

Cost Analysis and Efficiency Indicators for Health Care

Report Number 2

Summary Output for Suez General Hospital 1993-94

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Table of Contents

List of Tables	xi
List of Graphs	xiii
Acronyms	xv
Acknowledgments	xvi
Arabic Executive Summary	xviii
Executive Summary	xix
I. Introduction	1
A. Why Hospital Costing and Efficiency Indicators for Suez General Hospital?.....	1
B. Use of Data to Detect Inefficiencies in Resource Allocation and Identify Strategies to Improve Them.....	2
C. Description of Suez General Hospital	2
II. Methods	4
1. Allocation of Costs Between the Three Tiers	4
2. Cost Allocative Among Departments	4
C. Cost Categories	4
III. Results	9
Description of Suez General Hospital	9
Results of Costing Study	9
Department Specific Results	17
A. Ear, Nose and Throat Department.....	17
B. General Medicine Department.....	18
C. General Surgery Department	19
D. Gynecology and Obstetrics Department	21
E. Intensive Care Unit.....	23
F. Incubator Department	24
G. Ophthalmology Department.....	25
H. Orthopedics Department	27
I. Pediatrics Department.....	28
J. Urology Department.....	30
IV. Conclusion	32
V. Recommendations to Help Improve the Performance and Cut Cost in Suez General Hospital	33
1. Hospital Autonomy	33
2. Quality of Care	34
3. Hospital Staff	34
4. Drugs and Medical Supplies.....	34
5. Treatment Protocols	36
6. Maintenance	36
7. Average Length of Stay.....	36
8. Information Systems	36
9. Use of Results for Pricing and Contracts	37
10. Ambulatory Surgery	37

11. Nosocomial Infection	37
Bibliography	38
Annex I: Text Table.....	36
Annex II: Text Figures	73
Annex III: Definitions and Data Notes.....	105
Annex IV: Data Sources	108
Annex V: Data Collection Forms.....	110

List of Tables

Table 1	Functional departments at Suez General Hospital
Table 2	Equipment and furniture
Table 3	Total building space by functional departments
Table 4	Personnel Allocated for cost centers
Table 5	Physician allocation for each department
Table 6	Allocation criteria for distributing of hospital personnel
Table 7	Allocation of overhead department personnel to medical services
Table 8	Allocation of intermediate department personnel to medical services
Table 9	Personnel allocation to final service departments
Table 10	Utilities, maintenance, meals, stationery and travel per diem
Table 11	Drugs and medical supplies
Table 12	Average length of stay ranked alphabetically
Table 13	ALOS ranked by number of cases
Table 14	ALOS ranked by days of stay
Table 15	ALOS ranked by average days of stay
Table 16	Cost by category and functional departments
Table 17	Allocation criteria for distributing of overhead and intermediate cost
Table 18	Allocation of overhead departments cost to medical services (drugs and medical supplies cost are included)
Table 19	Allocation of intermediate departments cost to medical services (drugs and medical supplies cost are included)
Table 20	Allocation of overhead departments cost to medical services (drugs and medical supplies cost are not included)
Table 21	Allocation of intermediate departments cost to medical services (drugs and medical supplies cost are not included)
Table 22	Distribution of cost by cost category for inpatient departments
Table 23	Percentage of distribution of cost by cost category for inpatient departments
Table 24	Distribution of cost per admission by cost categories
Table 25	Distribution of cost by cost categories for outpatient clinics

Table 26	Percentage of distribution of cost by cost categories for outpatient clinics
Table 27	Distribution of cost per outpatient visit by cost categories
Table 28	Average cost per outpatient visit
Table 29	Efficiency indicators

List of Graphs

Graph 1	Allocation of full-time equivalent physician to final departments
Graph 2	Distribution of hospital staff for inpatient departments
Graph 3	Distribution of hospital staff of outpatient clinics
Graph 4	Average length of stay for the highest causes for admissions
Graph 5	Average distribution of annual hospital cost
Graph 6	Distribution of annual hospital cost to functional departments
Graph 7	Distribution of hospital staff
Graph 8	Distribution of personnel cost for each staff category
Graph 9	Average distribution of utilities cost
Graph 10	Distribution of annual cost to direct services departments
Graph 11	Distribution of cost by category for inpatient departments
Graph 12	Average distribution of cost per admission for general medicine department
Graph 13	Average distribution of cost per admission for general surgery department
Graph 14	Annual number of hospital admissions
Graph 15	Cost per admission
Graph 16	Distribution of cost per admission by cost category
Graph 17	Distribution of annual cost by category in outpatient clinics
Graph 18	Annual cost by category in renal dialysis unit
Graph 19	Distribution of cost per outpatient visit by cost category
Graph 20	Cost per outpatient visit
Graph 21	Occupancy rate versus cost per day
Graph 22	Annual cost per bed
Graph 23	Annual bed-days versus cost per day
Graph 24	Annual admissions per FTE physician versus cost per admission
Graph 26	Annual number of admission per FTE physician
Graph 27	Annual outpatient visits
Graph 28	Annual outpatient visit per doctor

- Graph 29 Drugs cost versus annual number of visits
- Graph 30 Drugs cost versus annual bed days
- Graph 31 Average length of stay versus cost per admission

