1). Economic limitations are a special factor in Sri Lanka where the state health expenditure was 1.4% of GDP in 1998 (2), and there is ample evidence to indicate that management of the available resources within the health sector is substandard. Hence, improvement of quality of health care provision will require optimising facilities within available resources, based on analysis of resource allocation and the cost effectiveness of interventions.

Analysing hospital procedures from a business

perspective is not a natural tendency among many health care workers. Most doctors would feel uneasy about analysing their interventions with cost and profit in mind. This is a drawback to optimising the meagre resources available to them. Several studies have shown that cost effective measures can be utilised without compromising patient care (3,4,5). A basic requirement for this would be to obtain detailed information regarding health care expenditure. In Sri Lanka, only a few studies (6) have addressed the cost to the state for hospitalisation of patients. The objective of this study was to conduct a pilot study within a limited time frame to determine costs of routine surgery, to identify areas where cost reduction may be possible or where further study should be focused.

Patients and methods

Between October 1999 and March 2000, 80 patients who underwent surgery at the University surgical unit at the North Colombo teaching hospital were selected at random. During their stay in the ward each management intervention was documented. Additional information relevant to costing, such as duration of operation, number of days in hospital were also documented. Capital cost and personnel costs were *not* included in the analysis.

The cost of each operation was based on 3 main categories: pre-operative, operative and post-operative. The pre-operative category included cost of investigations, drugs, intravenous fluids (IVF), procedures and blood product related cost. The operative category included anaesthetic charges, blood products, surgical consumables, IVF and theatre charges, and the post-operative category comprised investigations, IVF, procedures, drugs, consumables, blood products and hospital stay. A unit cost was assigned to each of the items within these categories. Several methods were used to cost the items. Drugs and other consumables which are provided by the Medical Supplies Division (MSD) were assigned the unit cost as stated in the MSD circular to the hospitals (7). Items obtained from individual hospital budgets were assigned the purchase values at that time. The daily expenditure for a patient in the ward was assigned a value as given by the hospital accounts department (Director, North Colombo Teaching Hospital. Personal communication). Procedures (eg. urethral catheterisation, wound dressing) were assigned a total unit value according to the cost of the consumables used. Cost of investigations was calculated from an average of three private sector hospital values excluding the margin of profit that is usually incorporated in the cost.

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Operating theatre charges included two components, a fixed and a variable charge. The fixed charge was based on the consumables used, which is determined by each operation (ie. major, intermediate or minor). These values were obtained from private sector figures. The variable charge depended on the type of anaesthesia used. Where the patients underwent general anaesthesia (GA), a price was assigned using a value obtained from the private sector multiplied by the time duration of the operation. Those receiving either spinal or local anaesthesia were assigned a value according to private sector pricing, excluding profit. For anaesthetic charges, a value was assigned which included the cost of drugs, gases and consumables used. The cost of 1 litre of each gas was calculated using MSD figures and a total cost assigned according to the flow rate and the time duration of anaesthesia.

Results

Eighty patients (males 39; median age, 41 years; range, 2.5 to 77 years) were included in the study. Table 1 indicates the categories of operations performed.

Table 1. Number of operations performed

Operation	No.
Gastrointestinal tract	42
Breast and endocrine	10
Urological	5
Hernia	22
Minor	1

Table 2. Costs by individual categories as a percentage of total expenditure

	Category	Median	Range
Pre op	Investigations	5.2%	0.0-44.7%
	Intravenous fluids	0.0%	0.0-1.6%
	Procedures	0.0%	0.0-0.7%
	Drugs	0.0%	0.0-0.5%
	Blood products	0.0%	0.0-3.6%
Per op	Anaesthetic	14.8%	1.0-35.7%
	Blood products	0.0%	0.0-4.3%
	Surgical consumables	4.6%	0.7-21.4%
	Intravenous fluids	0.3%	0.0-2.0%
	Theatre - variable	11.8%	2.3-24.1%
	Theatre - fixed	16.0%	3.4-39.1%
	Investigations	0.0%	0.0-18.5%
	Intravenous fluids	0.5%	0.0-10.7%
	Procedures	0.2%	0.0-2.9%
	Drugs	0.3%	0.0-32.4%
Post op	Consumables	0.0%	0.0-0.5%
	Blood products	0.0%	0.0-34.5%
	Hospital stay	29.9%	15.4-63.3%

