MONITORING HOSPITAL PERFORMANCE: THE CHALLENGE OF EFFICIENCY IN SERVICE DELIVERY IN ETHIOPIAN HOSPITALS

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Summary

Hospital reform is a priority in the context of the national health sector strategic plan of Ethiopia. Two of its main goals are to improve the accessibility and quality of health services and to increase the efficiency in health care delivery, considering improvements in both the distribution of resources to priority activities (allocation efficiency) and the management of resources that are allocated (technical efficiency). At each level of the hospital system, the utilization of the hospital capacity and the mix of patients and available services should be appropriate in order to provide quality services to the greatest number of patients at least cost.

This paper is based on data routinely collected in 47 hospitals (both governmental and non-governmental) located in 5 regions (Tigray, Amhara, Oromia, SNNP, and Addis Ababa) in EFY 2001. Its objective is to assess the hospital performance in the selected facilities, with a special focus on performance at different levels of the hospital system, highlighting areas of efficiency in service delivery as well as those in need of attention. This evidence is important in the perspective of the implementation of the ongoing hospital reform and the development of the hospital referral system.

The comparison of the hospital performance shows high variability across individual facilities, and this may have resulted not only from differences in staffing pattern and case mix, but also from the relative efficiency of input use (in addition to other factors, such as regional hospital resource allocation formulas), indicating that a number of elements subject to management intervention may contribute to low or high efficiency. In particular, the high variability in workload across facilities and by type of hospitals shows that some factors affecting performance are under the managerial control of the hospital board, such as admission and discharge policy, staff management, productivity, and, in general, utilization of available resources. The combination of low service utilization and high expenditures is a common cause of inefficiency because overhead costs and other fixed inputs are spread over a smaller number of service outputs. Improved efficiency may be obtained through reduced costs, higher service utilization and better productivity. The analysis of hospital performance by type of facilities shows an increasing gradient of performance from lower level facilities to referral and private not-for-profit hospitals. However, it is worth noting that high level of performance was found in facilities in both public and private sectors. Perhaps, more than public or private status, what matters is the context, the hospital governance autonomy, the incentives, and the management framework which governs a facility, regardless of ownership status.

It is crucial, in the framework of the current hospital reform, to strengthen the collection, analysis and use of basic hospital indicators, to ensure the full utilization of hospital capacity, to develop the referral system, to redistribute the case load within the hospital system and to reallocate resources in favour of the most efficient/least cost provider in order to meet the health needs of the population.

1) Introduction

Hospital reform is a priority in the context of the national health sector strategic plan of Ethiopia (FMOH, 2005). Two of the main goals of the hospital reform are to improve the accessibility and quality of health services and to increase the efficiency in health care delivery, considering improvements in both the distribution of resources to priority activities (allocation efficiency) and the management of resources that are allocated (technical efficiency). At each level of the hospital system, the utilization of the hospital capacity and the mix of patients and available services should be appropriate in order to provide quality services to the greatest number of patients at least cost.

Both goals require health management information, with a special focus on information use for performance improvement. In particular, data on outpatient visits, in-hospital admissions and duration of hospital stay, as well as on service costs and staff productivity, are routinely collected by the hospital information system and may be used to assess the performance in service delivery. While service utilization measures can disguise important dimensions of efficiency, they can also reveal whether the necessary inputs are reaching the intended target groups and offer useful insights into the demand for services.

Further examinations of service utilization patterns aim at describing quality of services and their outcomes. In this context, performance monitoring focuses on activities implementation and the intermediate steps that determine how inputs are transformed into outputs linked to the ultimate outcome of improved health of the people.

Monitoring the performance of multiple public and private providers constitutes a primary responsibility of the Federal Ministry of Health (FMOH) and the Regional Health Bureaus (RHB) (FMOH, 2007a; FMOH, 2007b; FMOH, 2009). This is critical to properly exercise their role as purchasers of health care services from the health care providers such as hospitals, health centres and health posts (Bilal et al., 2009). These purchasers need to be able to allocate funds on the basis of equity, efficiency and effectiveness, linking funding to volume and quality of services provided and assessing how they contribute to the overall target achievement.

Therefore, the interpretation of hospital indicators and performance measures has been developed within a comprehensive framework of analysis, linking input, output, and outcome data. This framework was presented in a paper published in a previous issue of the Health Bulletin "Policy and Practice" showing that, without understanding the differences in resources availability, quality of care and case mix across the hospitals, the efficiency implications of variations in hospital service indicators cannot be fully understood (Bilal et al., 2009).

This paper is based on data routinely collected in 47 hospitals (both governmental and non-governmental) located in 5 regions (Tigray, Amhara, Oromia, SNNP, and Addis Ababa) and updates the analysis to EFY 2001, assessing the structural and process features of service delivery that affect health outcomes. Its objective is to assess the hospital performance in the selected facilities, with a special focus on performance at different levels of the hospital system, highlighting variations of efficiency in service delivery as well as identifying problems requiring attention. This evidence is important in the perspective of the implementation of the ongoing hospital reform and the development of the hospital referral system. Practical examples of possible use of routinely collected data are provided, showing how a comprehensive framework of analysis relating resources, services and outcomes is necessary for hospital governing boards, managers and providers to manage care, that is, to match the resources to patient needs and achieve the best possible outcomes at an affordable cost.

2) Material and methods

Data were collected from 47 hospitals, of which 17 were in Oromia Region, 8 in Tigray, 8 in Amhara, 8 in Addis Ababa, and 6 in SNNPR. Concerning the type of facilities, 40 were governmental (12 district hospitals, 16 zonal hospitals, 7 regional hospitals, and 5 federal hospitals), while 7 were private-not-for-profit (PNFP) hospitals (see list in Table 1). These hospitals were selected on the basis of data availability; therefore, it is a convenient sample of hospitals located in 5 out of the 11 regions only, which may not be representative of the overall hospital system in the country.

Analysis was based on data routinely collected in the facilities and reported to higher levels, with quality control and data validation being performed on reported data, without on-site verification of hospital records. As a result, the quality of the data presented depends largely on the quality of the data reported by the hospitals; this may leave room for under- or over-reporting in some cases.

Furthermore, information on case-mix and outcomes for specific conditions (i.e., case fatality rate) was not available, limiting the scope of the analysis and making impossible to describe the morbidity and mortality profiles in the hospitals as well as to estimate effectiveness. As a result of the above limitations, this study includes about one-third of the hospitals in the country, and focuses on efficiency measures only. Further studies, including more hospitals, are needed to expand the methods of data collection (by ensuring on-site quality control of data and combining qualita-

tive and quantitative methods) as well as the scope of the analysis (by including case-mix and effectiveness measures). This will address the limitations of representativeness and scope of the present study.

Concerning data collection and reporting, the following 13 data elements were taken into consideration: (i) number of beds; (ii) number of OPD visits; (iii) number of admissions; (iv) number of inpatient days; (v) number of in-hospital deaths; (vi) number of physicians; (vii) number of nurses, (viii) number of other clinical staff (including other categories of clinical staff, such as laboratory and X-ray technicians etc., but excluding administrative and ancillary personnel); (ix) total expenditures; (x) number of deliveries; (xi) number of caesarean sections; (xii) number of major surgeries; and (xiii) number of minor surgeries.

On the basis of the above data elements, the following service indicators were estimated: bed occupancy rate (BOR), bed turnover rate (BTR) and average length of stay (ALOS). The indicator used to estimate cost-efficiency was the cost per patient-day equivalent (PDE), with the cost being estimated from the sum of salaries and operating budget, and PDE being estimated from the sum of inpatient days and one quarter of the number of OPD visits. Therefore, it is assumed that the cost of one inpatient day is the same as that of four outpatient visits (Barnum and Kutzin, 1993).

The formulas are presented in the Box 1.

For the purposes of performance comparison and outliers identification, service indicators may be presented more effectively, as shown in Figures 1 to 6, according to the graphical technique based on the following principles (Pabòn Lasso, 1986):

- There are three interrelated hospital service indicators (BOR, BTR and ALOS);
- BOR is represented in the horizontal axis, BTR in the vertical one, and a line starting from the origin represents a constant ALOS, and its measure increases consistently from left to right across the top of the graph and down along its right hand side;
- The graph is subdivided into four quadrants by two lines drawn according to the average BOR and BTR;
- The upper right quadrant (with high BOR and BTR) represents the area with hospital performance above the national average;
- The lower left quadrant (with low BOR and BTR) represents the area with hospital performance below the national average;
- The other two quadrants represent areas of mixed performance, with BOR below and BTR above the national average (upper left quadrant) and BOR above and BTR below the national average (lower right quadrant).

This technique does not imply any additional data burden, representing an important tool for performance monitoring to support appropriate decision and action by the hospital management.

Box 1

$$BOR = \frac{\text{Total length of stay in days per year}}{\text{Average number of beds per year} \times 365}$$

$$BTR = \frac{\text{Annual number of discharges per year}}{\text{Average number of beds per year}}$$

$$ALOS = \frac{\text{Total length of stay in days per year}}{\text{Number of discharges per year}}$$

$$\text{Cost per PDE} = \frac{\text{Total Costs}}{\text{Number of inpatient days} + (\text{OPD visits} / 4)}$$

Concerning staff availability, the following indicators were estimated:

- number of doctors per bed;
- number of nurses per bed; and
- number of other clinical staff per bed.

Similarly, the indicators reflecting staff productivity were the ratios of the number of inpatient days to the number of health personnel according to the above mentioned categories.

The formulas are presented in the Box 2.

The following indicators were estimated to assess the complexity of case mix and the outcome of hospital care (Box 3):

- percentage of caesarean sections;
- percentage of major surgeries; and
- in-hospital mortality rate.

