

The cost of the district hospital: a case study in Malawi

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Described is an analysis of the cost to the Ministry of Health of providing district health services in Malawi, with particular emphasis on the district hospital. District resource allocation patterns were assessed by carefully disaggregating district costs by level of care and hospital department. A strikingly low proportion of district recurrent costs was absorbed by salaries and wages (27–39%, depending on the district) and a surprisingly high proportion by medical supplies (24–37%). The most expensive cost centre in the hospital was the pharmacy. A total of 27–39% of total recurrent costs were spent outside the hospital and 61–73% on hospital services. The secondary care services absorbed 40–58% of district recurrent costs. Unit costs by hospital department varied considerably by district, with one hospital being consistently the most expensive and another the cheapest. A total of 3–10 new outpatients could be treated for the average cost of 1 inpatient-day, while 34–55 could be treated for the average cost of 1 inpatient. The efficiency of hospital operations, the scope for redistributing resources districtwide, and the costing methodology are discussed.

Introduction

Very few in-depth investigations have been carried out on the economics of hospitals in developing countries, despite their significance in terms of sector expenditure (1, 2). The present study reviewed the allocation of Ministry of Health resources within six districts in Malawi, with particular emphasis on the proportion absorbed by the hospital and on the unit costs for hospital departments. The objectives were to develop policies and guidelines to increase the efficiency of hospital operations and to improve the intrasectoral allocation of health sector resources.

Health care in the study districts was the responsibility of a district health officer (DHO), who held a budget that covered the non-salary expenditure of all government facilities. Ministry of Health services were largely provided free. The responsibility for the day-to-day running of the hospital was usually delegated to a chief or senior clinical officer and to the sister-in-charge and hospital secretary. A district health inspector was responsible for preventive activity, reporting both to the DHO and the regional health inspector. A number of staff based at the district hospital had districtwide responsibilities, most notably the DHO, district health inspector, maternal

and child health (MCH) coordinators, and tuberculosis, leprosy and ophthalmic assistants. The Ministry of Health services in all districts were complemented by mission facilities, ranging from general hospitals similar to the ministry's own district hospitals to simple dispensaries, and by district council units. These facilities were not examined in the present study but clearly are important in planning the overall provision of district health services.

Materials and methods

Because of physical constraints, districts had to be purposively rather than randomly selected. The main aim of the selection process was to choose a group of districts containing hospitals that reflected the range of types of district hospital in Malawi in terms of size, services offered, staffing, age of buildings, and geographical location.

Total district costs were compiled from several sources, as described below.

Expenditure controlled at the district level

With the exception of salary costs, most of the recurrent expenditure of districts was identifiable at the level of the individual districts. A particular difficulty arose in calculating the costs of drugs and medical supplies, since annual expenditure was not necessarily a good reflection of the value of the drugs used (due to changes in stock levels and donated items). To overcome this and to estimate the cost of drugs according to hospital department, we examined a selection of both the duplicate books used by hospi-

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tal wards and departments to order drugs (usually daily) from the pharmacy and the monthly requisition forms from health centres. The prices charged by the central medical store were applied to the quantities of drugs used to obtain the total cost; this was then converted to a cost per day and hence an annual cost. Donated drugs were therefore costed at the prices charged by the medical store for equivalent drugs. Vaccine costs were estimated on the basis of the quantities used and price CIF (cost-insurance-freight) Malawi.

The annual amount of X-ray film used (by film size) was noted from departmental records and its cost allocated to the wards and outpatient department, according to the origin of patients X-rayed and the film size (both these were routinely noted in the X-ray department ledger). Vehicle logbooks were analysed for 1 month in order to allocate vehicle costs to user departments.

Costs of salaries

Salaries were paid centrally; district salary costs could only be calculated for two broad groupings: senior staff and junior staff. Since the cost apportionment required more detailed data, salary costs were estimated from staff numbers by type and grade and average salaries (mid-point of the salary scale). The total actual costs were used to cross-check this procedure: the actual and estimated expenditures were in general extremely close. To allow for employment benefits, we added 10% to the annual salary cost of pensionable staff. Subsidized housing represented an important category of employment benefit and was treated as a capital rather than a staff-related cost; however, its significance as an employment benefit is discussed below.

Other recurrent costs

Specialists from the two central hospitals made fairly regular visits to district hospitals. These visits were not taken into account in the study since they were fairly similar for most hospitals, it was difficult to estimate accurately the time involved and the amount of work done, and the sums involved were probably small. A few items, e.g., most postal charges, were paid centrally and not charged to individual districts. Such charges were not included and were probably, in any case, an insignificant proportion of total district expenditure.

