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Bangladesh facility efficiency survey

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Abbreviations

ALOS	Average Length of Stay
BBS	Bangladesh Bureau of Statistics
BGFES	Bangladesh Facility Efficiency Survey
DH	District Hospital
DI	Data International
EPI	Expanded Programme of Immunisation
ESP	Essential Services Package
GH	General Hospital
HDS	Health and Demographic Survey
HEU	Health Economics Unit
IDA	International Development Association
IPS	Institute of Policy Studies of Sri Lanka
MCH	Medical College Hospital
MOH	Ministry of Health
MOHFW	Ministry of Health and Family Welfare
SLPFS98	Sri Lanka Public Facility Survey 1998
THC	Thana Health Complex

Executive Summary

The Bangladesh Facility Efficiency Study surveyed a nationally representative, stratified sample of 122 MOHFW facilities. A questionnaire administered by field investigators was effective in collecting the data required. Service indicators and unit costs for outpatient and inpatient services were estimated for calendar year 1997. Only recurrent costs were considered, and expenditures by the family planning division were excluded from consideration.

MOHFW facilities were categorised into four groups: thana health complexes, district and general hospitals, medical college hospitals, and specialised hospitals. MCHs offer more sophisticated and differentiated services and facilities than the other categories. DH/GHs offer only basic services, and differ from THCs only in the extent of their size, and relatively higher levels of basic equipment such as X-ray equipment.

All facilities are characterised by high levels of utilisation generally. Occupancy rates are high, close to what might be considered an optimal level of 80-85%, or even higher. Lengths of stay are generally short, ranging from 3-4 days at lower level facilities to 10-12 days at Medical College Hospitals. Facility budgets are generally fixed according to norms, so high utilisation rates translate in to low unit costs of services. Within the sample, some variation in unit costs are observed. DH/GHs have the lowest unit costs of all facilities, lower even than THCs. In fact, THCs are found to have unit costs similar to MCHs. The high costs at THCs arise from higher staffing intensities than at higher level facilities, coupled with lower utilisation rates. The evidence in the form of higher mortality rates, more frequent surgical intervention, and greater frequency of tests and investigations, indicate that MCHs do offer more sophisticated services and treat more severe cases than do THCs, despite equivalent costs.

THCs have higher costs largely due to higher staffing ratios. In comparison to most countries, where doctor-bed ratios are lower in basic level facilities, Bangladesh is unusual in having higher doctor-bed ratios at the lowest primary level facilities. The international pattern for staffing ratios, some very preliminary results on marginal products of installed beds and staff, and overall findings for aggregate unit costs strongly indicate that the current pattern of staffing and infrastructure at lower level facilities is suboptimal. The findings suggest that large THCs with more beds, but similar budgets and staffing to now would be more optimal and efficient. DH/GHs with 100-150 beds appear closer to an optimal size for basic facilities than THCs. High occupancy rates and turnover rates suggest the problem is more under-capacity than over-supply, which reinforces the case for expansion of smaller facilities. Additional changes to increase the ratio of nurses to doctors, and reduce the numbers of Class 4 employees in THCs might also promote reduce average costs in delivering health services.

There is little evidence of systematic differences in unit costs between different divisions. This presumably reflects the standard norms used in allocating budgets and other inputs. However, there is some evidence that facilities in Barisal and Sylhet have below-average levels of equipment and staffing, particularly doctors, and this may be partly the reason for lower levels of utilisation at facilities in these areas.

The survey demonstrates that rapid collection of data on unit costs is feasible at low cost. A survey of 100 facilities or more can also produce divisional-level cost information in addition to national aggregates. Repeat surveys might be used to monitor changes in facility efficiency. In addition, more sophisticated methods of analysis are required to fully examine determinants of efficiency in these facilities, but were beyond the scope of the initial study.

Introduction

GOB faces significant resource constraints in funding the proposed Essential Services Package (ESP). Previous reports have found that the potential for additional resource mobilisation is limited, and suggested that improvements in the internal efficiency of MOHFW-delivered health services must be an essential component of efforts to provide the ESP to the whole population. This study was conceived as an effort to provide the basic data required to develop a strategy for raising the efficiency of all facilities, particularly the Thana Health Complexes and District Hospitals of Bangladesh, to provide baseline data on performance of MOHFW facilities before commencement of the Fifth Population and Health Project, and to demonstrate the feasibility of survey methods to collect the necessary information to assess facility unit costs and efficiency.

At the inception of the study, data on actual unit costs of delivering services at the Thana and District level were extremely limited. In addition to making it difficult to estimate the likely cost of the Essential Package when implemented, it was impossible to quantify the likely costs of existing inefficiencies. Absence of detailed facility cost data prevented any assessment of the scope for improvements in facility efficiency.

This report presents the results of the first phase of the Facility Efficiency Study, during which survey instruments were developed and used on a sample of facilities. Findings for the sample of facilities surveyed are presented. Some preliminary implications are developed, but these must be subject to further analysis and investigation.

Approach and Methods

Overview

The Phase I Bangladesh Facility Efficiency Study (BGFES98) collected data from a representative national sample of MOHFW inpatient health facilities. Data were collected on expenditures, levels of staffing, availability of drugs and equipment, structural quality indicators, service volumes and other indicators for calendar year 1997. The data set was designed to permit estimation of recurrent unit costs in delivering services. The total sample consisted of 80 Thana Health Complexes (THCs), 18 District Hospitals (DHs), 12 Medical College Hospitals (MCHs) and 12 specialised facilities.

Development of methodology

The methodology used was based on that developed for the Sri Lanka Public Facility Study 1998 (SLPFS98) by the Institute of Policy Studies of Sri Lanka, which in turn was based on that developed earlier for the Health Facility Survey carried for the 1992 Sri Lanka MOH/IDA Health Strategy and Financing Study (Akin and Samarasinghe, 1994). The survey instrument specifically was based closely on the initial draft instrument prepared for SLPFS98, with modifications carried as appropriate for the Bangladeshi context.

Data source

The Bangladesh Facility Efficiency Study (BGFES) collected data from a national sample of MOHFW inpatient facilities. Data collection was primarily through completion of a paper questionnaire administered at each facility by a survey team.

The first draft version of the questionnaire instrument was based on that being developed for SLPFS98. This was adapted to the Bangladeshi situation by team members, and then was reviewed by a group of MOHFW hospital directors. Following revisions, it was then pilot-tested at six THCs and DHs, which were not to be included in the final sample. Based on feed-back from the pilot-test and the results of the simultaneous pilot-testing of the SLPFS98 instrument in Sri Lanka, revisions were then made by DI and the first author, in consultation with HEU. The SLPFS98 instrument was later revised in order to keep it as close in structure to that of BGFES98. This was to permit comparison of results from both surveys at a later date.

It was decided during the process of instrument development that cost and activity data would only be collected for the health activities of inpatient facilities. Many facilities house population activities which are budgeted separately and are under the administration of the Family Planning division of the ministry. These were excluded for reasons of simplicity and cost in the analysis and data collection.

During the development of the survey design, HEU decided to expand the survey to cover MCHs and Specialised Hospitals. The instrument was modified for this purpose, and pilot-tested at two MCHs, and then revised to produce a second version of the instrument for use in MCHs and specialised hospitals.

The final instrument was printed in English, and administered by field survey teams of Data International, each consisting of two persons. Data were collected by direct interview of facility staff, and by extraction from administrative records. In some cases, field collection of data was supplemented by extraction of data from central MOHFW records. Field work was conducted in two rounds: i) THCs and DHs, and (ii) MCHs and Specialised Hospitals.

Sampling

The sampling frame consisted of all health facilities with inpatient beds operated by MOHFW. The sample was selected using a stratified multistage probability design. The population was divided into two strata: (i) district and general hospitals (N=60), (ii) thana health complexes (THC) (N=395). Each stratum was then divided into six groups, according administrative divisions (N = 6). Annex Table A6 gives details of the distribution of all facilities.

District hospitals

It was decided that a minimum of two facilities would be drawn from each division, and that sampling would be proportionate to the share of the overall MOHFW budget allocated to each division. In some cases this would have led to the selection of one district hospital in a division. Given the available budget, it was therefore decided to increase the sample size in the smallest division (Sylhet) by one district hospital to guarantee a minimum of two district hospitals per division. This yielded a desired sample size of 20 district hospitals (Step 1).