Acronyms

ALOS	Average Length of Stay
CEA	Cost-Effectiveness Analysis
DALY	Disability Adjusted Life Year
DOP	Department of Planning
DDM	Data for Decision Making
ENT	Ear, Nose, and Throat
FTE	Full Time Equivalent
L.E.	Egyptian Pound
Gyn/Obs	Gynecology and Obstetrics
ICU	Intensive Care Unit
CCO	Occupancy Rate
MOHP	Ministry of Health and Population
PWAF	Present Worth of Annuity Factor
PV	Present Value
QALY	Quality Adjusted Life Years
RP	Reference Period
GGH	Gamhuria General Hospital
TC	Total Cost
na	Not available/not applicable

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Arabic Executive Summary

Executive Summary

The governorates of Alexandria, Suez, and Bani Suef, Aswan, Dakahlia, Port Said, North Sinai, and South Sinai undertook detailed costing studies for eighty health facilities to analyze costs and efficiency in Ministry of Health and Population hospitals. This study presents the results of the costing analysis for the Suez General Hospital in the Suez Governorate. The data collection and analysis were conducted by a team from the Suez Health Directorate in collaboration with the Data for Decision Making Project (DDM). The DDM project is a collaborative effort between the Department Of Planning (DOP), Ministry Of Health and Population (MOHP), United States Agency for International Development (USAID), the Harvard School of Public Health, and the University of California, Berkeley, School of Public Health.

The operating costs of the Suez General Hospital from July 1993 to June 1994 were allocated to the individual cost centers. These cost centers are classified as overhead, intermediate services and final services departments. The overhead departments such as, personnel, finance and maintenance, provide support to intermediate and final service departments. The intermediate departments, such as laboratory and operating theaters, provide procedures and services to patients in final service departments in the inpatient wards and outpatient clinics.

Fifty two functional departments were identified as cost centers at the hospital. Overhead, intermediate service, and final service departments account for 9, 20, and 71 percent, respectively, of total hospital-wide costs.

Five major categories of costs were selected to estimate the total costs: building and permanent structures, equipment and furniture, personnel, drugs and medical supplies, utilities, and food and clothing.

The study uses the step-down technique for allocating overhead and intermediate departments costs to final service departments. The step-down technique was also used to allocate overhead and intermediate department staff to final service departments, and to estimate the full-time equivalents for each department and clinic.

In general, the highest expenditure in hospitals is on personnel. These costs include take-home pay and all related benefits. Annual personnel costs account for 33 percent of the total expenditures at the Suez General Hospital. Costs for personnel at intermediate service and final service departments constitute 86 percent of personnel costs, while salaries for personnel at overhead departments represent 14 percent of the total cost of personnel. Physicians' and nurses' salaries account for 67 percent, while other staff categories constitute 33 percent of the total costs of personnel.

Twenty-five percent of the total annual costs for 1993-94 was spent on drugs and medical supplies. The total annual cost of drugs and medical supplies is estimated at 1,088,867 L.E., which includes not only the drugs actually used but also donated and wasted drugs. This estimate does not include prescription drugs purchased by patients out-of-pocket. The average cost of drugs per inpatient day is 4.07 L.E. This low expenditure suggests either the magnitude of the dependency of the system on patient drug purchases outside the hospital or it suggests low quality of care. A large portion of the drugs and medical supplies (37 percent of the annual total) is consumed by the Renal Dialysis Unit. The cost of drugs and medical supplies varies significantly across final service departments. For example, they constitute 52 percent of expenditures on renal dialysis, while they account for only 1.4 percent of the inpatient treatment for incubator patients.

The study assessed the actual cost of renal dialysis as an example of one of the interventions financially supported by the MOHP in spite of its high cost. The average cost per visit is 136 L.E., which totals 14,000 L.E. per patient annually taking into account that the renal failure patient

needs 2 weekly visits (104 visits yearly on average, 4-6 hours for each visit). Cost of drugs and medical supplies constitute 52 percent of the total cost, see table 31 for

distribution of cost per outpatient visit. This figure is higher than that of other MOHP general hospitals due to drug donations from several oil companies in the Suez governorate.

The average cost per admission is 142 L.E. Costs range from 232 L.E. for pediatrics department to 719 L.E. for the Orthopedics department. The cost per admission is highest in departments with low occupancy rates and long average lengths of stay (see Table 33). Some departments are very well staffed with an average of 1 physician for every two beds; however, the average occupancy rate is 46 percent resulting in high admission costs (see Graph 29 for annual admissions per full time physician output versus cost per admission).

The average cost per day, 48 L.E., varies depending on the occupancy rate. This daily cost ranges from 97 L.E. (incubator department) to 182 L.E. (ICU) due to lower occupancy rates and higher input costs in these departments.

The average annual cost per bed is 8,087 L.E.. This ranges from 4,983 L.E. in the general surgery department to 17,545 L.E. in the ICU. The Ophthalmology department has the lowest costs at 1,454 L.E per bed (see Graph 22 for the total annual cost per bed).

The total maintenance cost in this hospital is about 78,312 L.E., which represents 2.57 percent of the annual recurrent costs. This seemingly low figure is actually higher than the maintenance costs of other MOHP general hospitals. The international average percentage of maintenance costs ranges between 10 to 15 percent of the annual recurrent cost to maintain effective hospital operation (Mills 1991).