Capital costs

Capital costs comprised hospital buildings and equipment, rural facilities and equipment (rural hospitals, health centres, dispensaries, maternity

units), staff housing, vehicles and motorbikes. Such costs were in general based on the estimated replacement cost of a standard unit (hospital, house, vehicle, etc.), unadjusted for location. Costs were annualized, assuming a lifespan of 30 years for buildings, 10 years for equipment, 3 years for linen and bedding, 10 years for ambulances, 6 years for a car, and 4 years for a motorbike. A real rate of interest of 3% was used in calculating annual costs to allow for the opportunity cost of capital purchases.

The ultimate purpose of the analysis was to allocate all costs to departments that provided direct patient care, i.e., the wards, outpatient department, maternal and child health department, and rural facilities. Diagnostic and support departments such as the operating theatre, X-ray facility, and laboratory were considered to provide services to these direct patient care departments. The methodology adopted, therefore, was slightly different from the standard hospital costing methods used in the USA (3), where costs are primarily allocated to "revenue-producing" departments and no clear distinction is made between direct patient care departments and diagnostic and support departments.

The Ministry of Health accounting system did not distinguish between hospital and non-hospital expenditure. We therefore used an estimation procedure to apportion costs between not only hospital departments but also the hospital and rural facilities. This procedure involved three stages: in the first, expenditure by line item was grouped into a smaller number of categories; in the second, costs were allocated to cost centres; and in the third, the costs of cost centres were stepped down to the departments providing direct patient care.

The cost centres are listed in Table 1, and the criteria used to allocate costs to them are shown in Table 2. Most are self-explanatory, with the exception of staff costs. The majority of staff could be directly allocated to cost centres on the basis of their duties or a rota. The remaining staff were either asked how they spent their time or this was estimated by the DHO or matron. In the step-down procedure, the order is important since the costs are assigned from a particular cost centre to subsequent cost centres and not to those that precede it. A more elaborate apportionment procedure was not considered worthwhile, however, since the costs to be apportioned were estimates. The criteria whereby costs were distributed to direct service departments are shown in Table 3.

The cost analysis used activity statistics for some of the apportionment procedures and for the production of unit costs. Unfortunately, few hospitals paid much attention to inpatient statistics, which were frequently incomplete. The information avail-

Table 1: List of cost centres used in the study

Administration of district
Maintenance of buildings and grounds for district
Transport
Domestic
Laundry
Kitchen
Pharmacy
Laboratory
X-ray department
Operating theatre
Male ward
Female ward
Paediatric ward
Tuberculosis ward
Hospital outpatient department
Hospital maternal and child health department
Environmental health department at hospital
Rural hospitals
Health centres and primary health care

able, other sources of data (e.g., ward admission books and daily inpatient census records), and the advice of district staff were used to estimate missing data or to compile alternative statistics. The statistics on admissions were probably more accurate than those on inpatient-days. Outpatient statistics, when available, recorded only new outpatients and not the total number of visits. Where possible, estimates of total visits were also obtained.

Results

Table 4 shows the distribution of recurrent and total district costs, by broad input category. There are two striking features: the low proportion of recurrent costs absorbed by salaries and wages (27–39%); and the high proportion (46–57%) absorbed by the annual value of capital, of which buildings and equipment were the most significant and transport very small. As a proportion of total recurrent costs, the costs for drugs and medical stores accounted for 24–37% and vehicle-associated costs for 11–18%. Food, the only other significant item of recurrent expenditure, comprised 3–7% of total recurrent costs.

When costs were distributed by cost centre, the pharmacy was the most costly department, absorbing 25–38% of total recurrent costs. Administration accounted for 5–9%, maintenance for under 4% (in four districts for <2%), and kitchen costs for 5–9%.

The medical support departments apart from the pharmacy—laboratories, X-ray facility and operating theatre—had low direct costs.

Table 5 shows total recurrent costs distributed to direct service departments and Table 6 the unit recurrent costs per bed, inpatient, inpatient-day, new outpatient, and outpatient. Deficiencies in hospital statistics precluded calculating all these unit costs for each district.