3) Results and discussion

3.1) Assessing hospital performance: efficiency in service delivery

The list of facilities, with the respective number of beds, outpatient visits, inpatient admissions, as well as service and cost indicators, is presented in Table 1.

The average bed occupancy rate (BOR) in the selected facilities was 50.8% in EFY 2001, while the average bed turnover rate (BTR) was 27.8 inpatients per bed, meaning that an average of about one out of two beds laid idle, and every hospital bed was used to service about 28 inpatients during the year. The average length of stay (ALOS) was 6.7 days. The average cost per PDE was 196 ETB, expressing the average cost of producing a day-equivalent of institutional care (corresponding to one day of hospital admission or four outpatient visits). It assumes, as already mentioned, that the cost of one inpatient day is the same as that of four outpatient visits (Barnum and Kutzin, 1993).

Box 2

$$\text{Doctors per bed} = \frac{\text{Number of doctors}}{\text{Average number of beds}}$$

$$\text{Nurses per bed} = \frac{\text{Number of nurses}}{\text{Average number of beds}}$$

$$\text{Other clinical staff per bed} = \frac{\text{Number of other clinical staff}}{\text{Average number of beds}}$$

$$\text{Inpatient days per doctor} = \frac{\text{Number of inpatient days}}{\text{Number of doctors}}$$

$$\text{Inpatient days per nurse} = \frac{\text{Number of inpatient days}}{\text{Number of nurses}}$$

$$\text{Inpatient days per other clinical staff} = \frac{\text{Number of inpatient days}}{\text{Number of other clinical staff}}$$

Box 3

$$\text{Percentage of caesarean sections} = \frac{\text{Number of caesarean sections}}{\text{Total number of deliveries}}$$

$$\text{Percentage of major surgeries} = \frac{\text{Number of major surgeries}}{\text{Total number of surgeries}}$$

$$\text{In-hospital mortality rate} = \frac{\text{Number of deaths}}{\text{Total number of admissions}}$$

Region	Hospital		No. of beds	No. OPD visits	No. hospital admissions	BOR	BTR	ALOS	Cost per PDE
	Type	Name							
Tigray	Zonal	Lemlem Karl	137	46,481	3,747	49.5	27.4	6.6	108
Tigray	Zonal	Axum	170	50,178	4,538	32.4	26.7	4.4	182
Tigray	Zonal	Suhul	111	37,435	3,941	33.8	35.5	3.5	225
Tigray	Distr	Wukro	70	36,069	2,065	53,5	29,5	6,6	117
Tigray	Distr	Humera	120	37,717	2,149	23.6	17.9	4.8	193
Tigray	Distr	Abi Adi	90	23,543	1,421	24.2	15.8	5.6	241
Tigray	Distr	Adigrat	148	23,948	4,332	24.4	29.3	3.0	222
Tigray	Distr	Alamata	100	71,192	2,379	26.1	23.8	4.0	89
Amhara	Region	Dessie	200	82,429	8,807	60.3	44.0	5.0	165
Amhara	Region	Felege Hiwote	273	106,159	9,422	44.8	34.5	4.7	142
Amhara	Zonal	Debre Tabor	93	40,601	2,530	29.1	27.2	3.9	219
Amhara	Zonal	Debre Berhan	128	57,654	3,914	83.3	30.6	9.9	111
Amhara	Zonal	Woldia	120	34,259	3,133	22.9	26.1	3.2	281
Amhara	Zonal	Debre Markos	127	59,278	7,639	69.2	60.1	4.2	120
Amhara	Distr	Tefera Hailu	110	19,143	866	20.3	7.9	9.4	216
Amhara	Distr	Finot Selam	105	48,012	2,100	20.8	20.0	3.8	136
Oromia	Region	Nekemte	178	71,185	7,108	65.6	39.9	6.0	116
Oromia	Region	Shashemene	162	39,770	4,612	57.9	28.5	7.4	238
Oromia	Region	Adama	250	75,206	8,853	38.1	35.4	3.9	224
Oromia	Zonal	Ginnir	124	24,446	2,123	41.5	17.1	8.8	196
Oromia	Zonal	Ambo	105	52,752	3,584	56.4	34.1	6.0	163
Oromia	Zonal	Bishoftu	102	108,577	4,626	51.1	45.4	4.1	106
Oromia	Zonal	Bisidimo	145	24,529	2,240	76.2	15.4	18.0	109
Oromia	Zonal	Dembi Dollo	85	46,000	3,670	53.2	43.2	4.5	208
Oromia	Zonal	Fiche	100	33,730	1,598	23.9	16.0	5.5	227
Oromia	Zonal	Chiro	174	51,065	2,039	21.3	11.7	6.6	195
Oromia	Distr	Abhoomsa	55	11,072	720	25.1	13.1	7.0	307
Oromia	Distr	Horo Goduro W.	50	15,978	754	17.4	15.1	4.2	325
Oromia	Distr	Deder	80	35,269	1,913	37.0	23.9	5.7	188
Oromia	Distr	Shambo	50	15,978	754	17.4	15.1	4.2	325
Oromia	PNFP	Wolisso	157	63,915	8,037	81.3	51.2	5.8	218
Oromia	PNFP	Gambo	135	35,632	4,046	107.2	30.0	13.1	84
Oromia	PNFP	Aira	80	32,876	4,715	65.9	58.9	4.1	40
SNNPR	Zonal	Arbaminch	249	51,711	9,008	52.3	36.2	5.3	173
SNNPR	Zonal	Butaiita	105	21,844	2,262	17.9	21.5	3.0	373
SNNPR	Distr	Dilla	159	17,753	2,400	37.2	15.1	9.0	119
SNNPR	PNFP	Soddo	120	11,639	5,845	51.8	48.7	3.9	321
SNNPR	PNFP	Dubbo St Mary	72	24,802	5,835	89.9	81.0	4.0	166
SNNPR	PNFP	Attat	65	64,831	6,356	96.4	97.8	3.6	113
Addis Ababa	Region	D. Minilik II	272	70,802	3,712	34.6	13.6	9.3	319
Addis Ababa	Region	Ras Desta	92	29,792	3,187	59.7	34.6	6.3	317
Addis Ababa	Feder	St Peter	200	24,298	843	28.7	4.2	24.9	343
Addis Ababa	Feder	ALERT	260	121,784	3,061	39.4	11.8	12.2	242
Addis Ababa	Feder	Amanuel	256	95,336	1,899	81.6	7.4	40.2	130
Addis Ababa	Feder	Black Lion	558	258,784	13,165	85.9	23.6	13.3	188
Addis Ababa	Feder	St Paul	282	99,886	6,818	50.4	24.2	7.6	306
Addis Ababa	PNFP	Korean	132	73,970	4,482	60.5	34.0	6.5	654
Average						**50.8**	**27.8**	**6.7**	**196**

Table 1. *Hospital service and cost indicators in selected facilities (EFY 2001).*

It is worth noting that health facilities are expected to operate most efficiently at a level of about 80-90% of occupancy (Barnum and Kutzin, 1993); however, only few hospitals showed such level of performance. These included: Debre Berhan in Amhara Region, Wolisso and Gambo in Oromia Region, Dubbo and Attat in SNNPR, and Amanuel and Black Lion in Addis Ababa. These facilities are either teaching referral hospitals (i.e., Black Lion Hospital), or federal specialized hospitals (i.e., Amanuel Psychiatric Hospital), or zonal hospitals (Debre Berhan Hospital), or PNFP hospitals (Dubbo, Attat, Wolisso and Gambo Hospitals). None of the district hospitals is included in the list of high performing facilities.

The analysis of hospital performance by type of hospitals shows a gradient of increasing service utilization at higher levels of the referral system, with a bed occupancy ranging from 27.6% in district hospitals to 45.2% in zonal hospitals, 48.9% in regional hospitals, 63.6% in federal hospitals, and 78.1% in PNFP hospitals (Table 2). The bed turnover rate ranged from 16.6 inpatients per bed per year in federal hospitals to 51.7 in PNFP hospitals. ALOS ranged between 5.2 and 5.6 days in district, zonal, regional and PNFP hospitals, while it was much longer (14.0 days) in federal hospitals. Long ALOS accounted for low BTR in federal hospitals, whereas low BTR in district hospitals was mainly due to low utilization of hospital services, as reflected by low BOR. The average cost per PDE was 196 ETB, with zonal hospitals (164 ETB) and district hospitals (176 ETB) showing cost per PDE below the average, while regional, federal and PNFP hospitals showed a cost per PDE above the average (203, 210 and 234 ETB, respectively). These patterns reflect higher costs in providing care in referral facilities due to more intensive input use (such as specialized staff and sophisticated equipment) for more complex cases (referred, in some cases, by lower level facilities).

The different composition of hospitals in the regions accounted for the regional differences in hospital performance (Table 3). As already mentioned, the sample of selected hospitals is not representative of the overall hospital system, and generalization can not be made from the performance of the selected facilities to the overall hospital performance. SNNPR (with a high representation of zonal and PNFP hospitals) showed a 51.7% BOR with short ALOS (4.6 days) and high BTR (41.2 inpatients per bed per year). Amhara and Oromia (with a quite fair representation of all categories of hospitals) showed similar patterns in BOR (46.4%, and 52.7% respectively), and BTR (33.2 inpatients per bed in Amhara, and 30.2 in Oromia), with an ALOS of 5.1, and 6.4 days, respectively. Tigray (with a higher representation of district hospitals) showed low BOR (32.8%) and BTR (26.0 inpatients per bed), with an ALOS of 4.6 days. Addis Ababa (with only 3 hospitals: Ras Desta, Minilik and Korean) showed a performance similar to the national average (BOR=46.1%, BTR=22.9, ALOS=7.3 days). As expected, federal hospitals showed a BOR (63.6%) above the average and a long ALOS (14.0 days) because of the complexity of case-mix in referrals hospitals and long-term care in specialized hospitals (i.e., mental and TB hospitals).