Outpatient visits in this hospital cost an average of 5.31 L.E. Drugs account for 24 percent (1.2 L.E.) of the total amount while the personnel costs consume more than 41 percent. The cost of outpatient visits depends on the number of visits to each clinic. In the psychotherapy clinic it is 10 L.E. and 14 L.E. for the psychiatric clinic, which respectively treat 44 and 6 patients daily (see Table 31 for the distribution of costs per outpatient visit). The cost per visit for the Emergency unit is 5.18 L.E. Drugs and medical supplies make up 39 percent (which is more than the cost of drugs and medical supplies for outpatient clinics). Outpatient care at SGH absorbs 40 percent (1,707,582 L.E.) of total hospital recurrent expenditures.

The average occupancy rate in 1993-94 was 46 percent. This rate ranges from 12 percent in the Ophthalmology department to 90 percent in the ENT department. The departments of Pediatrics and ENT have the highest turnover rates (42 and 36 patients per bed, per year, respectively). Turnover rates decrease in the Orthopedics department with 14 patients per bed per year and is at its lowest in the Ophthalmology department at 3 patients per bed per year. The turnover rate in the Suez General Hospital is 18 patients per bed per year.

This study assessed the average length of stay for 125 diagnoses to help determine the diseases with the longest length of stay. Gastroenteritis account for the highest number of admissions (5.8 percent of total hospital annual admissions, ALOS 4 days), and lower segment cesarean sections represent the second highest number of admissions (5.4 percent of total hospital annual admissions, ALOS 7.7 days). Appendectomies represent the fifth highest cause of admission with ALOS 5.3. In general, average lengths of stay appear appropriate for the most common diagnoses. Patients in the Ophthalmology department stay an average of 18 days, while they stay only 4 days in the ICU and Incubator departments. These figures are based on an analysis of the admission and discharge sheets of the hospital, which were reviewed to ensure the accuracy of results. (See tables 12,13,14 and 15. for a list of average lengths of stay at the Suez General Hospital).

The average number of inpatient days per full-time equivalent (FTE) physician was 785 patient days. Based on the fact that each physician works 270 days a year, each physician attends to 3 patients during his/her 6 hour days. This number decreases to 241 patient days for a physician in the ICU, meaning he/she is responsible for fewer than one patient per working day. (See Graph 25 for number of physicians by output).

Recommendations: Improving the efficiency of this hospital will require an increase in occupancy rate. This can be achieved through a number of changes in management.

Recommended changes include:

1. Increase hospital autonomy and decision making by the hospital director in budget allocations, staffing, drugs purchases, etc. A performance-based incentive system is one feasible and practical method for rewarding good management practices and performance.
2. Staffing ratios per bed or bed day are not an infallible proxy for quality of service. Training and skill level, supporting technology, team work, and organization of services are all essential complementary co-determinants of quality. In addition, differences in the case mix inside and between departments has an important role. For example, ICU patients need more staff than orthopedics patients.
3. Increases in the budget for drugs and medical supplies. This will increase the total annual cost of the hospital, but, on the other hand, the availability of drugs will likely increase the quality of care and the utilization rate (number of admissions) and this, in turn, will decrease the total per admission cost.
4. Treatment protocols for the same cause of admission vary among physicians of the same department. The average length of stay can be reduced by more than 50 percent by changing the standard practice for specific cases of admissions.
5. Increases in the budget for maintenance. Maintenance has important implications for the overall technical efficiency of the hospital. Unfortunately, maintenance costs are directed mainly towards repairing hospital equipment and not towards regular and preventive maintenance, for which there are no plans.
6. Increasing occupancy rates by reducing the average lengths of stay would increase the turnover rate that would enable a greater number of people to benefit from hospital services. The study investigated the main causes of long average lengths of stay for different diagnoses.

The following factors contribute to extended lengths of stay:

Patients admitted for diagnostic tests remain in the hospital until the results are received before undergoing medical or surgical treatments.

Physicians are often late or absent because of conflicts in appointments between their hospital service and private practice. It is critical for the hospital to work out arrangements with the physicians to ensure that such conflicts are minimized.

An absence of standard practices and protocols for the same cause of admission creates variations in treatment among the physicians of the same department.

Hospital infections as a result of poor sterilization (although there is little data available on the magnitude of hospital infections and their effect on ALOS).

7. It is evident that the existing information systems rarely produce the required information.

Research is required into how routine systems can best be altered and augmented. Reliable data will help in identifying resource allocation problems and in planning changes to health sector resource allocation patterns.

8. The results of this study will provide a definitive basis for negotiating a price for the daily reimbursement rate for these private patients based upon the average cost per day of 31 L.E. The study can also be used for negotiating a reimbursement rate from health insurance companies and for health insurance companies to set insurance prices based on estimated annual costs for hospitalization and utilization in the population covered.
9. Increasing the capacity of the For Suez General Hospital, to perform ambulatory surgery and other treatments would potentially assist in increasing hospital occupancy and efficiency while fulfilling the patient demand for improved hospital care. This would require upgraded skills on the part of the surgeons and anesthesiologists, and possibly require some specialized equipment.