Table 2: Criteria for allocation of costs to cost centres

Cost item	Allocated to: ^a
<i>Recurrent costs</i>	
Domestic supplies	Domestic cost centre
Food	Kitchen cost centre
Vehicle-associated	Transport cost centre
Heating, lighting	In proportion to likely energy use of cost centres
Hospitality	Administration cost centre
Staff-associated	In proportion to salary costs by cost centre
Maintenance, buildings	Maintenance cost centre
Maintenance, office equipment	Administration cost centre
Maintenance, plant	According to plant location
Postage, printing	Administration cost centre
Public transport (i.e., travel warrants for patients)	Wards in proportion to in-patients
Medical supplies	Pharmacy
Subsistence, transport claims	10% to administration, 90% to health centres and PHC
Telephone, telex	Administration cost centre
Water, sanitation	In proportion to likely use by cost centres
Bicycle maintenance	Health centres and PHC
Uniforms (staff and patients)	88% to wards in proportion to inpatients, 1.5% to OPD, 0.5% to MCH, 10% to health centres
Salaries and wages	According to distribution of staff time by cost centre
<i>Capital costs</i>	
Buildings	Hospital, in proportion to floor space by cost centre; health centres etc., directly
Equipment	Hospital equipment list broken down by cost centre; health centre equipment estimated
Staff houses	For hospital houses, in proportion to salary costs
Vehicles	Transport
Motorbikes	Transport

^a PHC = primary health care; OPD = outpatient department; MCH = maternal and child health.

Table 3: Criteria for the distribution of the cost of cost centres to direct service departments

Cost centre	Distribution criteria ^a
Administration	Direct costs of cost centre
Maintenance	30% to health centres; 70% to hospital distributed on the basis of floor area
Transport	Shared between administration, wards, and health centres and PHC based on the analysis of logbooks: the administration share was allocated in proportion to the direct costs of cost centres following the transport cost centre; the ward share to wards in proportion to inpatients
Domestic	Floor area of hospital after health centre supplies had been subtracted
Laundry	Share of inpatient-days by ward
Kitchen	Share of inpatient-days by ward
Pharmacy	Estimation of actual use of drugs and medical supplies
Laboratory	Estimated allocation of time between inpatients and outpatients, and to wards in proportion to inpatients
X-ray	Actual use of X-ray department by OPD and wards
Operating theatre	To maternity department in relation to Caesarian sections as a proportion of total major (weighting = 1) and minor (weighting = 0.5) operations; remainder in proportion to male and female surgical inpatients (if distinguished separately) or male and female inpatients

^a PHC = primary health care; OPD = outpatient department.

The distribution of recurrent costs in Table 5 gives an accurate indication of the resources absorbed by rural services (27–39%), as opposed to the district hospital. While the hospital accounted for 61–73% of the district recurrent costs, part of this was spent on primary health care services for the local population; the secondary care services provided by the hospital consumed 40–58% of district recurrent costs. There was a considerable variation in the relative importance of the different wards, depending on the hospital. In Salima and Kasungu hospitals, the maternity ward had the largest share, in Chiradzulu and Rumphi, the children's ward, and in Mulanje and Nkhata Bay, the male ward. However, the differences were not particularly large except where there were major variations in bed numbers between the wards (for example, the small maternity ward in Mulanje).

The unit recurrent costs (Table 6) varied considerably between the hospitals. The most expensive hospital was consistently Mulanje, and the cheapest, Rumphi: in terms of cost per bed, Mulanje was 75% more expensive than Rumphi; in terms of cost per inpatient, 83% more expensive; and in terms of cost per inpatient-day, 234% more expensive. These differences should, however, be interpreted with caution since they are highly sensitive to the accuracy of the activity statistics used. Mulanje reported a bed occupancy rate of 76%, which was implausibly low. The range of unit recurrent costs is probably better represented by excluding Mulanje, whereupon the cost per inpatient varied between K (*kwacha*) 45.42

Table 5: Distribution of recurrent costs, by direct service department, in the six study hospitals, 1987–88

Department ^a	% distribution in:					
	Chiradzulu	Kasungu	Mulanje	Nkhata Bay ^b	Rumphi	Salima
Male ward	11.4	11.7	12.6	13.3	9.5	12.0
Female ward	9.4	11.7	8.1	9.3	10.7	11.9
Children's ward	13.8	7.7	9.7	11.0	12.7	13.1
Maternity	11.9	14.2	6.3	10.1	10.3	13.9
Tuberculosis ward	11.5	2.4	3.6	5.2	1.4	4.5
Poliomyelitis annex	—	—	—	—	3.9	—
All wards	58.0	47.7	40.3	48.9	48.5	55.4
OPD	10.8	11.2	18.2	10.6	14.7	14.3
MCH/district hospital	2.3	2.8	1.7	1.8	2.4	2.0
Environmental health/district	1.5	1.3	1.0	2.1	2.0	0.9
Rural hospitals	—	5.1	—	12.2	16.2	—
Health centres and PHC	27.4	31.9	38.8	24.4	16.2	27.4
All non-wards	42.0	52.3	59.7	51.1	51.5	44.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

^a OPD = outpatient department; MCH = maternal and child health; PHC = primary health care.

^b The urban health centre at Mzuzu was included under rural hospital category.