Regional cost per PDE was also a reflection of the types of hospitals which were prevalent in each region and it ranged between 154 ETB in Amhara and 444 ETB in Addis Ababa (mainly because of the high cost per PDE in the Korean hospital). The relatively high cost per PDE found in federal hospitals reflects more complex case-mix and more intensive use of resources.

Type of Hospitals	No. of hospitals	No. of beds	No. of OPD visits	No. of hospital admissions	BOR (%)	BTR (inpatients per bed)	ALOS (in days)	Cost per PDE (in ETB)
District H.	12	1,137	355,674	21,853	27.6	19.2	5.2	176
Zonal H.	16	2,075	740,540	60,592	45.2	29.2	5.6	164
Regional H.	7	1,427	475,343	45,701	48.9	32.0	5.6	203
Federal H.	5	1,556	600,088	25,786	63.6	16.6	14.0	210
Private-Not-For-Profit H.	7	761	307,665	39,316	78.1	51.7	5.5	234
National	**47**	**6,956**	**2,479,310**	**193,248**	**50.8**	**27.8**	**6.7**	**196**

Table 2. *Hospital service and cost indicators by type of facilities (EFY 2001).*

Region	No. of hospitals	No. of beds	No. of OPD visits	No. of hospital admissions	BOR (%)	BTR (inpatients per bed)	ALOS (in days)	Cost per PDE (in ETB)
Tigray	8	946	326,563	24,572	32.8	26.0	4.6	162
Amhara	8	1,156	447,535	38,411	46.4	33.2	5.1	154
Oromia	17	2,032	737,980	61,392	52.7	30.2	6.4	166
SNNPR	6	770	192,580	31,706	51.7	41.2	4.6	185
Addis Ababa	3	496	174,564	11,381	46.1	22.9	7.3	444
Federal hospitals	5	1,556	600,088	25,786	63.6	16.6	14.0	210
National	**47**	**6,956**	**2,479,310**	**193,248**	**50.8**	**27.8**	**6.7**	**196**

Table 3. *Hospital service and cost indicators in 5 regions and in federal hospitals (EFY 2001).*

Of note is the fact that wide variations were observed across facilities of the same type located in the same region (Table 1). For example, BOR in zonal hospitals in Amhara Region ranged between 83.3% in Debre Berhan Hospital and 22.9% in Woldia Hospital. It is therefore crucial to investigate if outliers are due to disparities of resources availability, variations in technical or economic efficiency, differences in case mix and quality of care, or other reasons. The identification of outliers is important to address factors determining technical inefficiency (in which output is less than is technically possible with the mix of inputs used by the hospital) and economic inefficiency (in which the hospital may be technically, but not economically, efficient because it is not using the least expensive combination of inputs per output) (Barnum and Kutzin, 1993). For example, in the hospitals with high BOR, heavy surgical case load and long waiting list, governing boards and management should examine the feasibility of day surgery, which dramatically increases efficiency, without compromising quality of care and outcomes of patients.

The analysis of hospital performance by type of facilities (using the performance graphs) highlights that private not-for-profit hospitals showed the highest BOR and BTR, while district hospitals showed the lowest BOR and BTR, with federal, regional and zonal hospitals performing at intermediate levels (Figure 1). For easy identification and understanding, different types of hospitals are represented with different symbols and colours: circle (in green) for district hospitals, rhomb (in blue) for zonal hospitals, and triangle (in black) for regional hospitals, large square (in brown) for federal hospitals, and small square (in red) for PNFP hospitals.

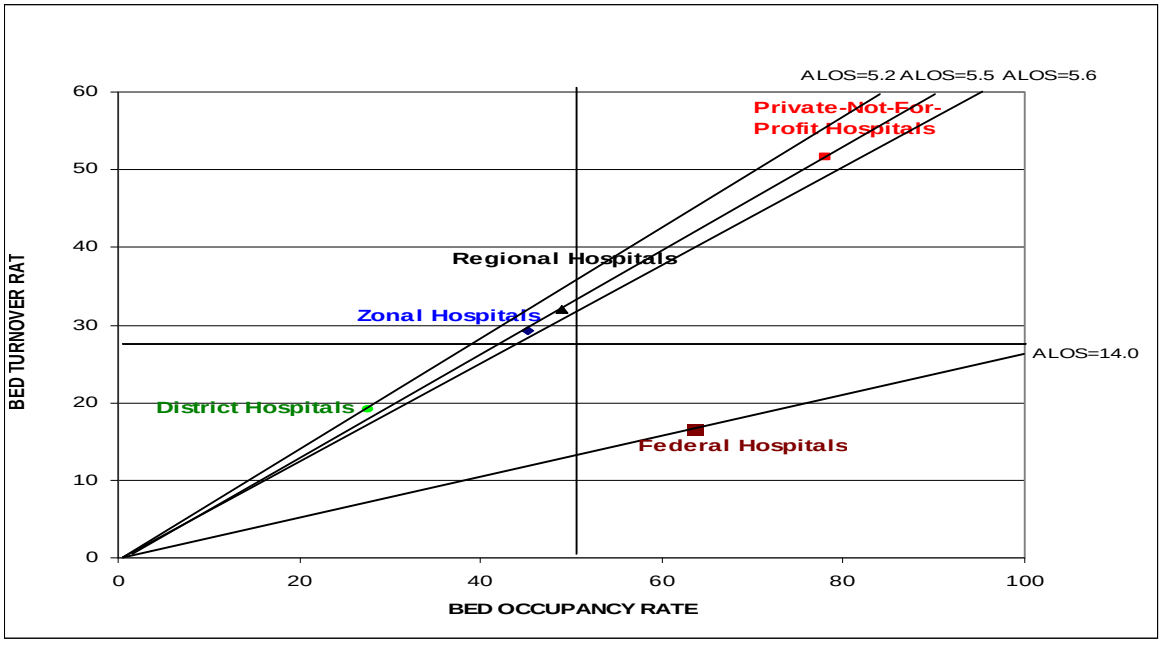

Figure 1. *Hospital service indicators by type of facilities (EFY 2001).*

The performance graph concerning Tigray Region shows that Wukro District Hospital performed slightly above the national average and was the only hospital in the region located in the upper right quadrant, while Humera and Abi Adi District Hospitals showed the lowest performance (BOR=23.6% and 24.2%, respectively; BTR=17.9 and 15.8 inpatients per bed per year) (Figure 2).

In Amhara Region, three facilities were located in the upper right quadrant with BOR and BTR above the national average: Debre Markos and Debre Berhan Zonal Hospitals and Dessie Regional Hospital (Figure 3). Tefera Hailu (20.3%) and Finot Selam (20.8%) District Hospitals showed the lowest BOR, with a BTR of 7.9 and 20.0 inpatients per bed per year, respectively.