The data for expenditures, admissions and sanctioned beds for each facility for 1996 were reviewed. Total facility expenditures are driven by total sanctioned bed numbers, because of budgeting norms, and show little variation across facilities. Expenditures per admission are therefore largely a function of admission rates, and will approximate the final unit costs for admissions to be calculated in survey. The ratio of total expenditures per admission was calculated for all district hospitals, and then all hospitals in each division were ranked according to level of this ratio. After ranking, each divisional list was divided into equally-sized strata; the number of such strata was based on the number of facilities determined in Step 1. One facility was then selected randomly from each stratum (Step 2). The use of budgetary data to order the sample was desirable since the ultimate objective was to obtain nationally representative cost estimates, and in Bangladesh where hospital non-budgetary revenues are limited, costs are driven by budgets.

Thana health complexes

Information on utilisation at THCs is limited. The number of beds per THC is fixed anyway, and budgets are tied closely to sanctioned bed numbers. Given the absence of comprehensive and recent data on THCs in a usable format, the THCs were chosen randomly (random sampling without replacement) from the thanas which were also listed in the BBS sampling frame for HDS. The following procedure was used: two THCs in every district where the district hospital is being surveyed, and was selected in Step 2 of the selection procedure for district hospitals, and one each from every other district. The BBS HDS survey was a household survey which could provide population level data on households by thanas. This was done since it was believed necessary to have household data to match with each facility during subsequent analyses of efficiency and performance. Two thanas were chosen from each district where a district hospital was being sampled for two reasons: (i) budgetary constraints as this reduced travel costs, (ii) a sample of two facilities permits later estimation of standard deviations; (iii) it was hypothesised that the referral behaviour of the lower level THCs might influence demand at district hospitals. This procedure yielded a sample of 85 THCs.

Medical college hospitals and specialised hospitals

Two separate samples of medical college hospitals and specialised hospitals were each randomly selected from the lists of such facilities. In total 8 MCHs were selected from a national total of 13 facilities, and 9 specialised hospitals from the national total of 28 facilities. The distribution of hospitals included in each sample were as follows (actual number in each division given in parentheses):

Medical college hospitals
Barisal: 1 (1); Chittagong: 1 (2); Dhaka: 3 (4): Khulna: 0 (1); Rajshahi: 2 (4); Sylhet: 1 (1).

Specialised hospitals
Barisal: 0 (1); Chittagong: 0 (4); Dhaka: 8 (10); Khulna: 0 (3); Rajshahi: 1 (7); Sylhet: 0 (3).

Response rates

To ensure full co-operation, all facilities were sent copies of the questionnaire in advance. MOHFW in Dhaka also wrote officially to all facilities seeking their co-operation. If staff were not available to complete questionnaires, field investigators were required to return to the facility at a later date.

There were two THCs which were dropped from the survey, and were therefore counted as non-responses. The reason in these cases was a flood, which rendered transport to the facilities unavailable. All other facilities responded satisfactorily. The response rates were therefore 100% for district hospitals, MCHs and specialised hospitals, and 98% for THCs.

Estimations

Facilities were categorised into four types:
1. Thana health complexes
2. District/General hospitals
3. Medical college hospitals
4. Specialist hospitals

General hospitals were categorised with district hospitals, since there is in practice little to distinguish them, and since they are similar in scale and function. General and district hospitals are essentially facilities offering basic services only, and therefore are similar also to thana health complexes. However, they differ from thana health complexes by virtue of size and staffing norms, and are treated as a separate category for purposes of initial analysis. DH/GHs are also regarded officially as secondary level facilities, while THCs are regarded as primary level facilities.

Average unit costs of services were calculated for inpatient and outpatient services for each facility. The data set contains information on the total recurrent expenditures of each facility in 1997 by major line items, such as personnel, supplies, utilities and drugs. All recurrent costs were allocated to either inpatient or outpatient services using a step down procedure.

For each facility, personnel costs, consisting of salaries and all other allowances, were allocated to either outpatient or inpatient use. Facility-specific data on the allocation of time to inpatient and outpatient duties by different grades of nurses and doctors were used to allocate their personnel costs by grade. Personnel costs were distributed as indicated in Table 1.

Table 1: Allocation of recurrent costs to inpatient and outpatient services

Staff Category	*Basis of estimation*
Doctors	According to reported allocation of time between outpatient and inpatient duties
Nurses	According to reported allocation of time between outpatient and inpatient duties
Pharmacists, medical technologists (pharmacy), storekeepers	Prorated according percentage value of drugs used by inpatient and outpatient services
Physiotherapists, occupational therapists	30% to inpatient (ratio estimated by Begum, 1998)
Pathologists	32% to inpatient (ratio estimated by Begum, 1998)
Radiology technicians	48% to inpatient (ratio estimated by Begum, 1998)
Rent controllers, ward masters, ward boys, laundry staff, cooks, stretcher boys,	100% to inpatient
Sweepers	75% inpatient (ratio estimated by Begum, 1998)
Other staff	Allocated as overhead cost using distribution of all other salary costs

The distribution of drug costs to inpatient and outpatient use was based on an estimation of the actual distribution of drugs by value from facility's stores. Information on the allocation of drugs to wards and outpatient departments was collected by examining the records kept at facility pharmacies for a sample of months over the course of 1997. Other medical supply costs were allocated as an indirect cost using the

distribution of staff and drug costs as the allocation ratio. Laundry and diet costs were allocated 100% to inpatient use. All other costs were treated as overheads and allocated on a pro-rata basis according to the distribution of other costs (excluding laundry and diet costs).

Selected cases of missing data were replaced by imputed values. Missing data on staff time allocations to inpatient and outpatient use were imputed using the observed averages for the relevant type of facility (i.e., THCs, DH/GHs, MCHs). A similar procedure was used for missing data on the size of the MSR budget (for medical supplies), staff numbers and laundry costs. Where data were imputed, the missing data accounted for less than 10% of all records with respect to the variable concerned. All analysis of data was carried out using the computer software package, Stata (version 5.0).

Unit costs were calculated by dividing total estimated recurrent inpatient or outpatient costs by the number of inpatient services delivered. Unit costs were calculated for outpatient visits, admissions, bed-days, available bed-days and beds. Lack of additional data prevented more detailed disaggregation of units cost by type of ward or medical department. Those parts of the data set relating to management indicators and other structural quality indicators were not analysed and are not reported here, as they were not available for analysis.

Results

Distribution of facilities

There were no non-responses due to refusal to co-operate, with two facilities not surveyed owing to logistical difficulties. Overall completion rates were high for all items in the instrument. The final geographical distribution of facilities in the final sample is shown in Table 2.

Table 2: Distribution of sampled facilities in survey by type and by division

Division	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*	*Total*
Barisal	8	2	1	0	11
Chittagong	12	3	1	0	16
Dhaka	17	6	3	8	34
Khulna	12	4	0	0	16
Rajshahi	28	4	2	1	35
Sylhet	6	2	1	0	9
Total	83	21	8	9	121
Note: Excludes two non-responses (both THCs)					

Hospital characteristics

Facilities in each category show considerable homogeneity, except in the case of MCHs and specialised facilities. Table 3 summarises key statistics as reported by each category of facility.

The typical thana health complex is a 31 bedded facility (range 15-50 beds), staffed by a 5 doctors (range 2-9), 6 nurses (range 2-8), and 31 other staff. With an average recurrent budget of Tk 6.2 million, it delivers 50,000 outpatient visits, 2,300 inpatient admissions, and 200 operations a year. THCs deliver only very basic medical services, and few operative interventions. They show considerably homogeneity in their basic characteristics reflecting that they operate according to fixed norms.

District and general hospitals are larger facilities, with a typical bed size of 50 (24% of sample) or 100 (48% of sample). A few district and general hospitals have more beds, up to a maximum of 150. The typical 100 bed district hospital is staffed by 10 doctors (range 5-14), 26 nurses, and 33 other staff. With an average recurrent budget of Tk 8.1 million (range Tk 6-14 million), it delivers an average of 68,000 outpatient visits, 7,000 inpatient admissions and 1,200 operations a year. DHs and GHs generally provide basic medical services only.

Medical college hospitals are larger, inpatient medical facilities which provide a range of different services, including specialities. Their bed size ranges from 540 to 1,100, with 40 to 90 doctors, and 140 to 370 nurses. Their budgets are much larger, being an average of Tk 115 million.