Table 4. Distribution of costs by input category, in the six study hospitals, 1987-88

Input category	% distribution of recurrent costs in:						% distribution of total costs in:					
	Chiradzulu	Kasungu	Mulanje	Nkhata Bay	Rumphi	Salima	Chiradzulu	Kasungu	Mulanje	Nkhata Bay	Rumphi	Salima
Domestic supplies	1.67	0.90	1.43	2.64	1.23	3.66	0.88	0.48	0.77	1.26	0.54	1.57
Food	6.84	5.78	4.45	7.35	4.11	3.11	3.60	3.04	2.41	3.51	1.80	1.33
Vehicles	10.90	15.27	16.55	14.83	18.13	13.94	5.75	8.04	8.97	7.09	7.95	5.96
Heating, lighting	1.03	1.82	1.57	1.55	0.78	2.62	0.54	0.96	0.85	0.74	0.34	1.12
Hospitality	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.01	0.00
Staff-associated costs	0.89	1.03	0.77	0.84	1.20	0.95	0.47	0.54	0.42	0.40	0.53	0.41
<i>Maintenance</i>												
Buildings	2.75	3.43	0.99	0.09	0.95	0.87	1.45	1.81	0.54	0.04	0.42	0.37
Plant	0.00	0.19	0.42	0.00	0.47	0.13	0.00	0.10	0.23	0.00	0.21	0.05
Office equipment	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.00	0.00
Postage, printing, etc.	0.46	0.78	0.73	1.85	0.67	1.29	0.24	0.41	0.40	0.89	0.30	0.55
Public transport	2.01	2.67	1.56	3.33	2.52	3.18	1.06	1.40	0.84	1.59	1.11	1.36
Medical supplies	33.17	28.28	37.42	24.99	24.34	26.71	17.49	14.88	20.29	11.95	10.68	11.43
Subsistence, transport claims	0.72	2.12	1.58	3.75	1.79	1.80	0.38	1.11	0.86	1.79	0.79	0.77
Telephone, telex	0.59	4.75	1.01	0.24	1.71	3.19	0.31	2.50	0.55	0.12	0.75	1.36
Water, sanitation	1.70	1.49	1.87	1.85	2.05	0.26	0.89	0.78	1.01	0.88	0.90	0.11
Bicycle maintenance	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.05
Uniforms	3.23	0.87	2.30	2.06	0.97	1.05	1.70	0.46	1.24	0.98	0.43	0.45
Total non-salary costs	65.95	69.41	72.72	65.37	60.96	62.87	34.78	36.53	39.42	31.25	26.74	26.89
Salaries and wages	34.05	30.59	27.28	34.63	39.04	37.13	17.96	16.10	14.79	16.55	17.12	15.88
Total recurrent costs	100.00	100.00	100.00	100.00	100.00	100.00	52.74	52.63	54.20	47.80	43.86	42.78
Buildings	—	—	—	—	—	—	23.48	25.82	26.03	25.11	30.26	31.49
Equipment	—	—	—	—	—	—	18.99	17.22	14.69	19.80	20.70	19.04
Staff houses	—	—	—	—	—	—	2.13	2.70	2.18	2.90	3.00	3.77
Vehicles	—	—	—	—	—	—	1.95	1.19	2.12	3.65	1.90	2.39
Motorbikes	—	—	—	—	—	—	0.71	0.44	0.78	0.74	0.28	0.52
Total capital costs	—	—	—	—	—	—	47.26	47.37	45.80	52.20	56.14	57.22
Total costs	—	—	—	—	—	—	100.00	100.00	100.00	100.00	100.00	100.00

Table 6: Unit recurrent costs in *kwacha* (K) (1US\$ = K 2.21) in the six study hospitals, 1987–88