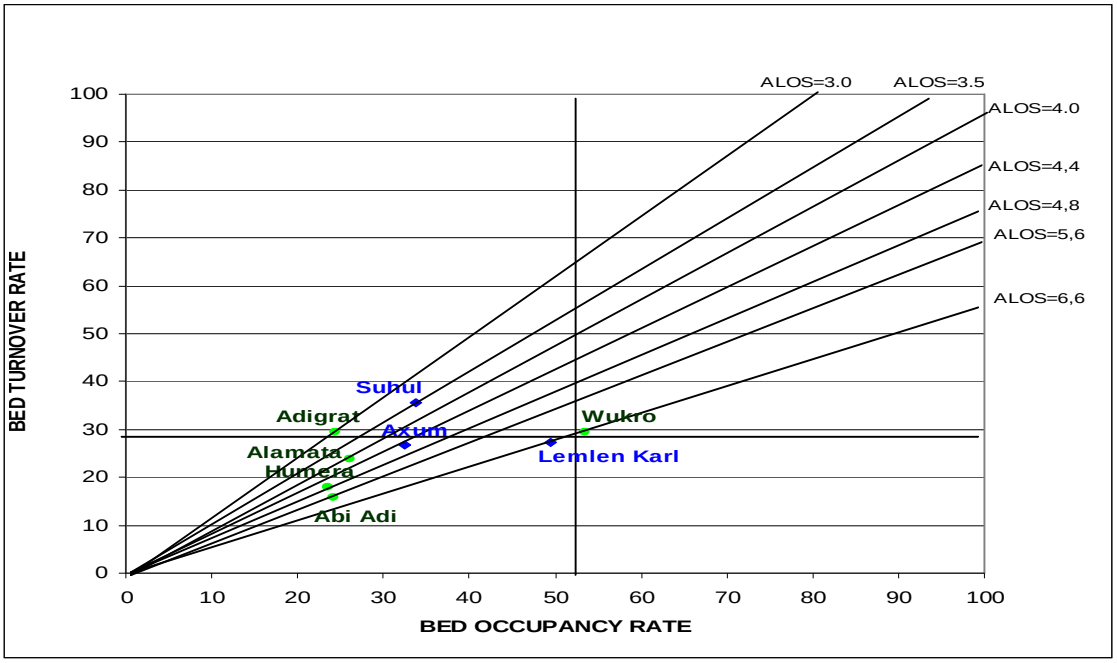

Figure 2. *Hospital service indicators in Tigray Region (EFY 2001).*

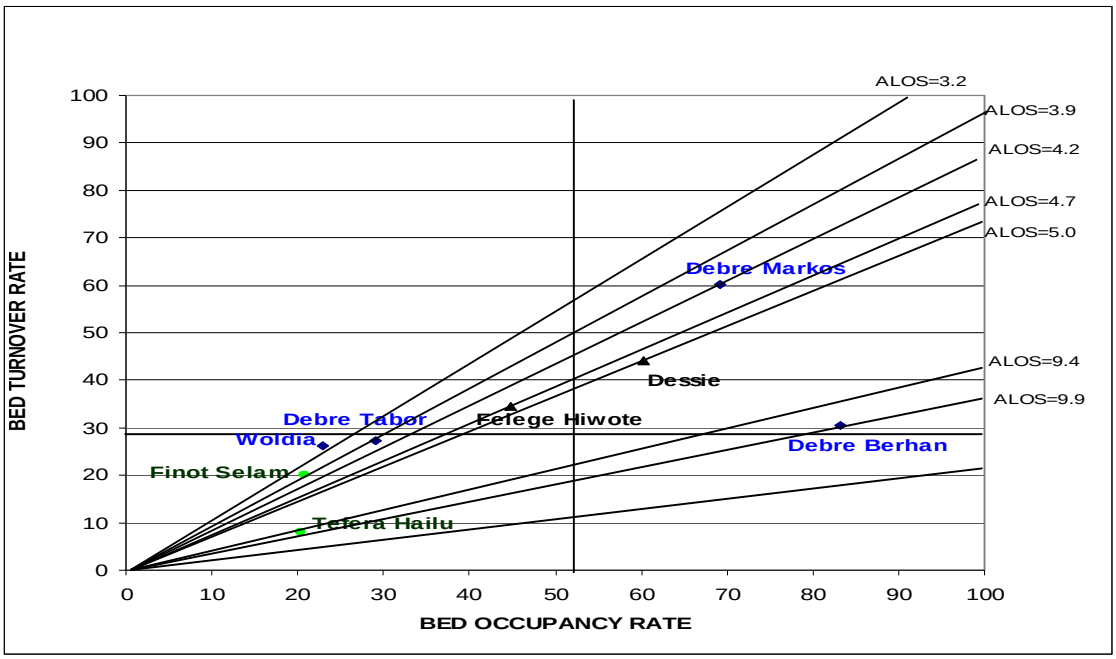

Figure 3. *Hospital service indicators in Amhara Region (EFY 2001).*

Three PNFP hospitals (Aira, Wolisso and Gambo), together with 2 regional hospitals (Nekempte and Shashemene) and 3 zonal hospitals (Ambo, Dembi Dollo and Bishoftu), were located in the upper right quadrant in Oromia Region (Figure 4). A cluster of district hospitals (such as Horo Goduro Wollega, Shambo and Abhoomsa), together with two zonal hospitals (Chiro and Fiche), showed the lowest performance.

In SNNPR 3 PNFP hospitals (Attat, Dubbo and Soddo) and one zonal hospital (Arbaminch) were located in the upper right quadrant, while Butaiita Zonal Hospital showed the lowest performance (BOR=17.9% and BTR=21.5) (Figure 5).

One PNFP hospital (Korean) and one regional hospital (Ras Desta) had identical performance and were located in the upper right quadrant in Addis Ababa (Figure 6). Black Lion Federal Hospital showed the highest BOR (85.9%), but, because of the long ALOS (13.3 days), its BTR (23.6) was below the national average. St Peter Federal Hospital, specialized in TB care, showed long ALOS (24.9 days), as well as low BTR (4.2 inpatients per bed per year) and low BOR (28.7%).

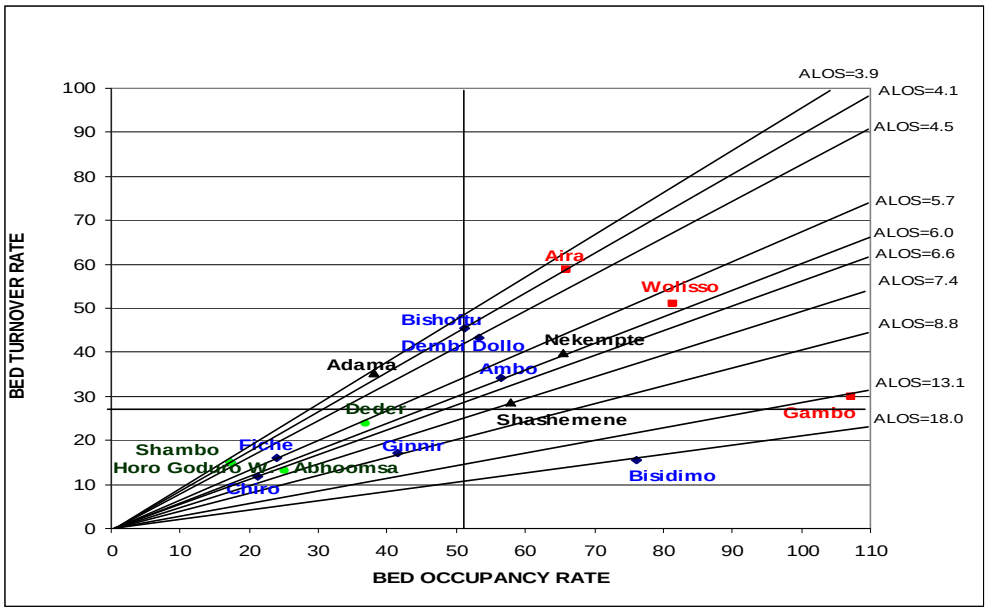

Figure 4. *Hospital service indicators in Oromia Region (EFY 2001).*

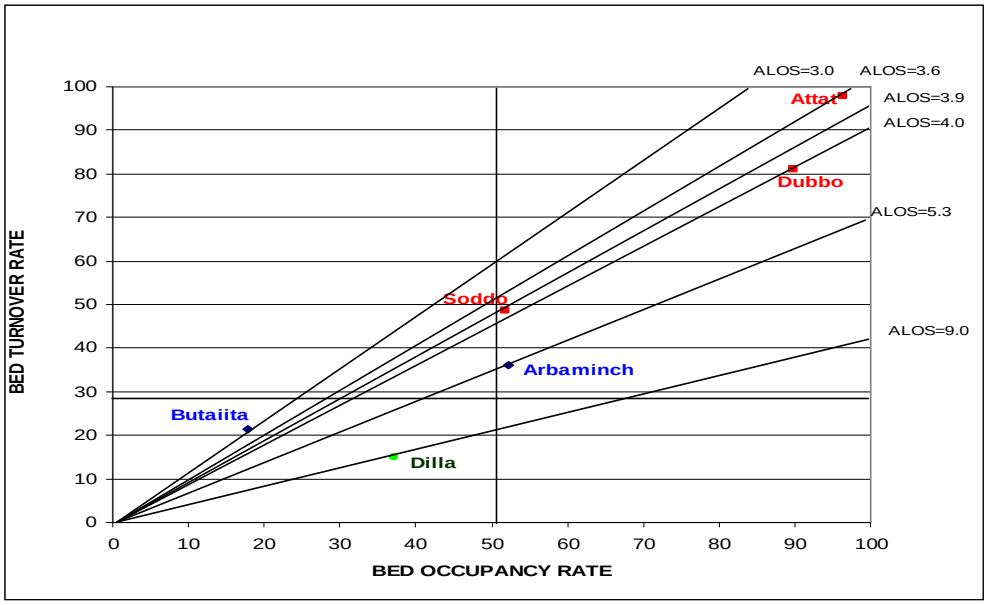

Figure 5. *Hospital service indicators in SNNPR (EFY 2001).*

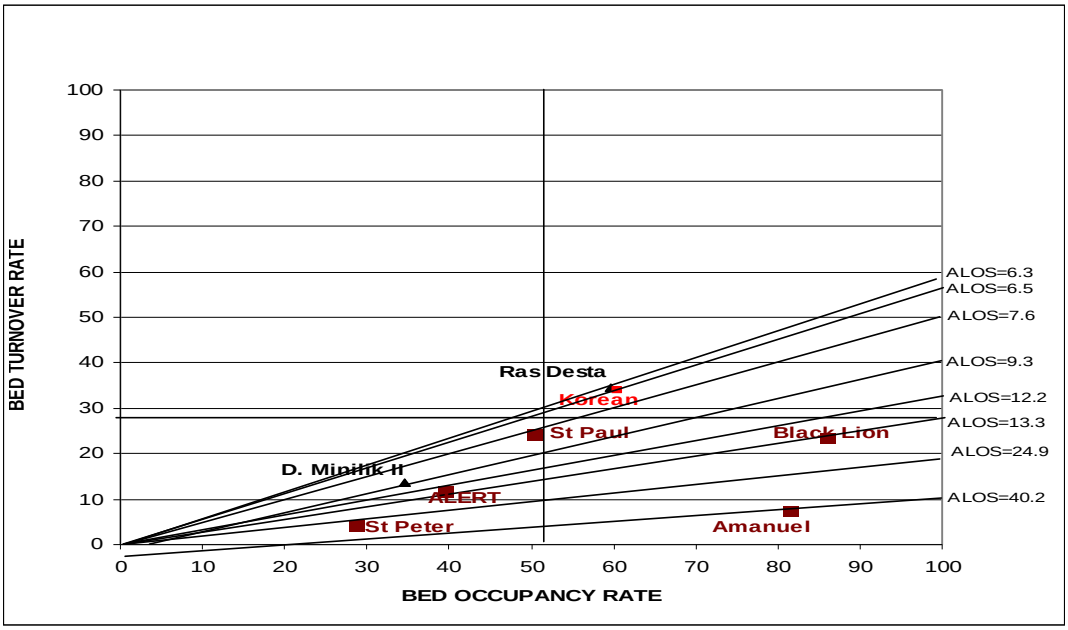

Figure 6. *Hospital service indicators in Addis Ababa (EFY 2001).*

The scatter diagram below illustrates the overall performance of all hospitals included in the analysis. As usual, green circles, blue rhombs, black triangles, large brown squares, and small red squares represent district, zonal, regional, federal and PNFP hospitals, respectively, while the names of the hospitals and the lines representing ALOS have been omitted because of space limitations. The graph shows the cluster of district hospitals in the low performing area (with low BOR and BTR), while the PNFP hospitals tend to be located in the high performing area (with high BOR and BTR). Zonal, regional and federal hospitals are quite scattered, showing high variability in performance. Furthermore, the cost per PDE has been added to each point representing individual hospitals, showing that the outliers in the lower left quadrant (with low BOR and BTR) tend to have a relatively high cost per PDE (because the costs are spread over a small number of service outputs), while outliers in the upper right quadrant (with high BOR and BTR) tend to have a relatively low cost per PDE because of the high number of service outputs (Figure 7).