Items termed as indirect costs have been defined in previous studies done in the UK and Canada. They include for example administration costs, 'hotel' costs (such as catering, bedding and linen, laundry, waste disposal, transport and travel, cleaning, furniture and other equipment etc.) (1). The indirect costs were 29.9% (range, 15.4 to 63.3%) and lower than similar costs in Scottish and Ontario hospitals. The cost of individual categories was calculated as pre-, per- and post-operative costs. Hospital stay accounted for the greatest expenditure (29.9%) while operating theatre expenses, anaesthetic expenditure, surgical consumables and investigations accounted for the major proportion of the total cost (Tables 2 and 3). Table 4 gives the cost of each operation.

The duration of hospital stay even for a potential day case operation such as inguinal herniorrhaphy has been 2.6 days (Table 5). The pre-operative stay in hospital is at least 1 day in all the patients studied. This includes patients who underwent operations such as hernia repair, anal fistulectomy and haemorrhoidectomy.

Table 3. Categories ranked according to contribution to total cost

Category	Median
Hospital stay	29.9%
Theatre - fixed	16.0%
Anaesthetic costs	14.8%
Theatre - variable	11.8%
Investigations	5.2%
Surgical consumables	4.6%
IVF	0.8%
Drugs	0.3%
Procedures	0.2%

Table 4. Average cost of each operation

Operation	Average cost (Rs)
Abdominal rectopexy	11 821.00
Anterior resection	34 002.00
Abdominoperineal resection	26 885.00
Cholecystectomy	8 852.00
Colectomy - right	22 171.00
Fistulectomy	4 543.00
Gracilis neosphincter	15 378.00
Haemorrhoidectomy	5 680.00
Ileostomy closure	9 735.00
Inguinal herniorrhaphy	4 221.00
Mastectomy and axillary clearance	11 058.00
Mesh repair for hernia	7 460.00
Open prostatectomy	16 365.00
Paraumbilical hernia	5 092.00
Thyroidectomy	9 526.00
Transurethral resection of prostate	13 233.00

Table 5. Days in hospital – total and pre-operative

Operation	Average days in hospital	Average days preoperative stay
Abdominal rectopexy	4.2	1.5
Anterior resection	14.8	2.6
Abdominoperineal resection	9.0	3.0
Cholecystectomy	3.7	1.2
Colectomy – right	7.0	1.5
Fistulectomy	3.0	1.0
Gracilis neosphincter	9.0	1.0
Haemorrhoidectomy	4.8	1.0
Ileostomy closure	5.2	1.5
Inguinal herniorrhaphy	2.6	1.1
Mastectomy and axillary clearance	7.5	1.3
Mesh repair for hernia	4.0	1.5
Open prostatectomy	15.5	1.5
Paraumbilical hernia	3.5	1.0
Thyroidectomy	3.8	1.0
Transurethral resection of prostate	11.0	2.7

Table 6. Contribution of costs of investigations and blood products to pre-operative costs (excluding cost of hospital stay)

Operation	Median %
Abdominal rectopexy	100.0
Anterior resection	100.0
Abdominoperineal resection	100.0
Cholecystectomy	100.0
Colectomy – right	100.0
Fistulectomy	100.0
Gracilis neosphincter	100.0
Haemorrhoidectomy	99.9
Ileostomy closure	100.0
Inguinal herniorrhaphy	100.0
Mastectomy and axillary clearance	100.0
Mesh repair for hernia	100.0
Open prostatectomy	100.0
Paraumbilical hernia	100.0
Thyroidectomy	99.7
Transurethral resection of prostate	100.0

Contribution of costs of investigation and blood products to pre-op costs

Preoperative costs include direct expenditure such as investigations and, cost of blood products and indirect costs due to hospital stay. When the costs incurred for hospital stay are not included, the major proportion of pre-operative costs seem to be for investigations and blood products (Table 6). (Except for blood product transfusion in two patients awaiting anterior resection, all the other patients had only grouping and cross-matching in the pre-operative days in hospital.)