Recurrent cost ^a	Chiradzulu	Kasungu	Mulanje	Nkhata Bay ^b	Rumphi	Salima
<i>Per bed per ward</i>						
Male ward	2091	2906	3305	2936	1342	2715
Female ward	2036	2900	3051	2053	1515	2690
Children's ward	5962	3986	3533	5557	3309	2976
Maternity ward	3143	4347	11 053	2942	3034	3151
Tuberculosis ward	2104	1007	1351	1433	1634	1082
Poliomyelitis annex	—	—	—	—	2053	—
All wards	2680	3046	3239	2704	1846	2540
<i>Per inpatient by ward</i>						
Male ward	54.41	72.85	100.16	78.35	53.55	70.13
Female ward	52.69	49.41	79.39	58.34	48.86	67.76
Children's ward	29.77	33.37	74.14	38.59	38.54	57.37
Maternity ward	44.90	38.56	63.04	43.97	59.33	56.86
Tuberculosis ward	303.87	139.84	136.09	125.13	166.18	131.71
Poliomyelitis annex	—	—	—	—	52.64	—
All wards	50.26	47.10	83.06	55.18	45.42	64.88
<i>Per inpatient-day by ward</i>						
Male ward	4.37	11.40	12.72	10.87	3.65	6.07
Female ward	4.14	8.05	13.22	8.90	3.56	7.99
Children's ward	5.65	8.16	11.12	8.98	3.87	8.53
Maternity ward	5.74	9.64	21.49	12.21	4.63	8.95
Tuberculosis ward	8.94	5.81	5.44	6.91	6.65	4.39
Poliomyelitis annex	—	—	—	—	2.92	—
All wards	5.43	8.98	11.75	9.64	3.52	7.31
<i>Per new outpatient^b</i>						
Hospital OPD	0.91	0.91	2.48	1.22	1.14	1.53
Rural hospital						
No. 1	—	1.10	—	0.92 ^c	0.90	—
No. 2	—	—	—	—	1.40	—
No. 3	—	—	—	—	1.15	—
Health centres	0.76	1.88	NA ^d	1.43	1.13	1.17
All	0.79	1.42	—	1.14	1.13	1.27

^a OPD = outpatient department.

^b Estimated cost per outpatient visit was K 0.64 (Kasungu OPD); K 0.57 (Mulanje OPD).

^c Urban health centre at Mzuzu was included under rural hospital category.

^d NA = not available.

(US\$ 20.55) in Rumphi and K 64.88 (US\$ 29.36) in Salima, and the cost per inpatient-day between K 3.52 (US\$ 1.59) in Rumphi and K 9.64 (US\$ 4.36) in Nkhata Bay.

The average hospitalwide unit cost disguises considerable differences between the various wards. In terms of cost per inpatient, after the tuberculosis ward, which was costly because of the long length of stays, the male ward was the most expensive, and the children's and maternity wards the cheapest. In terms of cost per inpatient-day, the male and female wards

tended to be cheaper than the children's and maternity wards. The cost of the tuberculosis ward was to some extent determined by whether rifampicin (a very expensive drug) was supplied during the period analysed. Excluding the tuberculosis ward, maternity was the most expensive in terms of cost per inpatient-day in five of the six hospitals.

Outpatient statistics were incomplete and comparisons were therefore more difficult. Also, while the cost per hospital outpatient reflected the cost of the outpatient department alone, the cost per out-

patient in a health centre or rural hospital included the cost of other activities (e.g., maternity ward for many health centres and general inpatient activities for rural hospitals) that could not readily be individually assigned. The cost per new hospital outpatient varied between K 0.91 (US\$ 0.41) for Chiradzulu and Kasungu to K 2.48 (US \$ 1.12) for Mulanje, with the other hospitals in the range K 1.14–1.53 (US\$ 0.52–0.69). The cost for Mulanje is probably an overestimate, because of overestimates of outpatient drugs. On the whole, those hospitals that provided cheaper inpatient care also provided cheaper outpatient care, though Rumphhi's extremely low inpatient unit costs were not replicated in the outpatient department. Allowing for the distortion in the cost per health centre outpatient and rural hospital outpatient, it seems likely that health centres and rural hospitals provided outpatient care at a slightly lower cost than the district hospital.

It should have been possible to estimate the unit costs of the various cost centres, particularly the laboratory and operating theatre. Unfortunately, however, neither of these kept records detailed enough to quantify their activities or to weight them for their intensity of resource use. The cost of the kitchen was divided by the number of inpatient-days to produce a unit cost (Table 7). This varied considerably between hospitals, as did the cost of the food component. The variation primarily arose because of differences in expenditures on food relative to the number of inpatient-days, some hospitals such as Rumphhi and Salima being relatively economical, and also because of the cost of water and heating.

The addition of annualized capital costs to recurrent costs only altered slightly the ranking of hospitals in terms of unit costs; this is not unexpected, since capital costs were based on a common replacement cost for a standard hospital and adjusted only for the number of beds.

The difference in the unit costs of outpatients and inpatients illustrates the scope for increasing efficiency by replacing inpatient care by outpatient

care if the characteristics of patients permitted. The ratios of the recurrent cost per new outpatient, per inpatient-day, and per inpatient, respectively, were as follows in the six hospitals:

- Chiradzulu, 1 : 6 : 55;
- Kasungu, 1 : 10 : 52;
- Mulanje, 1 : 5 : 34;
- Nkhata Bay, 1 : 8 : 45;
- Rumphhi, 1 : 3 : 40; and
- Salima, 1 : 5 : 42.