However, the current system of hospital admissions and management, which is desegregated between the governorate, the Ministry of Health and Population, and the hospital administration, provides no incentive to improve management, quality, and efficiency. Changing the decision making system so that efficient, high quality care is rewarded will likely have the greatest impact. This change will require increased decision-making autonomy in the hospital regarding staffing patterns, maintenance budgets, and drug purchases, among other considerations. These changes might also lead to the hospital's increased accountability to provide efficient and client-oriented services. The role of the central and governorate level health administration would expand to the development of hospital policy and monitoring and assuring quality services.

I. Introduction

In Egypt, as in other developing countries, the demographic and epidemiological transition is putting increasing pressure on scarce government resources.

Government spending on health care in Egypt, as a percentage of the gross domestic product, has remained fairly constant in the last decade. The budget tracking system of the Department of Planning demonstrates that scarce health resources are allocated towards services, which are costly, and result in limited benefits in terms of increased life expectancy. Only 5 percent is allocated to primary care services which are known to be most cost-effective. Under these circumstances, the challenge facing policy makers is to optimize returns on investments in health care.

Two major avenues for increasing health benefits from scarce resources are 1) increasing the efficiency and improving the management of existing health facilities and health programs and 2) increasing the allocation of resources to those programs that are most cost-effective. In order to increase the use of scarce resources for more cost-effective and efficient services, the Ministry of Health and Population undertook a cost-effectiveness exercise.

Cost-Effectiveness is a method for identifying interventions that achieve the greatest level of health impact per unit of expenditure. Effectiveness is typically measured in terms of improvements in health status. Various measures, including years of life gained through reduced mortality, Disability Adjusted Life Years (DALYs), and Quality Adjusted Life Years (QALYs) are used to assess effectiveness. An important aspect of cost-effectiveness analysis is that it can be used to assess technical and allocative efficiency.

Allocative efficiency measures the optimal distribution of resources among a number of competing uses. Technical efficiency is the extent to which the choice and utilization of input resources produce a specific health output, intervention or service at the lowest cost (WDR 1993). Inefficiency of inputs can lead to high costs per unit of service delivered to patients. Technical inefficiency occurs when output is less than is technically possible with the mix of inputs used by the hospital (Barnum 1993).

To define costs and efficiency in hospitals the governorates of Alexandria, Suez, Bani Suef, Dakahlia, Port Said, North Sinai, South Sinai and Aswan undertook detailed costing studies for eighty health facilities. This study presents results for the costing of Suez General Hospital at Suez Governorate. The data collection and analysis was conducted by a team from Suez Health Directorate in collaboration with the Data for Decision Making Project (DDM). The DDM project is a collaborative effort between the Department of Planning (DOP), Ministry of Health and Population (MOHP), Harvard University School of Public Health, and the University of California Berkeley, School of Public Health.

The study uses step-down analysis to cost hospital-based services in general hospital run by MOHP. Efficiency indicators point to significant technical and economic inefficiencies. Nearly half of the expenditures in the hospital go to paying for salaries of personnel, leaving less than optimal resources for drugs and medical supplies. Major intra-hospital differences exist in cost per admission, total full time equivalent staff per bed, output per physician, bed turnover rate and bed occupancy rate. The analysis shows that with better allocation for resources (human and financial), major efficiency gains can be achieved.

A. Why Hospital Costing and Efficiency Indicators for Suez General Hospital?

The main objectives of the cost and allocative efficiency study of the Suez General Hospital are the following:

- Develop a clear and appropriate methodology for calculating the service cost.
- Increase the technical capability of professionals at the governorate in undertaking costing studies and using the information for decision making.
- Estimate the actual economic costs of services delivered by each medical department of the hospital.
- Increase the efficiency of resource use by not only understanding the cost of services under the current operating system, but also providing some understanding of how resources can be used to provide the optimal level of service.
- Create a basis for a pricing system of medical services delivered by the hospital that can be used to establish fees for services and contracts.

B. Use of Data to Detect Inefficiencies in Resource Allocation and Identify Strategies to Improve Them

The data from the Suez General Hospital can be used to identify areas of inefficiencies by comparing the costs and outputs with other similar facilities both nationally and internationally.

By comparing results of the various facilities, the range of costs for outpatient and inpatient services becomes evident and reasons for the differences can be better analyzed: low utilization, high administrative costs, differences in personnel staffing, differences in equipment and maintenance budgets, etc. Strategies can then be developed to treat the identified problems which may include increasing utilization of under-utilized facilities, changing staffing patterns, closing under-utilized facilities, etc.

C. Description of Suez General Hospital

The Suez Governorate is located 134 km east of Cairo. It is an urban governorate with a total population of 327,717. Suez General Hospital (SGH) is the only general hospital for the Suez governorate. It was built in 1960 and currently houses about 262 beds. New wings expanded the existing structure in 1991. The hospital is operated by the MOHP and its primary objective is to provide general medical and surgical services to the local community.

Suez hospital is a full-service general hospital with the following specialties: ear, nose, and throat (ENT), general medicine, general surgery, gynecology and obstetrics (Gyn/Obs), intensive care unit (ICU), incubator, ophthalmology, orthopedics, pediatrics, and urology. The hospital also houses operating theaters, a laboratory, radiology services, and a renal dialysis unit. Outpatient services are provided in all of these specialties, as well as in dentistry, dermatology, rehydration, treating rabies, psychiatry, diabetes and cardiology.