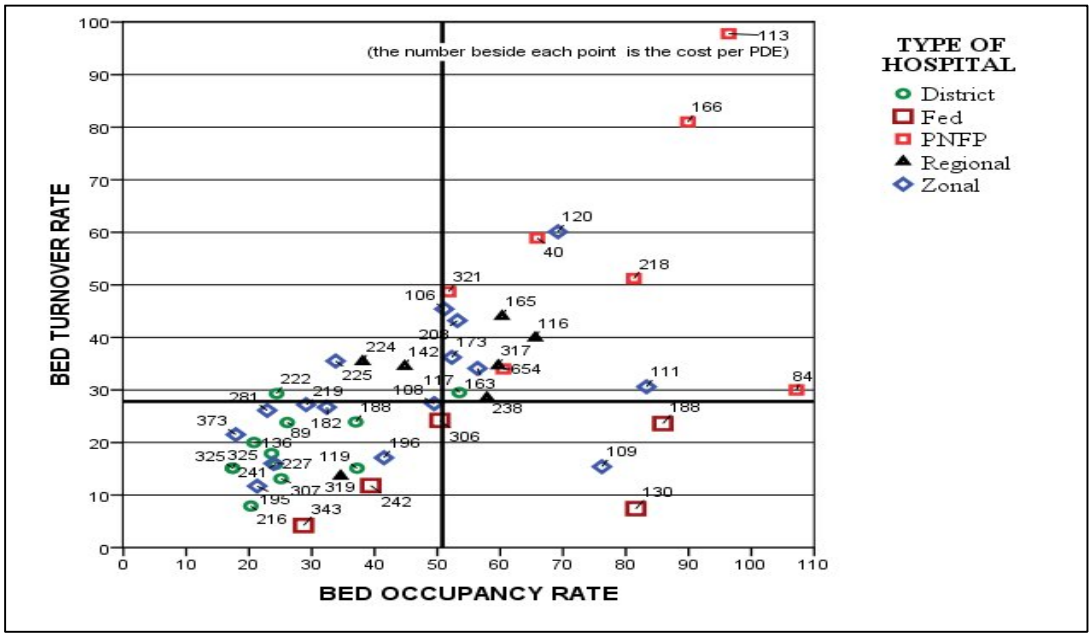

Figure 7. *Summary of hospital service indicators (with cost per PDE beside each point) in selected facilities classified by type of hospitals (EFY 2001).*

In general, the differences across individual facilities was high, and this may have resulted not only from differences in beds availability, staffing pattern and case mix, but also from the relative efficiency of input use, highlighting the fact that a number of factors subject to management intervention may contribute to low efficiency or drive high efficiency. These differences in performance provide useful information for benchmarking, which is the identification of "best-in-class" performance and analysis of the process by which that performance is achieved. This analysis is useful to identify which factors differentiated the service provision in hospitals with different levels of performance, with particular emphasis on efficient use of scarce resources in the labour intensive hospital settings. It is for this reason that the next sections will be devoted to the management of human and financial resources.

3.2) Assessing hospital performance: staff availability and productivity

Differences in case mix, technical capacity and staff profile differentiate hospital categories and imply different sizes of facilities roughly measured by the number of beds and health staff. Case mix differences between hospitals may suggest that referral hospitals require a more costly staff profile both in terms of higher level staff and greater numbers than lower level hospitals, and, as expected, referral hospitals tended to have higher staff ratio per approved bed (Table 4). In general, there was understaffing per approved bed in hospitals, especially for physicians, with wide differences across levels of facilities. Of note is the fact that staffing ratios may reflect the quality in health care delivery, but they are not perfect proxy for quality of services. Training and skill levels, staff attitude and behaviour, supporting technology, productivity, teamwork, adherence to best practices and clinical protocols, and the organization of services are all essential complementary co-determinants of quality.

Staffing ratios tended to increase with the level of facilities. For example, the average ratio of doctor per bed was 0.09 at the national level, ranging from 0.05 in district hospitals, to 0.07 in zonal hospitals, 0.13 in regional hospitals, and 0.10 in federal hospitals, with PNFP hospitals having 0.08 physician per bed (Table 5). Increasing staffing ratios per bed in higher level facilities were observed for nurses, while only slight variations were found for other clinical staffing ratio per bed. As a result, the highest and lowest differences in staffing ratios across levels of hospitals were observed for physicians and for other clinical staff, respectively, with nurses showing differences in staffing ratios that were similar to physicians, but with a less pronounced gradient. We must be cautious in interpreting these findings based on reports on staff availability from the facilities, because some staff (i.e., foreign doctors, volunteers, interns) could not be fully captured in the reports. These issues will be addressed in further studies with on-site data verification and validation of findings.

Workload analysis may provide better understanding of the efficiency in service delivery. The measure of staff "productivity" is expressed in terms of number of bed days per staff, being related to both staffing patterns and utilization of hospital capacity. The average "productivity" was 2,150 inpatient days per doctor, meaning that a doctor takes care of an average of 2,150 days of patient stay in a year (see Box 2 for formula). The inpatient days per doctor varied between 2,046 in district hospitals, 2,411 in zonal hospitals, 1,415 in regional hospitals and 2,245 in federal hospitals, with PNFP hospitals showing the highest productivity (3,557 inpatient days per doctor) (Figure 8). Of note is the fact that staffing ratios in PNFP hospitals were similar to the national average, while their productivity was almost double.

The average number of inpatient days per nurse was 369, with the lowest productivity being observed in district hospitals (n=244) and the highest one in PNFP hospitals (n=548) (Figure 9A). Similar patterns were observed in the number of inpatient days for other clinical staff, ranging between 396 in district hospitals and 1,173 in PNFP hospitals (Figure 9B).

The high variability in workload across facilities and by level of hospitals highlights that a number of factors affecting performance are under the managerial control of the hospital board (such as admission and discharge policy, staff management, workload and productivity, and, in general, utilisation of available resources) and may lead to high or low efficiency. RHBs also have a role to play by implementing information-based hospital resources allocation formulas and licensing the appropriate number of beds, therefore addressing management issues and answering key questions: for example, are the operational bed numbers appropriate in all hospitals with low BOR?

Region	Hospital		Staff availability			Staff per approved bed			Inpatient days per staff		
	Type	Name	Physi-cians	Nurses	Clinical staff	Physi-cians	Nurses	Clinical staff	Physi-cians	Nurses	Clinical staff
Tigray	Zonal	Lemlem Karl	8	50	25	0.06	0.36	0.18	3,095	495	990
Tigray	Zonal	Axum	7	66	41	0.04	0.39	0.24	2,868	304	490
Tigray	Zonal	Suhul	5	65	22	0.05	0.59	0.20	2,737	211	622
Tigray	Distr	Wukro	2	34	29	0.03	0.49	0.41	6,837	402	472
Tigray	Distr	Humera	8	59	24	0.07	0.49	0.20	1,290	175	430
Tigray	Distr	Abi Adi	4	31	29	0,04	0,34	0,32	1,989	257	274
Tigray	Distr	Adigrat	7	41	67	0,05	0,28	0,45	1,885	322	197
Tigray	Distr	Alamata	2	53	19	0.02	0.53	0.19	4,758	180	501
Amhara	Region	Dessie	22	110	44	0.11	0.55	0.22	2,002	400	1,001
Amhara	Region	Felege Hiwote	32	92	92	0.12	0.34	0.34	1,396	486	486
Amhara	Zonal	Debre Tabor	5	60	33	0.05	0.65	0.35	1,977	165	300
Amhara	Zonal	Debre Berhan	17	83	52	0.13	0.65	0.41	2,290	469	749
Amhara	Zonal	Woldia	3	38	11	0.03	0.32	0.09	3,343	264	912
Amhara	Zonal	Debre Markos	13	59	61	0.10	0.46	0.48	2,467	544	526
Amhara	Distr	Tefera Hailu	2	19	11	0.02	0.17	0.10	4,067	428	739
Amhara	Distr	Finot Selam	4	35	17	0.04	0.33	0.16	1,995	228	469
Oromia	Region	Nekemte	10	71	31	0.06	0.40	0.17	4,264	601	1,376
Oromia	Region	Shashemene	20	82	39	0.12	0.51	0.24	1,712	417	878
Oromia	Region	Adama	27	102	30	0.11	0.41	0.12	1,288	341	1,159
Oromia	Zonal	Ginnir	7	46	15	0.06	0.37	0.12	2,682	408	1,251
Oromia	Zonal	Ambo	11	47	36	0.10	0.45	0.34	1,964	460	600
Oromia	Zonal	Bishoftu	9	62	15	0.09	0.61	0.15	2,113	307	1,268
Oromia	Zonal	Bisidimo	6	55	27	0.04	0.38	0.19	6,720	733	1,493
Oromia	Zonal	Dembi Dollo	7	56	14	0.08	0.66	0.16	2,359	295	1,180
Oromia	Zonal	Fiche	8	43	16	0.08	0.43	0.16	1,089	203	544
Oromia	Zonal	Chiro	11	64	29	0.06	0.37	0.17	1,228	211	466
Oromia	Distr	Abhoomsa	4	36	11	0.07	0.65	0.20	1,260	140	458
Oromia	Distr	Horo God. W.	3	33	16	0.06	0.66	0.32	1,058	96	198
Oromia	Distr	Deder	5	36	12	0.06	0.45	0.15	2,162	300	901
Oromia	Distr	Shambo	3	33	16	0.06	0.66	0.32	1,058	96	198
Oromia	PNFP	Wolisso	10	114	27	0.06	0.73	0.17	4,661	409	1,726
Oromia	PNFP	Gambo	4	20	35	0.03	0.15	0.26	13,204	2,641	1,509
Oromia	PNFP	Aira	3	34	18	0.04	0.43	0.23	6,414	566	1,069
SNNPR	Zonal	Arbaminch	12	123	35	0.05	0.49	0.14	3,964	387	1,359
SNNPR	Zonal	Butaiita	13	53	20	0.12	0.50	0.19	529	130	344
SNNPR	Distr	Dilla	12	60	38	0.08	0.38	0.24	1,800	360	568
SNNPR	PNFP	Soddo	10	65	20	0.08	0.54	0.17	2,267	349	1,134
SNNPR	PNFP	Dubbo St M.	5	44	12	0.07	0.61	0.17	4,724	537	1,968
SNNPR	PNFP	Attat	5	28	43	0.08	0.43	0.66	4,576	817	532
Addis Ababa	Region	D. Minilik II	36	165	75	0.13	0.61	0.28	954	208	458
Addis Ababa	Region	Ras Desta	33	114	35	0.36	1.24	0.38	607	176	572
Addis Ababa	Feder	St Peter	21	75	57	0.11	0.38	0.29	998	279	368
Addis Ababa	Feder	ALERT	29	115	53	0.11	0.44	0.20	1,291	325	706
Addis Ababa	Feder	Amanuel	20	115	62	0.08	0.45	0.24	3,814	663	1,230
Addis Ababa	Feder	Black Lion	31	429	166	0.06	0.77	0.30	5,644	408	1,054
Addis Ababa	Feder	St Paul	60	194	78	0.21	0.69	0.28	865	267	665
Addis Ababa	PNFP	Korean	24	91	30	0.18	0.69	0.23	1,214	320	971
Average			13	74	36	**0.09**	**0.50**	**0.24**	**2,150**	**369**	**764**