Discussion

Mix of inputs

The cost of manpower was low, partly because of the provision of subsidized housing to staff. Also, the rates of pay were below their true market level, both relative to the private sector in Malawi and internationally. Since the prices paid for imported inputs were similar to international levels, the proportion of the total expenditure taken up by salaries and wages was lower than in countries with a different price structure of inputs.

The low salary and wage share was also a reflection of the mix of staff. Medical officers constituted only 3–6% of overall staff costs in the six districts; technical and technical assistant grades, 25–33%; and nurses, 21–37%. There was thus heavy reliance on technical, auxiliary and nursing staff. In contrast to many African countries, staff were provided with the resources with which to work. For example, there was little evidence, on the whole, that inputs of pharmaceuticals were in short supply, although shortages and overstocking of certain items occurred because of poor management at the hospital and central medical stores. Transport services did not appear to be constrained by lack of money for fuel; rather, the availability of vehicles in operating order was the main problem.

The annual value of capital represented an extremely high proportion of total costs. Probably capital (especially imported building supplies and equipment) was expensive relative to recurrent inputs, not least because salaries and wages were low. However, further study is required to determine whether the capital costs used were overestimates.

Unit costs

Unit costs are an important guide to efficiency, but need to be interpreted cautiously since the available indicators of output, such as bed-days, ignore any quality differences between hospitals. Often, how-

Table 7: Cost of providing food in the six study hospitals

	Cost of the kitchen per inpatient-day (in kwacha)	Food as a % of cost
Chiradzulu	0.80	80
Kasungu	1.48	73
Mulanje	1.95	66
Nkhata Bay	2.04	71
Rumphhi	0.52	63
Salima	0.74	56

ever, the differences in unit costs between the hospitals were so great that quality was unlikely to account for all the variation. Moreover, the interpretation of certain unit costs, for example, the cost of food per inpatient-day, is less affected by quality considerations.

The variation in unit recurrent costs between the six hospitals requires comment. Chiradzulu is a small hospital without a doctor or X-ray equipment and therefore referred many cases elsewhere; not surprisingly, it had low unit costs. Rumphhi, which is the referral hospital for the northern region and was staffed by two doctors, had unit costs that were almost as low. Differences in the type of hospital therefore did not inevitably lead to differences in unit costs.

Because a significant proportion of hospital costs are fixed, the intensity with which resources are used is likely to influence strongly unit costs. The first step in elucidating the unit costs is therefore to examine bed occupancy rates and lengths of stay (Table 8). The two hospitals with the highest bed occupancy rates, Chiradzulu and Rumphhi, had the lowest unit costs. Salima was operating at around 100% capacity and Nkhata Bay and Mulanje were lower (although there were discrepancies in the statistics). Lengths of stay varied considerably, being

lowest overall in Kasungu and Nkhata Bay and highest in Rumphhi; this suggests scope for reducing the length of stay, notably in Rumphhi but also in Salima, Mulanje, and Chiradzulu. Compared with other countries, however, the lengths of stay were low. It is very unlikely that case-mix differences would account for all the variation in length of stay, especially between Kasungu, Mulanje and Salima, although Rumphhi did serve a regional role.

Although bed occupancy rates and lengths of stay account for some of the unit cost variation between hospitals, particularly the low cost per inpatient-day in Rumphhi, they do not explain all of it; there was a clear difference in the efficiency with which hospitals used resources that was independent of occupancy rates or length of stay. It is also important to distinguish those costs that could be locally controlled and those over which the hospital had no influence. Examples of the latter were the source of heat for the kitchen and laundry (mains electricity or wood) and the technical efficiency of the equipment; and of the former, drugs and food. Detailed analysis of supplies of drugs to outpatient departments and wards indicated considerable variations in practices between hospitals, which were probably not related simply to the characteristics of patients: the cost of

Table 8: **Bed occupancy rates and length of stay statistics for the six study hospitals**

Hospital ^a	Male ward	Female ward	Children's ward	Maternity ward	Tuberculosis ward	Poliomyelitis annex	All wards
<i>Chiradzulu</i>							
BOR (%)	131	135	289	150	64	—	135
LOS (days)	12.4	12.7	5.3	7.8	34.0	—	9.3
<i>Kasungu^b</i>							
BOR (%) ^c	69.8	98.7	133.8	100.0	47.5	—	88.0
LOS (days)	6.4	6.1	4.1	4.0	24.1	—	5.2
<i>Mulanje</i>							
BOR (%) ^c	71.2	63.2	87.0	140.9	68.0	—	75.5
LOS (days)	7.9	6.0	6.7	2.9	25.0	—	7.1
<i>Nkhata Bay</i>							
BOR (%) ^c	74.0	63.2	169.6	66.0	58.5	—	76.9
LOS (days)	7.2	6.6	4.3	3.6	18.1	—	5.7
<i>Rumphhi</i>							
BOR (%)	100.6	116.6	234.1	179.5	67.4	192.3	143.6
LOS (days)	14.7	13.7	10.0	12.8	25.0	18.0	12.9
<i>Salima</i>							
BOR (%)	122.6	92.3	95.6	96.4	91.4	—	98.2
LOS (days)	11.6	8.5	6.7	6.4	30.0	—	9.2

^a BOR = bed occupancy rate; LOS = length of stay.