Being a MOHP hospital, SGH is administered under MOHP regulations and guidelines, as well as those of the Ministry of Manpower. Funds allocated from the Ministry of Finance to MOHP for personnel, including physicians, are controlled by the Ministry of Manpower and assigned by the MOHP to the Suez governorate. The governorate, through the office of Medical Affairs, assigns individuals to local health facilities. This system does not endow hospitals with sufficient control to select the numbers and quality of appointed personnel. This puts hospitals in a difficult position in terms of management autonomy and financial decision making.

The primary mission of the Suez General Hospital, as many other MOHP hospitals, is to provide free medical care. Unfortunately, in recent years, the MOHP's budget has not been adequate to defray the financial needs of such hospitals and other health units across the country. In order to help counterbalance overall costs, some facilities have introduced limited user fees. These fees

collected from inpatients, outpatient visitor's fees are used as bonuses for physicians and other staff, for drug purchase and other expenditures.

The staff consists of 585 employees (including 148 physicians and 178 nurses). This staffing level provides a ratio of employees to occupied beds (assuming Suez hospital's most recent occupancy rate of 45.83 percent) of 2.09 to 1. In relation to total beds, this ratio decreases to 0.96 to 1.

The total annual admissions in 1993-94 was 4,794, with an average length of stay of 9.14 days. Total annual outpatient visits (including emergency and renal dialysis units) was 140,891 visits.

II. Methods

1. Allocation of Costs Between the Three Tiers

Economic costs are used for the purpose of this analysis. The Suez General Hospital is organized into three tiers based upon the nature of service provided. These are identified as overhead departments, intermediate service, and final service departments. Intermediate service departments provide support and services to patients in final service departments. Table 1 identifies the functional departments of the hospital in the overhead, intermediate and final services categories.

The costs of the overhead departments are distributed to the intermediate and final service departments through a step-down method, according to allocation criteria devised to reflect as closely as possible the actual use of resources by each of the departments. The overhead department serving the most departments (in this case, the director's office) are distributed first; the overhead department serving the second-largest number of departments is distributed next (finance department); this continues until all overhead departments are distributed to the intermediate service and final service departments.

2. Cost Allocative Among Departments

Total costs consist of recurrent costs and the discounted present value of capital costs. These are allocated to the overhead, intermediate service, and final service departments according to the proportion of support required by each department. Data collected for cost estimation were grouped under five broad categories: major and minor equipment, building and permanent structures, labor (personnel costs), utilities, drugs and medical supplies.

1. Capital Costs are the annual costs of resources that have a life expectancy of more than one year. They include depreciated annual costs for buildings, equipment and furniture. The study uses replacement costs for capital items. The replacement value is the cost of the item if it were to be replaced at the current market price. The study was conducted between 1 July 1993 to 30 June 1994.

The costs of buildings and equipment are depreciated according to the unified accounting method currently practiced in Egypt, with 25 years useful life for the building.

2. Recurrent Costs are costs associated with inputs that will be consumed or replaced in one year or less, such as personnel salaries, training (refresher courses), drugs, food and utilities.

C. Cost Categories

Capital Costs

1. Annual Depreciation Cost For Equipment and Furniture

The study used the replacement cost of equipment and furniture during the period of data collection from July 1, 1993 to June 30, 1994. (See appendix V for the data collection sheet for equipment). Six categories of equipment and furniture, each with a secondary categorization of 2, 3, 5, 10, 15 or 20 working life years, were assessed. This categorizing system was designed with the assistance of MOHP experts in the field of medical supplies who are familiar with the

actual productive lifetime for equipment and furniture in Egypt according to the level of maintenance and used frequency of the equipment.

The number of units of equipment and furniture and their locations were obtained through a physical inventory and technical description in log books no. 118, 112, 121. Table 2 shows the total cost of equipment and the annual depreciation cost.

2. Annual Building Depreciation Costs

The study used the replacement cost for the building during the reference time. The replacement cost was 575 L.E. per sq. meter (including the cost of elevators and oxygen lines). These figures were obtained from the DOP at the MOHP, which is responsible for budget allocation in different governorates to establish and renovate health facilities. The building costs that are depreciated assume an effective life of 25 years. The price of the land has not been included in this estimation.

For allocation of corridors to cost centers (departments), we first allocated the special corridors, or the spaces located between departments. (See the diagram at the bottom of Table 3). These corridors were allocated according to the following rules:

- For overhead and intermediate departments, allocation was set according to the percentage of personnel using the corridors within each department.
- For inpatient departments (2,340 sq. m.), allocation was set according to the percentage of admissions using the corridors within each department
- For outpatient clinics (695 sq. m.) allocation was set according to the percentage of outpatient visits using the corridors within each clinic.

The other type of corridors are general corridors (1,518 sq. m.), which include all space outside the departments. These corridors have been allocated to the three main departments (overhead, intermediate and final services departments) of the hospital according to the proportion of occupied space from the total space area of the hospital. Again, inside each department of the three main departments, general corridors have been allocated according to the number of personnel at each cost center. This data was collected by preparing a floor plan of the hospital identifying and categorizing rooms according to their activities, and estimating the size of each room and corridors. The information about building characteristics was obtained from the engineering (maintenance) department.