Table 3: Key statistics by category of facility

Category	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Beds	31.2 (2.9)	90.5 (29.3)	781.2 (216.6)	258.9 (283.4)
Outpatients ('000s) per year	50.0 (68.0)	68.7 (25.7)	296.6 (109.2)	34.5 (21.5)
Admissions ('000s) per year	2.3 (1.0)	7.6 (3.8)	34.3 (14.5)	3.1 (4.0)
Bed occupancy (%)	74.8 (28.7)	94.6 (47.3)	109.9 (28.3)	76.0 (21.1)
Operations performed per year	200.0 (525.3)	1,296.8 (2,541.6)	9,827.0 (3,385.5)	809.4 (975.1)
Number of doctors	5.5 (1.3)	10.0 (2.6)	60.7 (13.8)	9.1 (5.0)
Number of nurses	5.9 (1.2)	26.2 (17.7)	203.5 (68.8)	60.0 (54.8)
Number of Class 3/Class 4 employees	31.0 (9.2)	33.2 (19.4)	480.5 (308.0)	95.2 (97.5)
Recurrent expenditures (Taka millions)	6.2 (1.9)	8.1 (3.1)	115.8 (64.5)	25.2 (16.3)
Note: Mean values in sample with standard deviation in parentheses below				

General facilities, equipment, hours of operation and services offered

Utilities and equipment

As expected, the number and range of facilities provided increases with level of facility (Table 4). All facilities have laboratories and operating theatres, although in 12% of THCs, the laboratories are non-functional. Only half of THCs have been provided and have functioning X-ray machines. All DH/GHs and MCHs have functional X-ray machines. ECG equipment is not available in THCs, and only in 43% of DH/GHs. Cardiac monitors, ultrasound scanners and ICU facilities are found only in MCHs. Only 2 THCs and just over half of all DH/GHs reported maintaining blood banks, while all MCHs did possess these facilities.

Generally, all facilities have basic utilities, such as electricity, piped or deep-tube well water, and refrigerators. 4% of THCs report having no telephone. Surprisingly, 98% of THCs reported having freezers, but only 24% of DH/GHs did so. The reason for this is unclear, but might be related to distribution of freezers to THCs through the EPI program.

Availability of services

The regular hours of operation are similar at all levels. Facilities offer routine outpatient services for 8 hours a day, five days a week, while being open to emergencies on a 24 hour-7 days per week basis (Table 6).

MCHs are designated to provide and do provide all major types of services, such as obstetric, gynaecological, paediatric, medical and major surgical care (Table 7). THCs and DH/GHs are quite similar in the services they actually provide, with more than 85% in each category providing obstetric, gynaecological, paediatric and minor surgical services. This is notably despite only 80% and 24% of THCs being designated to provide obstetric and paediatric services. Major surgery is generally only available at DH/GH level and above. A large proportion of THCs are designated to provide dental services, but do not (24%).

Table 4: Available equipment at facilities

	THCs		***DH/GHs***		***MCHs***	
	Available	*Functional*	*Available*	*Functional*	*Available*	*Functional*
Laundry	1%	1%	9%	9%	75%	75%
Laboratory	100%	88%	100%	100%	100%	100%
Operating theatre	100%	99%	100%	100%	100%	100%
Blood bank	2%	2%	57%	57%	100%	100%
ICU	0%	0%	0%	0%	75%	75%
X-ray	53%	52%	100%	100%	100%	100%
Ultrasound Scanner	0%	0%	0%	0%	25%	25%
ECG	0%	0%	43%	43%	100%	100%
Cardiac monitor	0%	0%	0%	0%	100%	87%

Table 5: Available utilities at facilities

	THCs		DH/GHs		MCHs	
	Available	*Functional*	*Available*	*Functional*	*Available*	*Functional*
Refrigerator	96%	93%	95%	95%	100%	100%
Freezer	98%	98%	29%	24%	75%	63%
Toilets	100%	100%	100%	100%	100%	100%
Piped water/Deep tube well	100%	96%	100%	91%	100%	100%
Electricity/Generator	100%	100%	100%	100%	100%	100%
Telephone	96%	95%	100%	100%	100%	100%

Table 6: Hours and days of operation

	Thana health complexes	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Routine outpatient services				
Hours per day	8.0	7.8	8.0	8.0
Days per week	5.0	5.0	5.0	5.0
Emergencies/others				
Hours per day	24.0	24.0	24.0	16.0
Days per week	7.0	7.0	7.0	4.7

Table 7: Types of services provided

	THCs		***DH/GHs***		***MCHs***	
	Designated	*Providing*	*Designated*	*Providing*	*Designated*	*Providing*
Obstetric	80%	90%	95%	90%	100%	100%
Gynaecological	100%	96%	95%	95%	100%	100%
Paediatric	24%	86%	95%	90%	100%	100%
Medical	96%	99%	95%	95%	100%	100%
Minor surgical	99%	93%	95%	90%	100%	100%
Major surgical	35%	13%	86%	86%	100%	100%
Dental	85%	61%	100%	88%	100%	100%

Staffing and allocation of staff time

MCHs are have more staff than DH/GHs, which have more staff than THCs (Table 8). DH/GHs have twice as many doctors as THCs, and 2-3 times the number of nurses. However, both categories have similar numbers of

Class 3 and Class 4 employees. DH/GHs have fewer Class 3 employees than THCs, and correspondingly more Class 4 employees.

The staff mix varies across categories of facility. The nurse-doctor ratio increases at higher levels, while the ratio of Class 3/Class 4 staff to doctors and nurses decreases. While the number of skilled staff (doctors, nurses) in relation to beds is approximately similar at all levels, the number of total staff per bed is higher in THCs than in other facilities. The higher ratios of staff to beds at THCs are due to relatively higher numbers of Class 3/Class 4 staff. The reason for greater staff intensity at the lowest level is not apparent. In the case of doctors, the ratio of doctors per bed actually decreases with increasing level of sophistication. Whether this counter-intuitive finding reflects an optimal staffing pattern is worth exploring.

Table 8: Staffing indicators and ratios

	Thana health complexes	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Doctors	5.5	10.1	60.7	9.1
Nurses	5.9	26.2	203.5	60.0
Class 3	15.0	9.6	96.4	27.2
Class 4	16.0	23.6	384.1	68.0
Nurses : Doctor ratio	1.2	2.8	3.3	10.2
Class 3/4 : Doctor/nurse ratio	2.8	1.1	1.8	1.1
Bed : Doctor ratio	6.2	9.3	13.1	55.9
(Nurses+Doctors) : Bed ratio	0.37	0.43	0.35	0.39
Staff : Bed ratio	1.4	0.9	0.9	0.9

Generally, doctors allocate 40-50% of their time to inpatient duties in all levels of facilities, while other staff allocate higher proportions (Table 9). This is consistent with the existence of some staff categories whose purpose is confined to providing services for inpatient wards, such as ward boys, laundry staff, cooks, etc.

Table 9: Allocation of staff time to inpatient care

	Thana health complexes	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Doctors	41%	41%	43%	49%
Nursing staff	94%	86%	95%	99%
Class 3	71%	56%	54%	66%
Class 4	76%	78%	56%	93%

Utilisation and performance

General patient load

All facilities provide both outpatient and inpatient services. The service mix at THCs is more predominantly outpatient than at higher levels. The ratio of outpatient visits to admissions at THC level is 22 compared with approximately 9 at higher level facilities. The overall patient load at MCHs is approximately five times greater than at DH/GHs. The type of care provided is more sophisticated at MCH level, reflected in proportionately more patients at that level being provided laboratory tests, radiological investigations and other tests. However, the number of immunisations provided decreases with increasing sophistication of facility type (Table 10).