Discussion

Direct costs in the treatment of surgical patients within the health service in Sri Lanka accounts for 70% (range 36.7 to 84.6%) of total health expenditure in a teaching

hospital setting. This is higher than corresponding values in the UK and Canada (60.8% and 65.7% respectively) (1). This, at face value, is a favourable finding as reducing indirect or overhead costs in health care plays a crucial role in managing health care expenditure. Expenditure for hospital stay seems to account for the highest percentage of total expenditure; 30% (15.4 to 63.3%), and this is in keeping with findings of other studies (8,9). A worrying fact is that despite long hospital stay (which means higher indirect costs) the percentage of total expenditure spent on direct costs is higher when compared with industrialised nations. Whether this is due to accommodating floor patients, compromising on basic facilities such as provision of clean water, food, linen etc., is a consideration which will have to be addressed in future studies.

Reduction of hospital stay would be a measure with considerable impact on total health expenditure. The findings of our study indicate that patients spend on average 2.6 days for an inguinal herniorrhaphy and up to 15.5 days for open prostatectomy. On analysis of the pre-operative stay in the ward the following findings are of interest: all patients spend at least a day in hospital preoperatively even for intermediate operations such as inguinal herniorrhaphy; the direct costs during this period are mainly ($\geq 99.7\%$) for investigations and blood product related procedures, which do not require hospitalisation. Thus if pre-operative investigations and blood grouping and cross-matching are completed on an outpatient basis, reduction in pre-operative hospital stay or even 'same day admissions' for surgery may be possible, with considerable savings. Same day admissions have proved to be a safe method even for operations such as aortoiliac surgery (4) and thyroid surgery (3). For some patients this may not be possible because of difficulty in travelling to hospital on the day of operation and to their homes after discharge.

Day-case surgery is the other method for reducing expenditure. It is standard practice to undertake operations such as inguinal herniorrhaphy as day cases, and many other procedures are being included in this category eg. thyroid surgery (3), in an attempt to reduce health care expenditure. Reduction of post-operative stay with the use of planned clinical pathways and day-case surgery centres has also been shown to reduce total costs without affecting outcome (10,11).

The next highest contributor towards total cost is anaesthesia which accounted for 14.8% of the total expenditure. This category includes anaesthetic gases and drugs, monitoring equipment and consumables. Some effective options for reducing this cost are use of low flow techniques and the use of alternate cheaper drugs (12). The use of regional and local anaesthesia instead of general anaesthesia is another practical method to reduce cost, which is effective, safe and acceptable to patients (5,12). Our study too has shown the benefit of regional and local anaesthesia in minimising cost eg. the cost of an inguinal herniorrhaphy performed under general anaesthesia was Rs. 4637 while the same operation done under spinal or local anaesthesia would cost Rs. 3398 or 2754.

Papers

This pilot study shows the usefulness of cost-benefit analysis in managing the limited resources available to the health service. Even though the role of doctors as managers remains controversial (13,14), it is essential for them to understand the process of cost-benefit analysis to optimise the use of available resources. Measures that would reduce duration of hospital stay include out-patient pre-operative investigation, grouping and cross-matching of blood, same day admission, and day case surgery. Further studies to find factors affecting post-operative hospital stay, operating theatre delays and assessing feasibility of early planned discharge are needed. Increased use of regional and local anaesthetic techniques would also contribute to reductions in expenditure in surgical units.

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