Table 3 shows the base cost center space and the total space for each cost center after allocating special and general corridors. It also shows the total cost of the building for each cost center and the annual depreciation cost using 25 years as useful life and 3 percent for Present Worth Annuity Factor (PWAF).

Recurrent Costs

1. Annual Personnel Costs

Staff are allocated to five categories, (see Table 4 for personnel allocation):

1. Physicians: Includes all medical doctors working in the intermediate and final service departments, in addition to dentists. Pharmacists are not included in this category.
2. Nurses: Includes all nurses who graduated from either the school of nursing or from the high institute of nursing.

3. Technicians/ skilled personnel: Includes personnel with a university degree or a special skill. It includes lab technicians, dietitians, pharmacists and drivers for vehicles or ambulances. The largest numbers of personnel included in this category work in the intermediate department, while a minimal number work in the final services department.
4. Administration: Includes personnel performing administrative work. Most personnel in this category are working in the overhead department while very few work in the final service department.
5. Unskilled personnel: Includes all personnel working as janitors and messengers.

The annual personnel cost or the “total pay” for each person working at the hospital, which includes:

- Take-home pay.
- Benefits (including exceptional honoraria and family planning), health insurance contributions, labor day allowance, feast honoraria, pay for working overnight, accommodation and food for doctors and nurses.
- Deductions such as insurance, pension and income tax.

All staff have been assigned to the three main departments. The Full-Time Equivalent (FTE) was calculated dividing the physician’s work by the ratio of his/her work in outpatient, inpatient, operations and emergency departments. The numbers shown in the personnel column are equal to the full time equivalent of personnel working at each cost center. Table 5 breaks down cost center and final services expenditure by percentage of each specialty’s working hours amongst different departments. Graph 4 shows distribution of hospital staff for inpatient departments. Physicians accounted for the highest percentage (40 percent) of annual personnel costs, followed by nurses costs (27 percent of annual personnel cost). See Graph 5 for the distribution of personnel costs for each staff category. Table 6 shows the criteria for the distribution of overhead and intermediate department personnel to final service departments. Tables 7 and 8, display the proportion of overhead and intermediate department used by the final service departments. The average number of hospital personnel per bed is 0.96. As the occupancy rate is 46 percent, this means an FTE of 2.09 per occupied bed. The ICU has the highest number with 4.52 FTE staff per occupied bed. See Table 9 and Graphs 2 and 3 for the total number of personnel working at final services departments before and after using step-down technique for hospital staff.

Data on personnel salaries were collected from Sheets no. 50 and 132 A.H. at the finance and personnel departments. Cost analysis shows that 33 percent of annual hospital expenditure was spent on personnel.

In addition, trying to allocate personnel not working in specific cost centers was somewhat ambiguous. For example there are 20 head nurses working in inpatient departments, but not affiliated with a specific department. The allocation of these personnel was computed according to the percentage of admissions for each inpatient department in which they are working.

The allocation rules of such personnel are:

- In overhead departments: Because all of the non-allocated personnel in this department are non-skilled workers (working in cleaning services), they are allocated according to the space area in each cost center.
- In intermediate departments: The same rule as in overhead departments.

- In direct service departments: Allocation is assigned according to percentage of days of stay for inpatient departments or outpatient visits for outpatient clinics.

2. Annual Utility Costs

This category includes electricity, water, telephone lines, vehicle gas, and kitchen oil. The annual costs of meals, patient and personnel apparel, stationery, building and equipment maintenance and travel per diem were also added to this category. Data on the cost of utilities and the official records of invoices was obtained from the financial department. Table 10 shows the total annual cost of utilities and their allocation to cost centers. Cost analysis shows that 13 percent of annual hospital expenditures was spent in annual utility costs (see Annex IV for data sources).

The following are the criteria for the allocation of each utility cost to cost centers:

- Personnel food costs: Allocated according to the number of meals for personnel in each department.
- Patient food costs: Allocated according to annual number of patient days in each department. The total annual food (patients and personnel) cost accounted for 59 percent of the utility costs (see Graph 9).
- Personnel apparel: Allocated to intermediate and final service departments according to the number of personnel in each of them. Personnel in overhead departments do not receive apparel.
- Stationery: Allocated to the overhead department according to the percentage of personnel at each cost center.
- Equipment Maintenance: Allocated to each department according to the equipment cost at each cost center as a total cost of equipment at the hospital.
- Building maintenance: Allocated to different cost centers according to the space area as a percentage of the total space area of the hospital.
- Vehicles maintenance: Completely allocated to the vehicle and ambulatory departments.
- Travel per diem and mail: Allocated completely to the personnel department.
- Fuel and oil: Allocated completely to vehicles.
- Natural gas: 70 percent allocated to the kitchen, the rest to the generators (which are allocated to all departments according to the space area of each).
- Water: Allocated to all departments according to space area.
- Electricity: Allocated according to the electricity consumption measured by using an avometer. Location of the highest consumption of electricity are the laundry and operation theaters.
- Telephone: Allocated according to number of phone sets in each cost center.