Table 4. *Staff availability and productivity in selected facilities (EFY 2001).*

Type of Hospitals	Staff availability			Staff productivity		
	Physician per bed	Nurse per bed	Other clinical staff per bed	Inpatient-days per physician	Inpatient-days per nurse	Inpatient-days per other clinical staff
District H.	0.05	0.41	0.25	2,046	244	396
Zonal H.	0.07	0.47	0.22	2,411	353	757
Regional H.	0.13	0.52	0.24	1,415	346	736
Federal H.	0.10	0.60	0.27	2,245	390	869
Private-Not-For-Profit H.	0.08	0.52	0.24	3,557	548	1,173
Average	**0.09**	**0.50**	**0.24**	**2,150**	**369**	**764**

Table 5. *Staff availability and productivity by type of facilities (EFY 2001).*

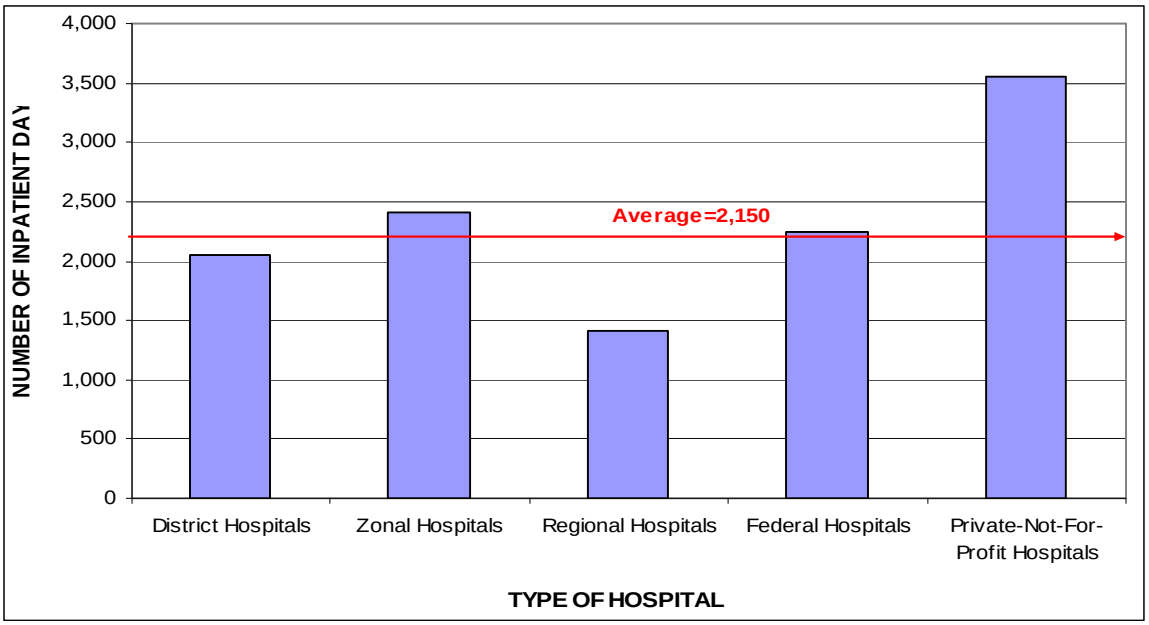

Figure 8. *Distribution of the number of inpatient days per doctor by type of facilities (EFY 2001).*

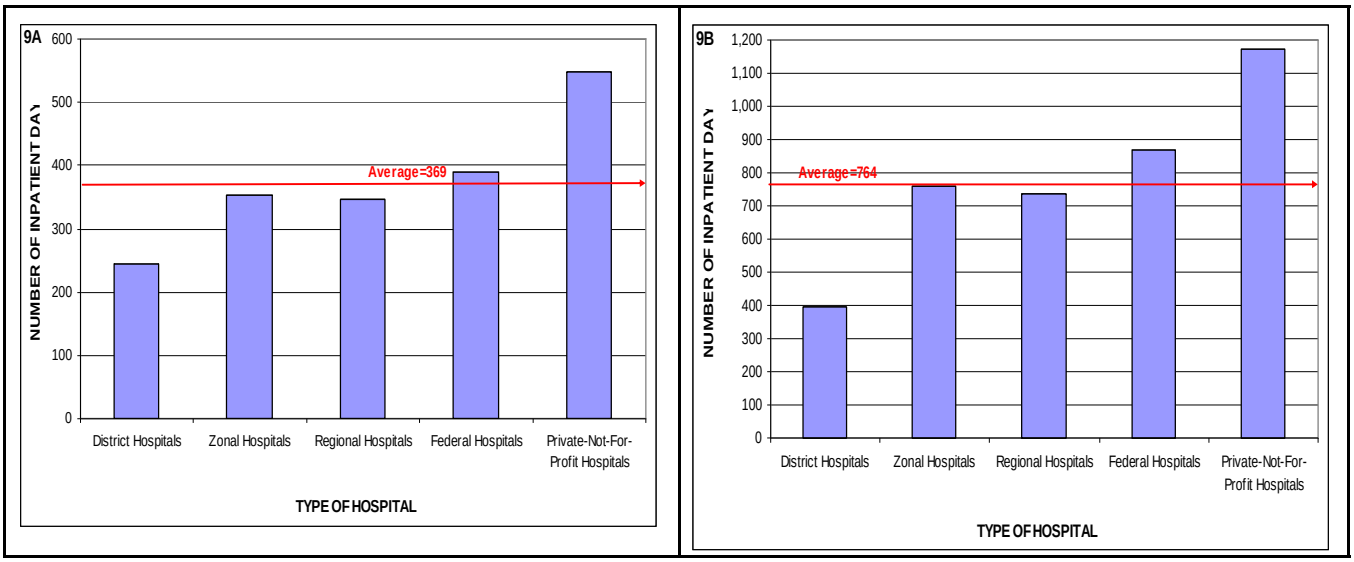

Figure 9. *Distribution of the number of inpatient days per nurse (9A) and per clinical staff (9B) by type of facilities (EFY 2001).*

The highest and lowest productivity was found in the PNFP and in the district hospitals, respectively. In general, higher productivity was found in PNFP hospitals which had staff similar to the average (Table 5), but higher service utilization (Table 2), resulting in a more efficient use of their capacity. Low utilization of inpatient services in district hospitals accounted for the relatively lower workload observed in these facilities. It is well known that economic and human costs of poor human resources management and low productivity are particularly high in the labour-intensive health system, with negative effects on service use, quality of care and patient demand.

The regional distribution of availability and workload for doctors shows that staffing ratio below the average and workload above the average were found in Tigray, Oromia, and SNNPR, while the highest staffing ratio, with lowest workload, was found in Addis Ababa (Table 6).