Table 10: Average annual number of outpatient services and investigations by category and by type of facility

Service	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
OPD visits*	50,024	68,744	296,619	34,557
Dental visits	451	4,712	17,689	0
Laboratory tests	3,736	7,039	53,987	23,972
Radiology examinations	580	3,217	30,781	9,855
Immunisations	51,096	22,842	6,135	0
Note: * Includes dental visits				

Inpatient services

Most facilities report high levels of occupancy, admission rates, and turnover rates (Table 11). The highest occupancy rates are found at MCHs (110%). DH/GHs were 95% occupied during 1997, compared with 75% occupancy at THCs. The higher rate at higher level facilities is comparable with admission patterns in many other developing countries, including those in the region. It probably reflects patient preferences for the better care provided by higher level facilities. The average length of stay is quite short at 3.9 days at THCs and 4.5 days at DH/GHs. This coupled with the high occupancy rates suggests that most of these primary level facilities are operating close to capacity. The longer length of stay at MCHs (11.0 days) is consistent with the more severe patient mix they appear to be treating.

Table 11: Beds, Admissions, Occupancy and Average Length of Stay (ALOS) by type of facility

Indicator	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Beds	31.2	90.5	781.2	258.9
Admissions (annual)	2,301	7,656	34,288	3,119
Occupancy rate	75%	95%	110%	76%
ALOS (days)	3.9	4.5	11.0	39.5
Turnover rate	73.6	90.6	47.3	13.7

All facilities, other than specialised hospitals, have a broad mix of inpatients. These are roughly equally distributed across surgical and medical specialities at both DH/GH and MCH levels. THCs only maintain general wards, but responses to the questions concerning which services are provided suggest that THCs probably have a similar diagnostic mix of patients to DH/GHs. Cabin inpatients represent 3-4% of all patients at DH/GHs and MCHs; THCs do not operate cabins (Table 12).

The inpatient load increases in severity with higher level of facility (Table 13). 32% of inpatients undergo surgical interventions at MCH level, compared with 16% at DH/GH level, and 9% at THC level. Severity of cases is also consistent with higher mortality rates at higher levels, ranging from 2% at THC level to 10% at MCH level, as well as longer length of stay.

The proportion of babies delivered by Caesarean section is significantly higher at MCH level than at DH/GH level. Very few Caesarean sections are reported by THCs. Under normal circumstances with optimal care, one would expect less than 10% of babies to be delivered by Caesarean section.[1] Whether the much higher rate of 36% reported at MCHs and 13% at DH/GHs reflects admission of higher-risk mothers or is the consequence of a high rate of unnecessary Caesarean sections cannot be determined from the data. As a rate of 36% can be considered high from a clinical perspective, this should be explored further.

[1] Teaching hospital units in Sri Lanka generally report Caesarean section rates of less than 12%.

Table 12: Number of admissions by speciality and type of facility

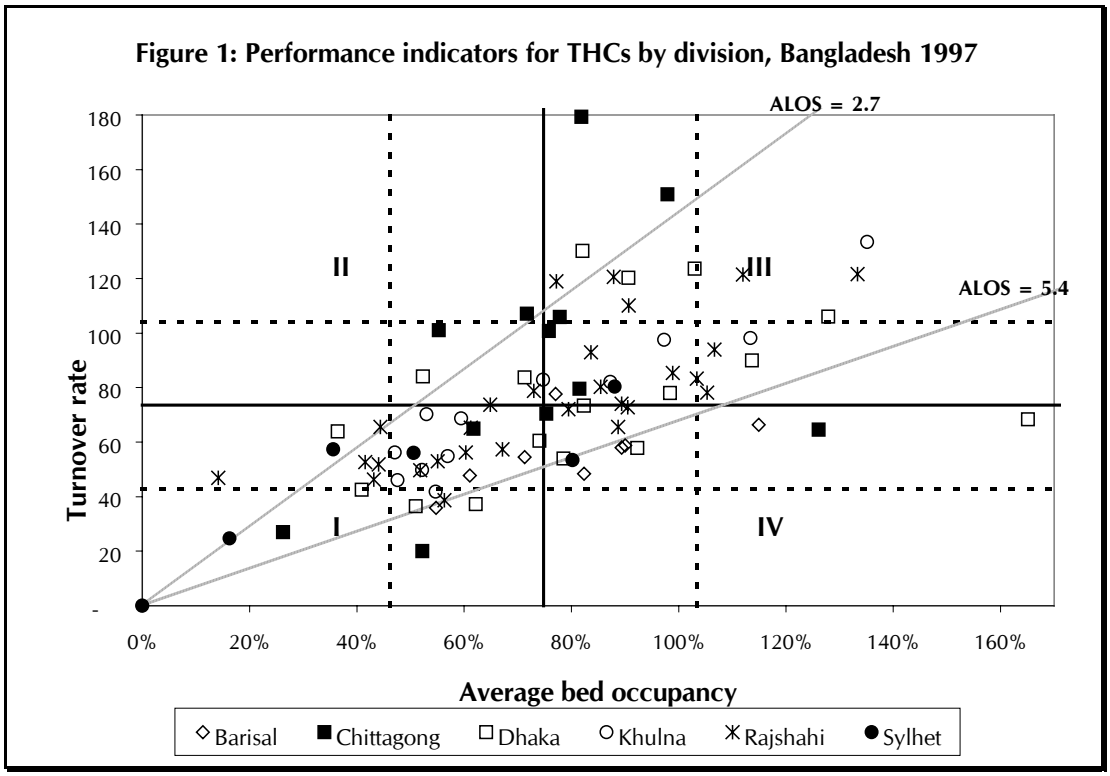
Speciality	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Obstetric	*	1,418 (19%)	3,467 (10%)	0
Medical	*	2,350 (31%)	4,398 (13%)	379
Surgery	*	1,803 (24%)	3,193 (9%)	274
Paediatric	*	1,034 (14%)	2,478 (7%)	0
All wards	2,301	7,656 (100%)	34,288 (100%)	3,119
All cabins	**	286	982	406
Note: * Not applicable as admissions not categorised in this way at THC level. **THCs also do not operate cabins.				

Table 13: Inpatient service statistics

	Thana health complexes	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Admissions/year	2,301	7,656	34,288	3,119
Operative intervention rate	8.7%	15.8%	31.6%	29.9%
Mortality rate	1.8%	4.6%	10.2%	6.2%
Deliveries/year	95	488	5,105	0
Caesarean section rate	0.9%	12.9%	35.9%	-
Ratio of outpatient visits to admissions	21.7	9.0	8.7	11.1

Comparative assessment of facility performance using service indicators

Performance indicators can be used to conduct a preliminary assessment of relative facility performance (Barnum and Kutzin, 1993). The method of Lasso (1986) is used to summarise data on bed occupancy and turnover rate (and therefore implicitly ALOS) in a large sample of facilities. Figure 1 presents the data on bed occupancy and turnover rates for the sample of THCs. The bold horizontal and vertical lines indicate the mean values for turnover rates and bed occupancy respectively, while the dotted lines are one standard deviation each from the respective means. The rays from the origin represent points whose ALOS is either one standard deviation below the mean or one standard deviation above the mean.



The four quadrants represent different groups of facilities. Those in quadrant I have below average turnover rates and bed occupancy. These facilities have capacity to admit more cases without reducing ALOS. There are a large number of facilities in this quadrant, suggesting that many have the capacity to admit more patients. Quadrant II represents facilities with below average occupancy rates and above average turnover rates. These facilities have an ALOS below the mean, and this may represent facilities admitting predominantly minor cases. Quadrant III contains facilities with above average turnover rates and bed occupancy. These facilities have occupancy rates close to 100% or higher, indicating considerable overcrowding. A large percentage of THCs fall into this category. Since for most of these, ALOS is less than 5 days, there would seem to be little room for improving output by reducing ALOS, confirming that these facilities suffer from insufficient capacity to meet the presented demand.

Examination of the distribution of facilities by division indicates no systematic pattern. There are many outliers in each quadrant, and their exceptional performance may warrant further detailed examination.

Costs

Detailed information was collected on costs at each facility. These were used, as described above, to estimate unit costs for services. These cost estimations are for recurrent costs only, and therefore underestimate full costs. In addition, costs of services administered and funded by the Family Planning Division are not considered.

Table 14 gives the overall distribution of costs by category in each group of facilities. Personnel costs account for a high 84% of total recurrent costs at THCs. The proportion is lower at DH/GHs and MCHs, where spending on drugs and other medical supplies is relatively higher.