^b Official statistics except maternity, where 100% BOR and 4-day LOS were assumed.

^c Probably underestimated.

drugs per new outpatient varied between K 0.55 (US\$ 0.25) and K 1.84 (US\$ 0.83); in one hospital, supplies of tablets and injections were strictly controlled, but large amounts of bandages were regularly supplied; some hospitals used large quantities of intravenous fluids and others less; and use of antibiotics and injectables varied enormously. The findings on the cost of food and kitchens indicated substantial differences that could not be explained by regional price variations.

Districtwide distribution of resources

The distribution of resources districtwide was determined to a considerable extent by the physical infrastructure of rural facilities. This helps to explain, for example, why health centres and primary health care absorbed 27% of district recurrent costs in Chiradzulu (which had few rural units under its control) and 39% in Mulanje (which had many rural units). There was a fair amount of local flexibility, however, since a considerable number of staff and other resources were based at the hospital to serve the district as a whole. Two indicators of the effort expended in districtwide activities are the proportion of time the DHO spent on district supervision and the proportion of vehicle mileage devoted to health centre and primary health care activities. The former varied between 9% and 25%: most DHOs spent one day per week on districtwide activities with a further 30–40% of time being spent on district administration. The DHO thus found it difficult to avoid spending the great majority of his time in the hospital. Virtually no other senior staff were involved in district supervision.

Analysis of the vehicle logbooks indicated that only about 20% of mileage was associated with primary health care and that the great majority was devoted to the transport of inpatients. The requirement to have vehicles available to transport patients was a major factor that precluded their use for other activities, particularly primary health care.

Conclusions

The cost analysis permitted conclusions to be drawn under the following headings: the efficiency of hospital operations; scope for redistribution of resources districtwide; and the costing methodology and scope for more frequent cost analysis.

Efficiency of hospital operations

The study identified areas where improvements in efficiency might be feasible, for example, through

better drug purchasing, stock control, distribution, and prescribing. There was scope for economies in some hospitals, particularly for food purchasing and vehicle running costs. In contrast, the sums spent on maintenance appeared to be inadequate. Although capital costs were high relative to recurrent costs, there was little evidence that buildings were unduly lavish. Building standards had improved in recent years, new hospitals being more spacious than old ones, permitting greater efficiency.

Many of the problems in the hospitals resulted from organizational weaknesses, particularly in relation to the pharmacy, supplies, and transport. Since the pharmacy was the biggest single manager of resources in the whole district, there is a strong case for strengthening its management.

Scope for reducing inpatient numbers and the lengths of stay was relatively limited, although in view of the low cost of diagnostic services compared with the total hospital costs, it should be investigated whether improved laboratory services would permit better standards of care and shorter stays. Most district hospitals were limited to a very basic range of haematological, biochemical and parasitological tests, other tests being referred to Blantyre or Lilongwe (50–60 cases per week in the case of Salima). The outpatient department was considered to be overused for minor ailments, and in highly populated districts such as Kasungu and Mulanje was viewed as a drain on hospital resources, especially staff time. One way of tackling this would be to charge nominal fees to discourage those with minor complaints.

Further investigation of health centre costs is required, since they are an alternative source of care for outpatients and maternity cases. In some hospitals maternity care was one of the more expensive types of inpatient care, accounting for 10–15% of recurring costs, suggesting that further decentralization of maternity care might be desirable.

Redistribution of district resources

In recent years there has been a notable increase in the number of staff based at the district hospital who have districtwide responsibilities. Availability of transport is vital to the efficient use of their time: without it, they are presumably underemployed unless, as with MCH services, there are sufficient hospital-based activities to occupy them. The difficulty posed by transport was not simply a shortage of vehicles but also one of maintenance and priorities: district outreach activities received lower priority for transport than administrative activities or transport of patients. There was a similar problem with regard to the DHO's time: hospital business

tended to displace primary health care despite good intentions to the contrary. There is no easy solution to changing priorities, which must include increasing staff motivation. Vehicles have been assigned to particular activities and this may help as will improving vehicle maintenance. Provision of vehicles unsuitable for patient transport (e.g., motorbikes) could be increased, provided maintenance is ensured.