3.3) Assessing hospital performance: Average Cost per Patient-Day Equivalent (PDE)

Different patterns in hospital utilization, case-mix and staff availability accounted for the distribution of the Cost per PDE by type of facilities. In fact, since the average cost per PDE is the ratio of costs to service outputs, high cost per PDE may be related to high values in the numerator (corresponding to high costs) and/or low values in the denominator (due to low attendance). The combination of high costs and low service utilization is a common cause of inefficiency in hospital resource use because most of the hospital costs are fixed and they need to be spread over a high number of service outputs to achieve cost-efficiency (FMOH, 2007c). Of note is the fact that only actual costs in the year (from the sum of salaries and operating budget) were taken into consideration in the estimation of cost per PDE, while revenues (not spent in the year) were excluded from the calculation. The average cost per PDE was 196 ETB, with a level above the average being found in PNFP (234 ETB), federal (210 ETB), and regional hospitals (203 ETB), while district hospitals (176 ETB) and zonal hospitals (164 ETB) showed a cost per PDE below the average (Figure 10). These costs per PDE seem consistent with findings of other studies. For example, an assessment of unit cost of health services (excluding capital cost) carried out in 2007 estimated the cost per in-patient day in zonal hospitals within a range between 126.7 and 214.0 ETB, while the cost of 3 OPD visits ranged between 87.9 ETB and 232.5 ETB (FMOH, 2007c). Of note is the fact that the provision of care at high-level facilities implies more intensive input use (such as specialized staff and sophisticated equipment) and the cost of producing a day-equivalent of institutional care is high. In fact, average cost data include expenditures generated by a heterogeneous mix of in-patient cases, with more complex case mix contributing to higher average costs (FMOH, 2007c). However, wide differences were observed across hospitals of the same type located in the same region; for example, the cost per PDE was 130 ETB in Amanuel Hospital and 343 ETB in St. Peter Hospital (both referral facilities in Addis Ababa), and it was 84 ETB in Gambo Hospital and 218 ETB in Wolisso Hospital (both PNFP facilities in Oromia Region) (Table 1).

	Staff availability			Staff productivity		
Region	**Physician per bed**	**Nurse per bed**	**Other clinical staff per bed**	**Inpatient-days per physician**	**Inpatient-days per nurse**	**Inpatient-days per other clinical staff**
Tigray	0.05	0.42	0.27	2,632	284	442
Amhara	0.08	0.43	0.28	1,997	395	610
Oromia	0.07	0.46	0.19	2,642	419	1,010
SNNPR	0.07	0.48	0.22	2,548	389	864
Addis Ababa	0.19	0.75	0.28	898	226	596
Federal hospitals	0.10	0.60	0.27	2,245	390	869
National	**0.09**	**0.50**	**0.24**	**2,150**	**369**	**764**

Table 6. *Staff availability and productivity in 5 regions and in federal hospitals (EFY 2001).*

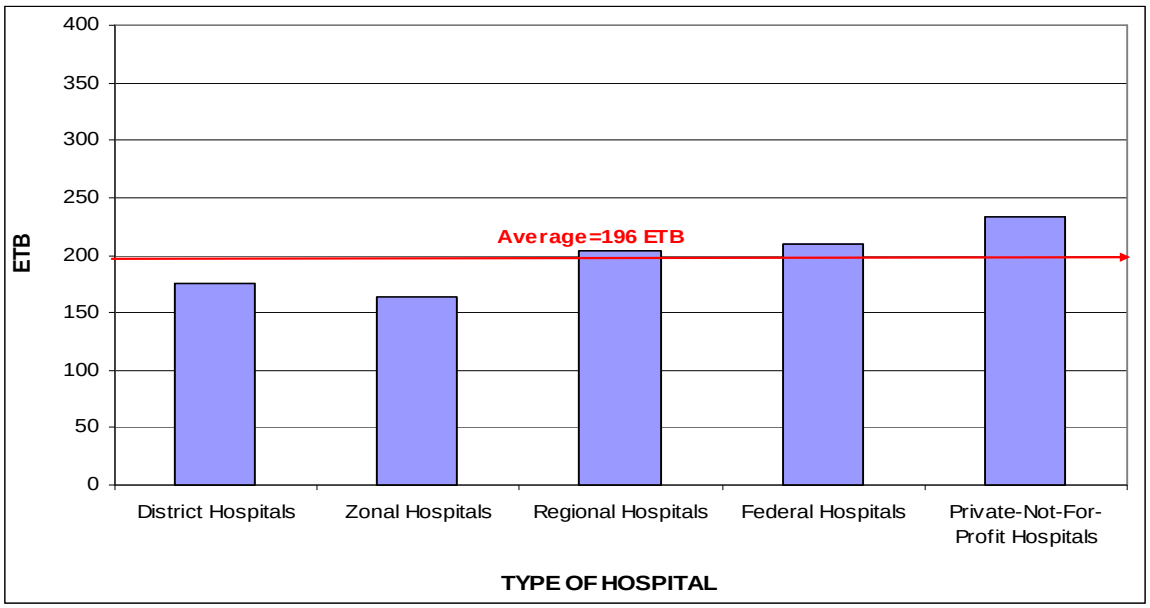

Figure 10. *Distribution of the cost per patient-day equivalent (in ETB) by type of facilities (EFY 2001).*

Provision of chronic care for psychiatric patients (for Amanuel Hospital) and less complex case-mix (for Gambo Hospital) may contribute to the relatively low cost per PDE, while the high number of costly surgical and orthopaedic admissions may account for the relatively high cost per PDE in the busy Wolisso Hospital. Conversely, low service utilization may account for the high cost per PDE in St. Peter Hospital.

From the above discussion, it is clear that high cost per PDE may reflect poor efficiency or more complex case mix, and improved efficiency may be obtained through reduced costs, higher service utilization and better productivity (i.e., by setting and enforcing standards). Cost analysis is therefore useful for assessing hospital performance and identifying hospitals whose average costs are far from the average, therefore guiding the implementation of the corrective actions, with differentials in cost per PDE across facilities giving an approximation of the potential savings (or increased availability of services) to be derived from improving performance. In this regard, estimation of the cost per PDE should be combined with analysis of the case-mix to give a clearer picture of efficiency.

3.4) Assessing hospital performance: case-mix and quality of care

Case-mix is crucial for interpreting hospital performance measures and average cost differences. In particular, the comparison of the cost of producing a PDE in different facilities may be difficult to interpret because the outputs may be qualitatively different and we have to take into account not only the relative efficiency of input use, but also the inpatient case mix and the quality of care, with more complex case mix contributing to higher average costs. If information on the case mix and quality of services is added to cost data, it becomes easier to understand the efficiency implications of the average costs (Accorsi et al., 2008). However, case-mix data are available in few hospitals only, and, even when such information is available, it is often affected by reliability problems. Thus, we limited the analysis to proxy indicators, such as the percentage of caesarean sections out of the total deliveries (as proxy of the complexity of case mix for maternity care) and the percentage of major surgeries out of the total surgeries (as proxy of the complexity of case mix for surgical care).

The average percentage of caesarean sections was 21%, increasing at higher levels of the referral system from 13% in district hospitals to 18% in zonal hospitals, 23% in regional hospitals and 47% in federal hospitals, while it was 18% in PNFP hospitals (Figure 11A). The average percentage of major surgeries was 43%, increasing from 18% in district hospitals to 36%, 46%, and 57% in zonal, regional and federal referral hospitals, respectively, with PNFP hospitals showing a percentage of major surgeries (50%) slightly above the national average (Figure 11B). These patterns are consistent with the technical capac-

ity and standard of the different types of hospitals, with increasing complexity of obstetrical and surgical procedures in referral facilities.

The analysis of in-hospital mortality patterns is an important tool for assessing the quality of care (Donabedian, 2003). In general, low in-hospital mortality rate may be related, among others, to the admission profile (with low proportion of complicated cases) or better case management, whereas high in-hospital mortality may reflect poor quality of care, lack of appropriate skilled staff and supplies or more complex case-mix and higher readmission rates (for which no data are available at present). The average in-hospital mortality rate was 4.5% in the selected facilities, ranging between 3.4% in zonal hospitals and 8.2% in federal hospitals (Figures 12). The different distribution of types of hospitals across regions accounted for the regional variations of in-

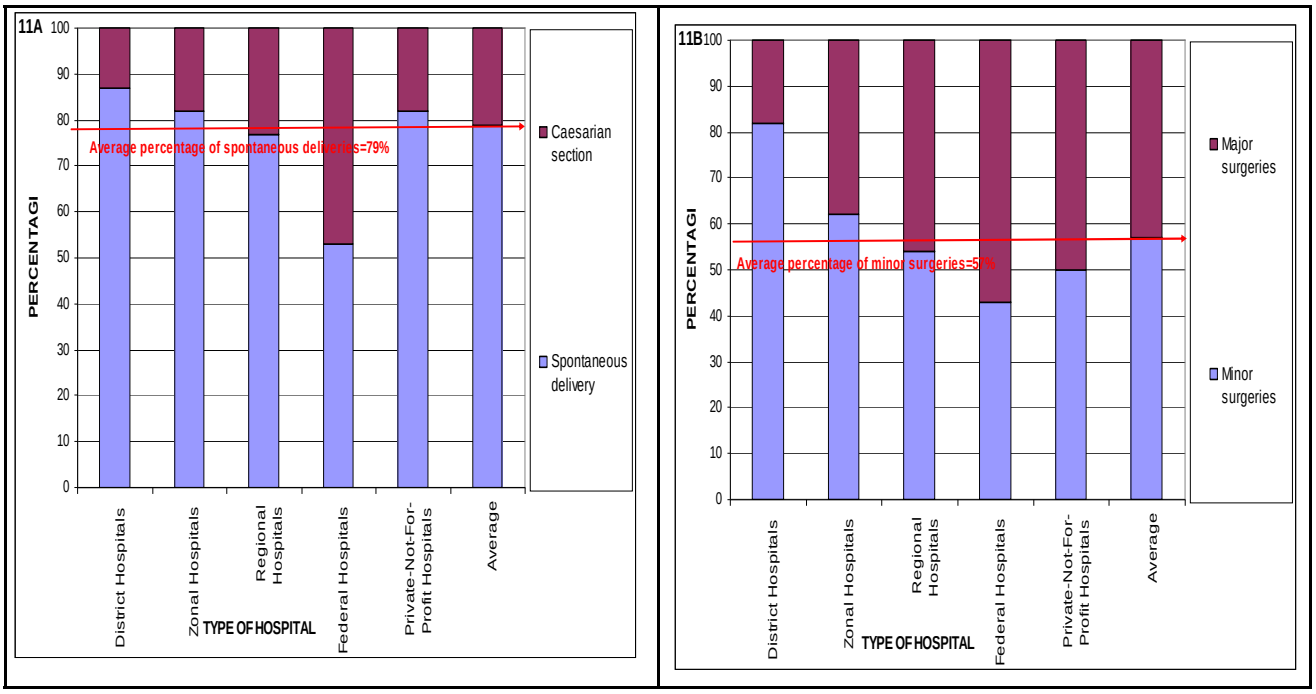

Figure 11. *Percentage of spontaneous deliveries and caesarian sections (11A) and percentage of minor and major surgeries (11B) by type of facilities (EFY 2001).*