Table 14: Distribution of recurrent costs by category of cost

Cost category	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Personnel	84%	61%	54%	57%
Drugs	5%	14%	16%	16%
Medical supplies	3%	8%	13%	8%
Other	8%	17%	17%	19%
Total	100%	100%	100%	100%

Within facilities, inpatient services account for the greater share of all costs (Table 15). Surprisingly, despite the greater predominance of outpatient load at THCs, the proportion of overall costs accounted for inpatient services is similar at both THCs (63%) and DH/GHs (62%). The cost mix for outpatient services is similar to that of inpatient services in all facilities, except that drug costs are relatively higher for outpatient services (Tables 16-17).

Table 15: Share of recurrent costs accounted for by inpatient use

Cost category	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Personnel	64%	66%	78%	80%
Drugs	26%	32%	65%	64%
All costs	63%	62%	77%	77%

Table 16: Breakdown of recurrent costs in providing inpatient services

Category	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Share of facility costs (%)	63	62	77	77
Cost per admission (Taka)	1,957	843	3,249	11,872
Percentage of costs (%)				
Staff	85	63	54	60
Drugs	3	7	13	11
Medical supplies	3	8	13	8
Others	9	22	20	21

Table 17: Breakdown of recurrent costs in providing outpatient services

Category	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Share of facility costs (%)	37	38	23	23
Cost per outpatient visit (Taka)	66	55	102	283
Percentage of costs (%)				
Staff	82	52	53	58
Drugs	10	24	24	22
Medical supplies	3	7	13	8
Others	5	17	10	12

Inpatient unit costs

Three indicators of inpatient costs were estimated:
(i) Annual cost per available bed
(ii) Cost per bed-day occupied
(iii) Cost per admission

The average cost of an outpatient visit was also estimated. A summary of results is given in Table 18.

Table 18: Gross unit costs for inpatient and outpatient services (Taka)

Item	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Bed available/year	111,397 (46,515)	56,119 (14,924)	110,565 (31,820)	117,830 (71,419)
Bed-day occupied	521 (325)	188 (68)	277 (45)	441 (260)
Admission	1,957 (1,232)	843 (603)	3,249 (2,896)	11,872 (7,673)
Outpatient visit	66 (45)	55 (44)	102 (68)	283 (516)
Note: Mean values in sample with standard deviation in parentheses below.				

THCs appear to be the most costly facilities for the delivery of inpatient services. The cost per available bed and per bed-day occupied is lowest in DH/GHs, and highest in THCs. Although cost per available bed in THCs (Tk. 111,397) is only double that in DH/GHs (Tk. 56,119), the cost per bed-day occupied is almost three times higher (Tk. 521 vs. Tk. 188), owing to the higher utilisation at DH/GHs. There are several possible explanations for the higher unit costs at THCs. First, THCs have higher staff-to-bed ratios compared with DH/GHs and MCHs. Second, the staff mix at THCs is more expensive than at DH/GHs, which use relatively more nurses per doctor, and fewer Class 3/Class4 employees. Overall, the ratio of administrative and other support staff to doctors and nurses is highest at THCs, which would add to the relative cost of delivering services. Finally, patient demand is higher for the level of services offered by DH/GHs than for those of THCs. An unavoidable conclusion is that THCs are too small to achieve economies of scale.

Although the cost per available bed is similar at MCHs and THCs, the unit cost of an occupied bed-day is almost double at THCs. This would be the result of the almost 50% higher occupancy rate at MCHs compared with THCs. Cost per admission is lowest again at DH/GHs (Tk. 843). THC admission costs are higher (Tk. 1,957), but lower than at MCHs (Tk. 3,249). The high admission costs at MCHs reflects the much longer length of stay at these facilities, and presumably the more severe cases admitted, and more sophisticated services provided.

Outpatient unit costs

Outpatient unit costs are highest in the higher level MCHs (Tk. 102). However, they are lowest at DH/GHs (Tk. 55). THCs are unexpectedly not the least costly for delivering outpatient services. The high costs of THC outpatient visits again primarily reflects their higher staffing levels with respect to volume of services delivered.

Geographical variation in unit costs

Tables 19 provides details of the variation in costs per available bed by division. There is little systematic difference in budgets and costs per available bed between facilities in different divisions. This may reflect the standard norms used in allocating budgetary resources and staff to different facilities. In contrast, there are significant differences in the utilisation of facilities across divisions (Tables 20 to 21). Facilities in Barisal and Sylhet report significantly lower rates of inpatient and outpatient utilisation than other areas. Facilities in Dhaka and Chittagong report the highest utilisation. In combination with essential fixed and relatively equal budgets for each facility, this leaves facilities in Barisal and Sylhet with the highest unit costs (Tables 22 to 24). Similarly, facilities in Dhaka and Chittagong possess the lowest unit costs.

Table 19: Cost per available bed by type of facility and division (Taka)

Division	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Barisal	123,282 (20,836)	54,794 (27,136)	91,732 (*)	-
Chittagong	145,817 (68,804)	42,163 (19,457)	90,190 (*)	-
Dhaka	131,712 (40,834)	63,222 (15,754)	131,989 (34,958)	125,644 (73,354)
Khulna	125,126 (29,251)	57,185 (11,197)	-	-
Rajshahi	118,583 (29,614)	59,478 (3,923)	115,649 (34,692)	63,128 (*)
Sylhet	93,369 (42,327)	50,431 (769)	75,332 (*)	-
COUNTRY	111,397 (46,515)	56,119 (14,924)	110,565 (31,820)	117,830 (71,419)

Note: Mean values in sample with standard deviation in parentheses below. *Only one facility in cell.

Table 20: Utilisation statistics for thana health complexes by division

Division	**Number of beds**	*Admissions*	*Occupancy rate*	*Outpatient visits*
Barisal	31	1,734	80%	28,264
Chittagong	31	2,795	74%	37,640
Dhaka	32	2,494	84%	44,621
Khulna	30	2,203	73%	38,373
Rajshahi	31	2,367	75%	50,605
Sylhet	31	1,404	45%	44,616

Table 21: Utilisation statistics for district and general hospitals by division

Division	*Average beds*	*Admissions*	*Occupancy rate*	*Outpatient visits*
Barisal	76	4,394	75%	46,921
Chittagong	118	9,990	92%	78,741
Dhaka	83	7,841	128%	63,544
Khulna	112	8,032	83%	89,171
Rajshahi	75	7,793	86%	58,112
Sylhet	73	5,834	59%	71,904

Table 22: Cost per bed-day occupied by type of facility and division (Taka)

Division	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Barisal	439 (112)	195 (26)	266 (*)	-
Chittagong	635 (396)	149 (73)	252 (0)	-
Dhaka	465 (161)	149 (36)	325 (35)	479 (256)
Khulna	491 (137)	245 (136)	238 (11)	-
Rajshahi	523 (407)	211 (2)	238 (11)	178 (*)
Sylhet	657 (558)	236 (5)	245 (*)	-
COUNTRY	521 (325)	188 (68)	277 (45)	441 (260)
Note: Mean values in sample with standard deviation in parentheses below. *Only one facility in cell.				

Table 23: Cost per admission by type of facility and division (Taka)

Division	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Barisal	2,256 (405)	895 (336)	2,390 (*)	-
Chittagong	2,564 (2,845)	506 (71)	2,082 (*)	-
Dhaka	1,960 (975)	733 (247)	5,430 (4,201)	9,738 (5,119)
Khulna	1,834 (559)	1,066 (735)	-	-
Rajshahi	1,684 (623)	1,281 (1,375)	1,603 (355)	26,806 (*)
Sylhet	1,968 (1,232)	631 (100)	2,023 (*)	-
COUNTRY	1,957 (1,232)	843 (603)	3,249 (2,896)	11,872 (7,673)
Note: Mean values in sample with standard deviation in parentheses below. *Only one facility in cell.				

Table 24: Cost per outpatient visit by type of facility (Taka)

Division	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*
Barisal	89 (28)	81 (38)	49 (*)	-
Chittagong	85 (40)	95 (103)	130 (*)	-
Dhaka	58 (30)	47 (18)	121 (104)	383 (708)
Khulna	52 (19)	36 (4)	-	-
Rajshahi	57 (34)	43 (21)	114 (47)	198 (*)
Sylhet	61 (50)	24 (6)	49 (*)	-
COUNTRY	66 (45)	55 (44)	102 (68)	283 (516)
Note: Mean values in sample with standard deviation in parentheses below. *Only one facility in cell.				