3. Annual Cost of Drugs and Medical Supplies

This category includes drugs and medical supplies provided by the hospital. It does not include prescribed drugs that patients purchase outside of the hospital. Table 11 shows the total annual

cost of drugs and medical supplies in each department and outpatient clinic. The study used the price list of Drugs and Medical Supplies Department at MOHP for purchasing drugs and medical supplies for its health facilities. Data related to drugs and medical supplies consumed by the final service departments were collected from the Pharmacy and Store Departments. Cost analysis shows that 25 percent of annual hospital expenditure was spent on drugs and medical supplies cost.

The Renal Dialysis Unit accounts for 37 percent of the total expenditure on drugs and supplies. The second highest consumer is the Emergency Unit at 21 percent, followed by inpatient departments at 17 percent (the gynecology and obstetrics department is at 5 percent), outpatient clinics at 15 percent (of which the diabetes clinic is the highest consumer at 3 percent). Operation theaters are at 9 percent of the annual cost of drugs and medical supplied of the hospital.

III. Results

Description of Suez General Hospital

Suez General Hospital (SGH) is a full service general hospital with 262 beds and fifty-two functional departments. Of these, 12 are overhead departments, 12 are intermediate service departments, and the remaining 28 are direct service departments. The hospital has a total area of approximately 14,078 square meter, with inpatient departments making up 37 percent of the total area. SGH has a total staff strength of 585 employees made up of 148 physicians, 178 nurses, and 259 other employees. Put another way, 121 employees are in the overhead departments, 116 are in intermediate service departments, and 348 are in final service departments. The Emergency Unit is the largest department in the hospital with 70 full-time equivalent employees. Operating theaters are the largest intermediate service department with 50 employees, and the general surgery department is the largest direct service department with 33 full-time equivalent employees. See Table 4 for the allocation of hospital personnel. There were a total of 4,794 admissions in 1993-94 with an average length of stay of 9.14 days. This is significantly longer than the reported length of stay. Total outpatient visits (including the Emergency and Renal Dialysis units) was 140.891 visits.

Results of Costing Study

This section presents the main findings from the cost study. To recapitulate, the total annual cost is the sum of the annualized capital costs and recurrent costs. In turn, capital costs and recurrent costs are subdivided into five subcategories. The total annual cost for SGH in 1993-94 was L.E. 4,277,097.

Cost by Budget Category

Graph 5 presents the breakdown of total costs by capital and recurrent costs.

- Annualized capital costs represented 29 percent of total costs. Of these building costs accounted for 11 percent and equipment and furniture 18 percent. For the analysis, the cost of land is not taken into consideration.
- Recurrent costs represent 71 percent of the total cost. Personnel accounted for 33 percent of total cost, followed by drugs and medical supplies at 25 percent and utilities at 13 percent.
 - Physicians make up 40 percent of personnel costs followed by nurses with 27 percent, and other personnel making up the remaining 34 percent.
 - A large portion of the cost of drugs and medical supplies - 37 percent - is attributable to the renal dialysis unit.
 - Only 2.57 percent of the total annual recurrent costs are spent on maintenance.

Cost by Department

Hospital costs are initially broken down into three departments: overhead, intermediate service and final service. Graph 6 gives the breakdown of costs by these three departments.

- 10 percent of total annual costs are attributable to overhead departments. From Table 16 it

can be seen that, of this 35 percent are for capital costs, 52 percent are for personnel costs, and 13 percent are for other recurrent costs.

- 20 percent of total annual costs are attributable to intermediate service departments. Again, from Table 16 it can be seen that, of this, 47 percent are for capital costs, 14 percent are for personnel costs, and 39 percent are for other recurrent costs.
- 70 percent of total costs are attributable to direct service departments. Of these, 23 percent are for capital costs, 30 percent are for personnel costs, and 47 percent are for other recurrent costs.

Step-down Allocation of Overhead and Intermediate Service Departments Costs

Capital and recurrent costs are assigned to overhead, intermediate service and final service departments through direct distribution (as in the dental lab and emergency pharmacy) or step-down allocation.

Costs of the overhead departments are first allocated to intermediate service and final service departments. Total costs of the intermediate service departments after allocation of overhead costs are then allocated to the final service departments. Finally, final service department costs are allocated to inpatient departments, outpatient clinics, emergency and renal units. (See Graph 6-1 for the distribution of annual hospital costs to the direct service departments after step-down allocation).

a. Allocation of the Overhead Departments

Table 17 shows the allocation criteria for the distribution of overhead and intermediate departments costs to the final departments. Fifty percent of cost centers within overhead departments are allocated according to their proportion of the total annual costs of the hospital. Table 18 shows the allocation of overhead departments and the total cost of intermediate service and final service departments after the allocation of overhead department costs. Approximately 17 percent of overhead department costs were distributed among intermediate service and 83 percent to final service departments. The renal dialysis unit, operation theaters, and general surgery department received the largest share of overhead department allocations (21, 8 and 14 percent, respectively).

b. Allocation of Intermediate Service Departments

Intermediate departments costs were distributed among the final service departments according to the number of procedures or services used. The proportion of intermediate service department procedures and services used by the final service departments and the amount of the costs distributed are shown in Table 19. The obstetrics and gynecology department is the largest user (24 percent) of intermediate department services, followed by 18 percent for the orthopedics department. The emergency unit uses 5 percent of intermediate department services.

c. Composition of Costs for Inpatient Departments

The Distribution of costs and percentages for inpatient departments by major categories is presented in Tables 26 and 27. Overhead departments represent 5 percent of the total final cost of inpatient departments, while intermediate services departments procedures and services represent 38 percent. Cost of FTE personnel within inpatient departments (hospital staff working only at inpatient departments) represent 18 percent of total annual costs of inpatient departments (See Graph 11 the average distribution of costs by category in inpatient departments).