Costing methodology

Our analysis has shown that detailed costing of hospital operations is feasible in a country such as Malawi, despite the inclusion of rural facility and hospital expenditures in a single district budget, and the poor availability of information on district salaries and wages. Indeed, the greatest problem lay not in the accounts but in obtaining accurate activity statistics. Such costing can lead to useful conclusions on district resource allocation patterns and hospital efficiency.

This type of analysis cannot be performed routinely in Malawi with the current accounting system, but marginal changes could facilitate the more regular production of unit costs that would be useful in planning and management. Minor changes could be introduced in routine information systems that would permit health centre and hospital costs to be separated. Analysis of intra-hospital costs would nevertheless remain a problem. However, our findings suggest that overall unit costs (not distinguished by department) per outpatient, per inpatient, and per inpatient-day give a reasonable indication of the relative costliness of different hospitals and thus could be used to monitor efficiency, supplemented by readily calculable unit costs such as the cost of food per inpatient-day. This would simplify the drug analysis, and make it feasible to use pharmacy tally cards to note the issue of supplies for inpatient and outpatient use. Use of a prospective rather than a retrospective analysis would enable temporary changes to be made in information systems to facilitate the study and would encourage better recording of activity statistics.

The results of the study are relevant also to other countries. Detailed examination of the allocation of resources within hospitals; especially of staff time and drugs, is a valuable exercise. Investigation of the distribution of resources between inpatients and outpatients is particularly important because of its variation in different hospitals; it should not be apportioned using an assumed ratio of cost per outpatient to cost per inpatient-day. It is also important to examine the hospital's role in the district health system and the extent to which its resources and skills serve the district as a whole.

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Résumé

Coût de l'hôpital de district: une étude de cas au Malawi

L'article présente les résultats d'une étude sur les ressources allouées par le Ministère de la Santé dans six districts du Malawi, l'accent portant en particulier sur la proportion absorbée par l'hôpital de district et sur la détermination des coûts unitaires pour les services de l'hôpital de district. L'objectif était de choisir les options propres à améliorer l'efficacité de l'hôpital et l'allocation des ressources à l'intérieur de chaque secteur. Six districts correspondant à une fourchette d'hôpitaux de district différents ont été choisis pour l'étude. Les données sur l'investissement initial et les coûts renouvelables ont été obtenues ou évaluées en cas de besoin. Ces chiffres ont ensuite été ventilés par centre de coûts (services hospitaliers et services externes), répartis entre les services dispensant des soins directs aux malades, et les coûts unitaires ont finalement été calculés.

Les principaux résultats concernent les coûts unitaires et la répartition des coûts comme suit: par catégorie de ressources utilisées, par centre de coûts et par service fournissant des soins directs. Dans les six districts, les salaires n'absorbent qu'une part étonnamment faible des coûts renouvelables (27–39%) et les médicaments et magasins de fournitures médicales une part étonnamment élevée (24–37%); le principal centre de coûts de l'hôpital, en termes de ressources gérées, est la pharmacie: de 27 à 39% de tous les coûts renouvelables sont dépensés en dehors de l'hôpital et de 61 à 73% sont consacrés aux services dispensés par l'hôpital de district; les services de soins secondaires de l'hôpital absorbent de 40 à 58% des coûts renouvelables au niveau du district et les coûts unitaires accusent des écarts sensibles entre les hôpitaux de district, l'un d'eux étant systématiquement le plus cher et un autre systématiquement le moins cher. De 3 à 8 nouveaux malades en consultation externe peuvent être soignés pour le coût moyen d'une journée d'hospitalisation tandis que de 34 à 55 nou-

veaux malades en consultation externe peuvent être soignés pour le coût moyen d'un séjour à l'hôpital.

Les aspects qu'il convient de noter sont les suivants: la faible proportion des coûts absorbés par les personnels, les écarts sensibles entre les coûts unitaires et la mesure dans laquelle les personnels hospitaliers peuvent s'acquitter d'activités s'étendant à l'ensemble du district.

Des économies sont apparues possibles concernant les ressources utilisées, notamment les médicaments et les denrées alimentaires, mais les hôpitaux sont en général bien utilisés et la durée des séjours relativement brève en regard des normes internationales.

Accroître le rôle de l'hôpital de district dans les activités mises en œuvre à l'échelle du district suppose des ressources et une plus grande moti-

vation. Des améliorations pourront être obtenues si des efforts sont faits tout à la fois pour inciter les personnels à travailler en dehors de l'hôpital, pour mettre à leur disposition des moyens de transport (comme des vélomoteurs) là où le déplacement des malades n'est pas indiqué et pour les encourager à entretenir les véhicules.

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