The variation in unit costs is largely driven by differences in relative utilisation. These differences in utilisation could be due to underlying differences in demand for facility services, differences in the quality of facilities, or a

combination of both. Table 25 summarises differences in budgeting, staffing and equipping of THCs by division. Although facilities in all divisions receive similar budgets, facilities in Sylhet have fewer doctors and nurses in place, and fewer X-ray machines and other basic equipment in functioning order. These differences may provide part of the explanation for differences in utilisation, but other differences in the propensity of people to seek care at MOHFW facilities cannot be excluded. Further research might explore analysis of the BBS HDS data to investigate this.

Table 25: Indicators of resource availability at THCs by division

Division	*Total recurrent expenditure (Tk. Millions)*	*Number of doctors in place*	*Number of nurses in place*	*X-ray machines functional*
Barisal	5.4	5.4	6.7	0.38
Chittagong	6.9	6.3	5.4	0.58
Dhaka	6.2	5.6	5.7	0.68
Khulna	5.5	4.9	6.6	0.42
Rajshahi	5.7	5.6	6.0	0.52
Sylhet	5.3	4.3	4.5	0.33
Note: Values given are means per facility.				

Comparison of costs and performance indicators with international data

Tables 26 to 28 compares the performance of the sampled MOHFW facilities in 1997 as with selected other developing countries for which comparable data are available. The tables distinguish between three levels of hospitals in countries (Barnum and Kutzin, 1993):

> *Level I:* Tertiary level facilities with the most specialised staff and technical equipment, with highly differentiated clinical service functions.
> *Level II:* Lacking the most technically sophisticated services available in Level I hospitals, but with some functional differentiation by clinical speciality.
> *Level III:* Most basic level facilities, with few specialists, and limited laboratory services;, generally referred to as "district" of "first-level referral" hospitals.

Medical College Hospitals in Bangladesh are compared with level I hospitals in other countries, while THCs and DH/GHs are compared with level II/level III hospitals. All tables rank countries according to the specific indicator being tabulated.

Bangladesh facilities have high occupancy rates in comparison with most other countries, with MCHs having amongst the highest observed occupancy rates for hospitals of their type. This is the product in MCHs of relatively long length of stays and average bed turnover rates. In the case of THC/DH/GHs it is the consequence of very high turnover rates and short lengths of stay. Why lower level MOHFW facilities admit so many short-stay cases is unclear. However, it cannot be explained on the basis of a high per capita admission rate, since these are quite low in Bangladesh in comparison with the other countries shown in the tables. A possible hypothesis that might be explored is that overall bed capacity is low in Bangladesh relative to potential demand, and so lower level facilities in the face of overwhelming demand act to keep lengths of stay short, while maintaining high admission rates. Another possible explanation is that admitting doctors exercise a relatively low level of tolerance when deciding whether to admit or not, thus admitting a large number of cases who might not have been admitted in other contexts.

The comparison of costs presents a quite different picture. MCHs have relatively low unit costs for both inpatient and outpatient services in comparison with other countries. In contrast, the lower level facilities have the highest unit costs for these services in comparison with relevant facilities. The basic difference between Bangladesh and other countries seems to be that in Bangladesh the average cost per bed in lower level facilities is no different to that in higher level facilities, while in most countries it is generally lower. This might suggest either that the budget should be reallocated in favour of higher level facilities, or that funds allocated to lower level facilities in Bangladesh should be reduced, or that the size of lower level facilities be increased relative to their budget allocations.

The high costs at lower level facilities is highlighted when staffing indicators are examined (Table 28). In comparison with other countries, Bangladesh has fewer doctors per bed in level I facilities (MCH equivalents), but oddly more doctors per bed in level II and level III facilities (THC/DH/GH equivalents). The same contrast is observed with nurses, although to a lesser extent. Since overall staffing per bed in Bangladesh is more comparable with those in other countries, this suggests that the staffing mix in Bangladesh is at least unusual. In most countries, the number of doctors per bed increases with increasing sophistication of facility, but Bangladesh chooses to place more doctors at lower levels than at higher levels. Although an international comparison cannot be used to draw country-specific lessons, it at least suggests that fewer doctors per bed at lower levels in Bangladesh may be a desirable option to explore. This of course can be achieved either by reallocating doctors to higher levels, or by expanding bed numbers in lower level facilities. Taken in combination with other findings in this study, this again confirms that lower level facilities have too few beds relative to their staffing numbers and patient demand.

Table 26: Comparison of hospital services statistics (selected countries)

Level I hospitals

Country	Year	OR
Ethiopia	1983-85	47
Colombia	1980	73
Indonesia	1985	75
Tunisia	1989	76
Jamaica	1985	79
Papua New Guinea	1988	80
Fiji	1987	83
Niger	1986-87	87
Rwanda	1984	88
Zimbabwe	1987	89
China	1986	94
Sri Lanka	1991	96
Bangladesh	1997	110
Lesotho	1985	125

Level II & III hospitals

Country	Year	OR
Belize	1985	36.3
Fiji	1987	46.0
Indonesia	1985	54.7
Colombia	1980	56.9
Rwanda	1984	58.4
Ethiopia	1983-85	59.0
Sri Lanka	1991	63.9
Jamaica	1985	66.4
Papua New Guinea	1988	66.7
St.Lucia	1986-87	74.0
Bangladesh	1997	78.8
Zimbabwe	1987	79.1
China	1986	89.5
India (AP)	1990	93.1
Malawi	1987-88	116.0
Lesotho	1985	129.0

rate (per year)

Level I hospitals

Country	Year	Turnover
China	1986	13.7
Ethiopia	1983-85	14.7
Niger	1986-87	22.5
Bangladesh	1997	47.3
Tunisia	1989	27.6
Indonesia	1985	29.2
Papua New Guinea	1988	29.4
Jamaica	1985	35.2
Colombia	1980	37.8
Zimbabwe	1987	41.7
Fiji	1987	42.5
Bangladesh	1997	47.3
Lesotho	1985	50.7
Sri Lanka	1991	65.0

Level II & III hospitals

Country	Year	Turnover
Papua New Guinea	1988	20.6
China	1986	20.9
Ethiopia	1983-85	29.7
Jamaica	1985	32.0
Indonesia	1985	33.4
Belize	1985	37.8
St.Lucia	1986-87	38.8
Colombia	1980	41.5
Zimbabwe	1987	43.6
Malawi	1987-88	47.4
Fiji	1987	47.9
Lesotho	1985	54.9
India (AP)	1990	56.0
Sri Lanka	1991	57.1
Bangladesh	1997	77.0

Average length of stay (days)

Level I hospitals

Country	Year	ALOS
Sri Lanka	1991	6.9
Colombia	1980	7.2
Fiji	1987	7.2
Zimbabwe	1987	7.8
Jamaica	1985	8.2
Lesotho	1985	9.0
Indonesia	1985	9.4
Papua New Guinea	1988	9.9
Tunisia	1989	10.1
Bangladesh	1997	11.0
Ethiopia	1983-85	11.8
Niger	1986-87	14.1
China	1986	25.1

Level II & III hospitals

Country	Year	ALOS
Belize	1985	3.4
Bangladesh	1997	4.1
Fiji	1987	4.2
Colombia	1980	5.5
Sri Lanka	1991	6.0
Indonesia	1985	6.0
India (AP)	1990	6.3
Zimbabwe	1987	6.7
St.Lucia	1986-87	7.0
Ethiopia	1983-85	7.2
Jamaica	1985	7.6
Lesotho	1985	8.6
Malawi	1987-88	9.0
Papua New Guinea	1988	12.1
China	1986	16.1

Source: Barnum and Kutzin (1993); IPS database; Mahapatra and Berman (1994).