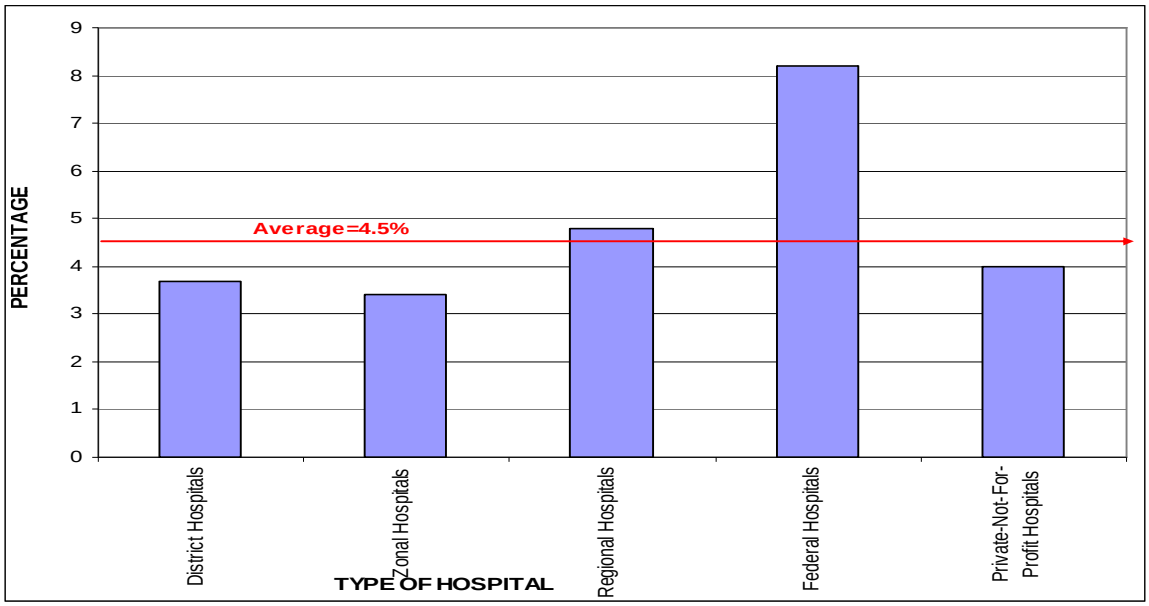

Figure 12. *Distribution of in-hospital mortality rate by type of facilities (EFY 2001).*

hospital mortality, ranging from 3.1% in SNNPR to 7.2% in Addis Ababa and 8.2% in federal hospitals; the latter rates reflect the more complex case-mix in referral facilities.

Because of the purposive sampling method used (with high representation of referral facilities), we cannot generalize these findings to the overall hospital system in Ethiopia. However, it may be interesting to describe the patterns in other countries and compare them to those found in Ethiopia. Concerning caesarean section rates, the percentage of caesarean sections over total deliveries in developing countries is estimated at around 12% with a high variation between 3% in sub-Saharan Africa and 26% in East Asia and Latin America (Stanton and Holtz, 2006). The variation across categories of hospitals is also high as suggested by the fact that caesarean sections in urban areas are three times higher than in rural areas (Thomas, 2006). According to the World Health Organization, national caesarean section rates should range between 5 and 15%.

Concerning in-hospital mortality rate, the level in Ethiopia is consistent with the average mortality rates observed in other developing and developed countries: for example, it was 4.2% in US in 2008 (PHC4, 2009).

4) Conclusion and recommendations

Although hospital reform has been implemented in Ethiopia over the past few years with large international, national, and regional efforts, there has been little documentation of the results in terms of improvement of hospital performance, with subsequent limited discussion on the lessons learnt. For example, Annual HSDP Performance Reports have included a very limited section on hospital performance over the years due to unavailability and/or unreliability of hospital data (FMOH, 2009). This article has tried to fill the gap by providing an update picture of the efficiency and productivity in the hospital services delivery.

The comparison of the hospital performance shows high variability across individual facilities, and this may have resulted not only from differences in staffing pattern and case mix but also from the relative efficiency of input use, highlighting the fact that a number of factors subject to management intervention (such as admission and discharge policy, staff management, workload and productivity, and, in general, utilisation of available resources according to standards) may contribute to low efficiency or drive high efficiency.

The combination of low service utilization and high expenditures is a common cause of inefficiency because overhead costs and other fixed inputs are spread over a smaller number of service outputs. Improved efficiency may be obtained through reduced costs, higher service utilization and better productivity.

The analysis of performance by facility type highlights the low utilization of inpatient services in district hospitals with increasing service utilization in higher level facilities. Inadequate availability of resources, weak managerial capacity, poor quality of care, and insufficient qualified staff leading to increased referral of cases, may have contributed to demand displacement, with district hospitals often operating as primary care units, with low utilization of the hospital capacity and inefficient use of resources. The recent investments in construction and expansion of facilities have not yet resulted in a coherent system of primary, secondary, and referral services.

Therefore, it is crucial, in the framework of the current hospital reform, to ensure the full utilization of the hospital capacity, to strengthen the referral system, to redistribute the case load within the hospital system and to reallocate resources in favour to the most efficient/least cost provider in order to meet the health needs of the population. The cost differences between higher and lower level hospitals, the inverse relationship between hospital type and occupancy rates, and the scope for further increasing the efficiency (with higher occupancy and turnover and shorter hospital stay) at lower level hospitals indicates that there are economic gains from improving the match between patient care needs and the type of facilities. At each level of the hospital system, the mix of patients and available services should be appropriate in order to provide quality services to the greatest number of patients at least cost. This increases the cost-efficiency of services by reducing the average cost per PDE.

PNFP hospitals had higher occupancy, better staff productivity, and slightly higher costs per PDE, highlighting the attempt to ensure maximal utilization of

hospital capacity. Further studies are needed to estimate the costs to patient in PNFP hospitals and assess if cost-recovery may affect financial accessibility to services. However, it is worth noting that high level of performance was found in both public and private sectors. Perhaps more than public or private status, what matters is the context, the incentives, and the management framework which governs a facility, regardless of ownership status. The emphasis therefore may be to set the right incentives for staff and institutions as well as standards for both public and private sectors. Anecdotal information highlights the value of having twinning arrangements with both local and foreign hospitals providing best practice systems, training and support. In this context, it is worth noting that many PNFP hospitals, and only a few public hospitals, have twinning arrangements with foreign hospitals.

Efficiency and sustainability in hospital care delivery and cost-recovery mechanisms play an increasingly important role in both demand and supply-side of health care delivery. Achieving a balance between demand and service provision at each hospital level depends on several factors, including underlying morbidity pattern, health care seeking behaviour of the population, availability of the services and their perceived quality, as well as their costs to patients. From the demand side, the health care seeking behaviour reflects the balance between costs and benefits the patients expect to incur. From the supply side, cost-recovery mechanisms are becoming increasingly important in financing health services. The knowledge of the cost per unit of services and staff productivity is crucial to ensure the balance between equity and sustainability in health care delivery, and it is even more important in the perspective of the implementation of performance-based contracting and prepayment schemes. The costing of services in public hospitals performed in Tigray Region is a good model to follow, as the specific elements of treatments were separated, costed and compared to costs in the private sector.

This paper shows that it is possible to monitor hospital performance through indicators derived from data routinely available and analyzed according to the framework linking input, output and outcome data. It is important to be highly selective with regard to the amount of data collected and reported, and only data useful for decision-making should be collected. For management purposes, it is preferable to have regular and reliable information on a few key indicators for decision making, rather than waiting for a long time to try to collect data for a longer list of more complex indicators. This is consistent with the fundamental principle of the design of the new simplified, standardized and integrated HMIS focusing on use of information for performance improvement.

A service-oriented, action led information system may be developed by increasing the demand for high-quality data, by applying the results of analysis to the public health practice, and by providing feedback to those involved in data collection. Finally, problems identified by the routine system can be investigated selectively, at a second stage, by more intensive data gathering and analysis, through surveys and health research studies.

In conclusion, despite the limitations of the hospital information system, data available from routine sources are useful for performance monitoring and for identifying problematic areas in health care delivery at the facility level. This requires commitment of senior management staff and availability of trained technical staff with analytic skills. The analysis of specific efficiency issues can quickly move beyond the realm of statistics and into management, organization and human resources planning. Problems with low turnover and occupancy rates, inappropriate length of stay, and inefficient use of personnel and technical inputs may be solvable by changing administrative rules or clinical management at the local level.

However, where inefficiency is widespread, policy decisions on strategic issues (such as referral system and budget allocation) and corrective actions must be developed at the federal and regional levels, as it is devised in the current hospital reform and implementation of Business Process Re-engineering (BPR) of the hospital system. This includes restructuring patient flow, and implementing case teams for outpatient, inpatient, emergency, and community outreach services, governing boards, and private wings (Bilal et al., 2009). From preliminary results, this restructuring and reporting using Balanced Scorecard is having positive effects in terms of improvement of the hospital system.

Further papers in the next editions of the Health Bulletin “Policy and Practice” will document the efforts towards improved accessibility to hospital services and increased efficiency and quality in hospital care delivery.

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