Table 27: Comparison of hospital unit costs as a percentage of per capita GNP (selected countries)

Unit cost per patient day

Level I hospitals

Country	Year	%
Sri Lanka	1991	1.4
Bangladesh	1997	2.2
Niger	1986-87	2.2
Indonesia II	1985	2.8
China (Barnum, 19	1986	3.0
China (Chen, 1988	1986	3.2
Papua New Guinea	1988	3.3
Colombia	1978	3.4
Jamaica	1985-86	3.7
Zimbabwe	1987	4.3
Rwanda	1984	5.2

Level II & III hospitals

Country	Year	%
Indonesia II	1985	1.1
China (Chen, 1988	1986	1.5
Sri Lanka	1991	1.7
China (Barnum, 19	1986	1.8
Malawi	1987-88	1.9
Indonesia I	1987	2.0
Rwanda	1984	2.6
Jamaica	1985-86	2.7
Zimbabwe	1987	2.7
St.Lucia	1986-87	3.0
Papua New Guinea	1988	3.1
Bangladesh	1997	3.6
Belize	1985	3.7

Unit cost per admission

Level I hospitals

Country	Year	%
Sri Lanka	1991	9.3
Colombia	1978	25.0
Bangladesh	1997	26.0
Indonesia II	1985	26.0
Niger	1986-87	32.0
Papua New Guinea	1988	33.0
Zimbabwe	1987	33.0
Jamaica	1985-86	40.0
China (Barnum, 19	1986	76.0
China (Chen, 1988	1986	90.0

Level II & III hospitals

Country	Year	%
Sri Lanka	1991	5.3
Indonesia II	1985	6.6
Belize	1985	12.9
Bangladesh	1997	13.9
Malawi	1987-88	17.0
Zimbabwe	1987	17.0
Jamaica	1985-86	18.3
St.Lucia	1986-87	21.0
China (Barnum, 19	1986	29.8
China (Chen, 1988	1986	30.0
Papua New Guinea	1988	38.7

Unit cost per bed

Level I hospitals

Country	Year	%
Sri Lanka	1991	437.2
Niger	1986-87	710.0
Indonesia II	1985	756.0
Bangladesh	1997	884.5
Papua New Guinea	1988	962.0
Colombia	1978	985.0
China (Barnum, 198	1986	1039.0
China (Chen, 1988)	1986	1119.0
Jamaica	1985-86	1148.0
Zimbabwe	1987	1393.0
Rwanda	1984	1667.0

Level II & III hospitals

Country	Year	%
Sri Lanka	1991	172.3
Indonesia II	1985	221.2
China (Chen, 1988)	1986	502.0
Belize	1985	505.9
Rwanda	1984	556.6
China (Barnum, 198	1986	584.2
Zimbabwe	1987	667.0
Papua New Guinea	1988	734.0
Malawi	1987-88	806.0
St.Lucia	1986-87	808.0
Jamaica	1985-86	812.3
Bangladesh	1997	887.4

Unit cost per outpatient visit

Level I hospitals

Country	Year	%
Indonesia II	1985	0.7
Papua New Guinea	1988	0.7
China (Barnum, 19	1986	0.8
Colombia	1978	0.8
Bangladesh	1997	0.8
Sri Lanka	1991	1.0
Rwanda	1984	1.3
Jamaica	1985-86	1.5
Zimbabwe	1987	1.6
Niger	1986-87	5.4

Level II & III hospitals

Country	Year	%
Sri Lanka	1991	0.1
Zimbabwe	1987	0.3
Indonesia II	1985	0.3
Malawi	1987-88	0.4
China (Barnum, 19	1986	0.5
Papua New Guinea	1988	0.5
Bangladesh	1997	0.5
Indonesia I	1987	0.6
Rwanda	1984	0.6
Jamaica	1985-86	1.1
St.Lucia	1986-87	1.3

Source: Barnum and Kutzin (1993); IPS database; Mahapatra and Berman (1994).

Table 28: Comparison of hospital staffing indicators (selected countries)

Physicians per bed

Level I hospitals

Country	Year	Ratio
Bangladesh	1997	0.1
Niger	1986-87	0.1
Papua New Guinea	1988	0.1
Colombia	1979	0.2
Fiji	1987	0.2
Jamaica	1985-86	0.2
Sri Lanka	1991	0.2
Indonesia	1985	0.6
Dominican Republic	1989	0.9

Level II & III hospitals

Country	Year	Ratio
Papua New Guinea	1988	0.03
Sri Lanka	1991	0.08
Belize	1985	0.10
Fiji	1987	0.10
Jamaica	1985-86	0.10
Indonesia	1985	0.11
Bangladesh	1997	0.17

Nurses/paramedical staff per bed

Level I hospitals

Country	Year	Ratio
Niger	1986-87	0.3
Bangladesh	1997	0.4
Papua New Guinea	1988	0.6
Sri Lanka	1991	0.8
Dominican Republic	1989	0.8
Fiji	1987	1.0
Indonesia	1985	1.0
Jamaica	1985-86	1.4
Colombia	1979	1.4

Level II & III hospitals

Country	Year	Ratio
Papua New Guinea	1988	0.47
Belize	1985	0.47
Sri Lanka	1991	0.51
Indonesia	1985	0.61
Bangladesh	1997	0.62
Jamaica	1985-86	0.77
Fiji	1987	0.80

Other staff per bed

Level I hospitals

Country	Year	Ratio
Fiji	1987	0.1
Papua New Guinea	1988	0.2
Niger	1986-87	0.3
Sri Lanka	1991	0.3
Dominican Republic	1989	0.4
Jamaica	1985-86	0.4
Bangladesh	1997	0.5
Colombia	1979	1.0
Indonesia	1985	1.2

Level II & III hospitals

Country	Year	Ratio
Belize	1985	0.10
Fiji	1987	0.10
Sri Lanka	1991	0.30
Papua New Guinea	1988	0.33
Indonesia	1985	0.42
Bangladesh	1997	0.47
Jamaica	1985-86	0.63

Total staff per bed

Level I hospitals

Country	Year	Total
Niger	1986-87	0.7
Papua New Guinea	1988	0.9
Bangladesh	1997	0.9
Sri Lanka	1991	1.4
Fiji	1987	1.4
China	1986	1.9
Jamaica	1985-86	1.9
Dominican Republic	1989	2.1
Colombia	1979	2.6
Indonesia	1985	2.8

Level II & III hospitals

Country	Year	Total
Belize	1985	0.59
Sri Lanka	1991	0.89
Papua New Guinea	1988	0.90
Fiji	1987	1.00
Indonesia	1985	1.05
Bangladesh	1997	1.25
Jamaica	1985-86	1.47
China	1986	1.68

Bed days per staff

Level I hospitals

Country	Year	Ratio
Indonesia	1985	97.0
Colombia	1979	100.0
Jamaica	1985-86	160.0
China	1986	177.0
Fiji	1987	225.0
Sri Lanka	1991	313.7
Papua New Guinea	1988	328.0
Niger	1986-87	476.0
Bangladesh	1997	506.5

Level II & III hospitals

Country	Year	Ratio
Fiji	1987	176.0
Indonesia	1985	193.2
China	1986	195.3
Jamaica	1985-86	211.3
Belize	1985	224.0
Papua New Guinea	1988	283.3
Bangladesh	1997	289.8
Sri Lanka	1991	323.8

Sources: Barnum and Kutzin (1993), IPS Database

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Annex: Estimation of Production Functions

Analysis of unit costs is a very limited method of analysing efficiency in hospital facilities. Government-funded hospitals, as in Bangladesh, are not profit-seeking entities. Their input mix is largely determined by external rules and budgetary allocations, and they cannot be assumed to operating at full technical efficiency. Nevertheless, as a first step in examining the efficiency and performance of MOHFW facilities, a preliminary attempt to estimate production functions is made. The objectives of this analysis is merely to explore the data, and determine whether a simple production function can be fitted to the data. It does not represent a full analysis. More appropriate methods of analysis such as linear programming methods exist and should be attempted, if resources permit.

Method

Following Wouters (1993) and Hanson (1996), a series of biproduct production functions are estimated for the non-specialised facilities in the sample. This type of function indicates the technical relationship between inputs and outputs for the production of two services: inpatient admissions and outpatient visits. The output of each services is estimated controlling for the output of the other by including the other as an additional independent variable. Endogeneity of the second service is likely to be a problem, but is not tested for in this preliminary analysis.

Model

A simple translog form of the Cobb-Douglas production function is estimated. More sophisticated forms are available, which don't place the same restrictions on the technology parameters, but these would require more time to estimate. Other studies have shown that the Cobb-Douglas model performs almost as well as the next alternative, which is a full transcendental logarithmic form.

Both OLS and robust regression methods are used for estimation. Robust regression places less weight on outliers when estimating parameters. In some cases, results were not obtainable, as the estimation procedure failed to converge.

Variables

The inputs considered are: number of doctors in place, nurses, Class 3 employees, Class 4 employees, total annual drug expenditures, annual expenditures on other medical supplies, beds and whether X-ray facilities are available. The outputs are the annual total of admissions and annual total of outpatient visits.

Since all variables must be logged, any observations for which any of the variables have zero values would be dropped. To avoid this, all zero values for the relevant variables were replaced by a value of 0.10. Table A1 lists the variables considered. The mean values for each variable are given in Table A2.

The number of medical college hospitals for which data are available is only eight. The number of variables included in the estimation of functions for the lower level facilities is too great for estimation with the MCHs. Owing to the problem with insufficient degrees of freedom, the number of variables included in the analysis for MCHs was reduced. Some variables which appeared not to have any explanatory power in the estimation results for the lower level facilities were dropped. Other variables were dropped through a process of trial and error in order to obtain a reasonably parsimonious model which could be estimated.

Table A1: Variables used for estimation of production functions

Variable name	*Description*
Lnadmit	Logarithm of annual number of admissions
Lnopv	Logarithm of annual number of outpatient visits
Lndocs	Logarithm of number of doctors in place
Lnnurses	Logarithm of number of nurses in place
Lnclass3	Logarithm of number of Class 3 employees in place
Lnclass4	Logarithm of number of Class 4 employees in place
Lndrugs	Logarithm of drug expenditures in year
Lnsuppl	Logarithm of other medical supplies expenditures in year
Lnxray	Logarithm of number of functioning X-ray machines
Lnbeds	Logarithm of number of beds
ALOS	Average length of stay

Table A2: Mean values for variables used in estimations

Variable name	*THCs, DH/GHs*	*Medical College Hospitals*
Lnadmit	7.90 (0.65)	10.36 (0.45)
Lnopv	10.67 (0.48)	12.53 (0.41)
Lndocs	1.79 (0.38)	4.08 (0.23)
Lnnurses	2.02 (0.64)	5.28 (0.28)
Lnclass3	2.63 (0.46)	4.49 (0.41)
Lnclass4	2.88 (0.32)	5.65 (0.92)
Lndrugs	12.56 (1.15)	16.60 (0.72)
Lnsuppl	11.35 (2.66)	16.03 (1.35)
Lnxray	-0.77 (1.25)	1.54 (0.30)
Lnbeds	3.64 (0.45)	6.63 (0.27)
ALOS	4.06 (1.70)	10.99 (8.08)
N	97	8
Note: Standard deviations given in parentheses below means.		

Samples

Functions are estimated separately for medical college hospitals, and for all thana health complexes, district and general hospitals. THCs and DH/GHs are grouped together as they provide a similar pattern of basic services, differing significantly only in the quantity of staff, beds, equipment available and other inputs. THCs are all built according to one standard specification, and then equipped and staffed according to a single set of norms. It would be difficult to econometrically estimate a production function for THCs alone using the data available, since most of the variables considered would exhibit no variation. Combining the analysis of THCs with that of DH/GHs allows consideration of a greater range of variation in the key variables, but assumes that the same production process is going in both types of facility.

Results

The overall explanatory power of the models for admissions was good. The adjusted R^2 was 0.661 for Model 1 (for THC/DH/GHs), and 0.984 for MCHs. In general, robust regression yielded similar coefficients to OLS

regression and with the same sign, except for the MCH models which failed to converge. The model for outpatient visits at THC/DH/GHs had poor explanatory power, as reflected in the adjusted R^2.

The signs on the coefficients are generally as would be expected for the models estimated for admissions. Since double-logs were used in the estimation, the parameters can be directly interpreted as output elasticities. The sign for the coefficients for drug spending were negative, but the coefficients were not statistically significant. Note that the sign for the second service variable was positive in all models estimated. This may reflect endogeneity, plus a direct relationship between outpatient visits and admissions. THCs and DH/GHs are functioning as primary care facilities, where most outpatient visits involve patients seeking first contact care. Inpatient admissions are drawn directly from the pool of those outpatients presenting for examination, with a given probability of admission depending on severity of illness. In this context, increasing numbers of outpatient visits should result in increased admissions to the facility.

As this analysis is preliminary, firm conclusions should not be drawn from the results. However, for the purposes of discussion, the marginal products for the main inputs for inpatient admissions for which the coefficients were positive and significant at the 10% level are estimated in Table A5. These results suggest that the number of nursing staff should be increased in MCHs, as their marginal product is higher than the average product. In addition, the marginal product of staff in higher level facilities may be higher than in lower level facilities, which would suggest that the optimal placing of additional staff would be in the higher level facilities. The coefficient for beds was highly significant in all the models, and positive. This is consistent with the picture of overcrowding observed, suggesting that expansion in bed numbers at all levels of facility would result in increased output of services. Since the capital cost of building new bed capacity was not available it is not possible to make a direct cost comparison between expanding facility size and employing new staff. However, the approximate size of the estimated marginal products for lower level facilities (137 for doctors, and 57 for beds) is such that expanding bed size is likely to be more cost-effective than increasing staff numbers.

Table A3: Estimated marginal products (annual admissions per unit of input)

	THC/DH/GHs		**Medical College Hospitals**	
	Average product	*Marginal product*	*Average product*	*Marginal product*
Doctors	528	137	564	-
Nurses	338	*(41)*	168	827
Class 3	244	*(34)*	356	294
Beds	78	57	44	93
Note: Marginal products estimated using parameters from OLS models. Marginal products not estimated where coefficients in OLS models were negative. Values estimated using non-significant parameters indicated in parentheses.				

Table A4: Results of estimation of production functions for admissions

	Model 1: Admissions at THC/DHs				**Model 2: Admissions at MCHs**			
Dependent variable	**lnadmit**		**Lnadmit**		**lnadmit**		**lnadmit**	
	OLS		**Rreg**		**OLS**		**Rreg**	
Independent variables	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*
Lndocs	0.259	1.83	0.297	0.14	-1.878	-6.71	Doesn't converge	
Lnnurses	0.123	1.16	0.099	0.10	4.905	9.69		
Lnclass3	0.140	1.50	0.161	0.09	0.829	6.70		
Lnclass4	0.074	0.50	0.053	0.15				
Lndrugs	-0.028	-0.81	-0.034	0.03				
Lnsuppl	0.040	2.29	0.088	0.02				
Lnxray	0.030	0.85	0.003	0.03				
Lnopv	0.099	1.11	0.103	0.09	0.534	6.31		
Lnbeds	0.725	3.83	0.683	0.19	2.122	10.39		
ALOS	-0.140	-6.26	-0.137	-6.22	-0.231	-13.04		
Constant	3.397	1.05	2.989	2.89	-29.788	-7.56		
R2		0.697				0.998		
Adj R2		0.661				0.984		
N		94		94		8		

Table A5: Results of estimation of production functions for outpatient visits

	Model 3: Outpatient visits at THC/DHs				**Model 4: Outpatient visits at MCHs**			
Dependent variable	**lnopv**		**lnopv**		**lnopv**		**lnopv**	
	OLS		**Rreg**		**OLS**		**Rreg**	
Independent variables	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*
Lndocs	0.235	1.37	0.265	1.63	3.423	4.28	Doesn't converge	
Lnnurses	-0.038	-0.30	-0.102	-0.84	-9.053	-7.84		
Lnclass3	0.114	1.00	0.175	1.61	-1.505	-4.03		
Lnclass4	-0.199	-1.11	-0.203	-1.20				
Lndrugs	0.019	0.45	0.025	0.62				
Lnsuppl	-0.047	-2.23	-0.047	-2.33				
Lnxray	-0.030	-0.72	0.005	0.13				
Lnadmit	0.190	1.76	0.180	1.76				
Lnbeds	0.402	1.66	0.423	1.85	-3.898	-6.44		
ALOS					0.425	8.17		
Constant	7.892	0.92	7.786	0.87	55.307	9.59		
R2		0.263				0.991		
Adj R2		0.184				0.933		
N		94		94		8		

Table A6: Distribution of MOHFW facilities by type and by division, Bangladesh 1997

Division	*Thana health complexes*	*District/ General hospitals*	*Medical College hospitals*	*Specialised hospitals*	*Total*
Barisal	32	6	1	1	40
Chittagong	78	11	2	4	95
Dhaka	104	15	4	10	133
Khulna	49	10	1	3	63
Rajshahi	108	14	4	7	133
Sylhet	31	4	1	3	39
Total	402	60	13	28	503