There are wide variations in the composition of costs by departments. Personnel costs absorb the highest percentage of the total cost of the departments without surgical procedures (36

percent in the Incubator department). Operation theaters absorb a large percentage of the total cost of departments with surgical procedures (70 percent for operation theaters in the ENT department). See Graphs 12 and 13 for average distribution of cost per admission in general medicine and general surgery departments. Gynecology and obstetrics, ENT and orthopedic departments are final departments where more than 40 percent of the total cost is allocated from operation theaters at intermediate service departments. Inpatient departments represent 49.5 percent (L.E. 2,118,692) of the total annual hospital cost (see table 26 for total annual cost of inpatient departments).

d. Allocation of Costs for Inpatient Departments

Estimates were made of the number of admissions in inpatient departments from July 1993 to June 1994 (see Graph 14). The average cost per admission for inpatient care at Suez Hospital (ALOS 9.14 days) was L.E. 442 (see Graph 15 for the average cost per admission). There is a substantial variation in inpatient admission costs by department (see Table 28 and Graph 16 for the distribution of cost per admission).

The highest cost per admission is in the orthopedic department (L.E. 719). This high cost is the result of a low turnover rate (14 patients per bed per year) and a longer average length of stay (2 weeks). The lowest cost per admission is for the general surgery department (L.E. 316), which is the result of a low average length of stay (9 days) and a high number of admissions and turnover rate (2.5 times that of the orthopedic department).

The average cost of an inpatient day is estimated to be L.E. 48. The annual cost per bed reached L.E. 17,125 for ENT with an average annual cost per bed of L.E. 8,087 in Suez General Hospital. See cost analysis and efficiency indicators for inpatient departments for more details.

e. Composition of Costs for Outpatient Clinics

The distribution of costs and percentages by major categories of outpatient clinics are presented in Tables 29 and 30. Outpatient clinics (including the emergency and renal dialysis units) represent 50.5 percent of annual hospital costs. The cost of FTE personnel, hospital staff working only in outpatient clinics, (41 percent of total cost) and the cost of drugs (24 percent of total cost) are the largest cost items allocated to outpatient clinics (see Graph 17 for the average distribution of cost by category at outpatient clinics).

There are, however, wide variations in the composition of costs among different clinics. About 70 percent of the cost for Obs/Gyn outpatient visits are personnel costs. In the renal dialysis unit, drugs and medical supplies represented the highest percentage of the total cost of outpatient visits (52 percent), while personnel cost represented only 7 percent (see Graph 18 for distribution of the annual cost by category). The cardiology clinic began operating in January 1994 and is therefore not included in the final results.

f. Allocation of Costs for Outpatient Clinics

Estimations were made according to the number of outpatient visits in outpatient clinics and emergency units from July 1, 1993 to June 30, 1994. There is substantial variation in outpatient visit costs (see Table 30 and Graph 19 for the distribution of cost per outpatient visit).

The rabies outpatient clinic has the highest cost per outpatient visit, L.E. 25, with personnel representing 79 percent of the total visit cost. The high cost is due to a low utilization rate (369 visits per year). The Obs/Gyn clinic is another example of high costs per visit, L.E. 12, due to high personnel costs representing 70 percent of the total visit cost. The lowest cost per visit is the General Medicine clinic where drugs represent 36 percent of the total visit costs, followed by 32 percent for personnel costs. The average cost per outpatient visit at Suez Hospital is L.E. 5.31; the average cost of drugs per visit is L.E. 1.28.

The average cost per visit for renal dialysis patients is L.E. 136; of this, drugs and medical supplies cost L.E. 74. For the emergency unit, the average cost per visit is L.E. 5.18, which includes L.E. 2.03 for drugs and medical supplies. See Table 32 for the average cost per visit for the dental clinic, outpatient clinics, and emergency unit.

Step-Down Allocation of Hospital Staff To Final Service Departments

The total hospital staff of the Suez Hospital is comprised of five categories of personnel (physician, nurse, technician, administrative and unskilled workers). Each category of personnel is assigned to overhead, intermediate service and final service departments through direct distribution. They are then converted to FTEs.

Personnel of the overhead departments were first allocated to intermediate service and final service departments. The total personnel of the intermediate service departments, after the allocation of overhead departments, is then allocated to the final service departments. Finally, personnel of the final service departments are allocated to the inpatient department, outpatient clinics, emergency and renal units. See Graph 2 and 3 for the distribution of hospital staff to direct service departments after the step-down allocation.

a. Allocation of Overhead Departments Personnel

Table 7 gives the criteria used to allocate personnel within overhead departments to intermediate and final service departments. Eighty percent of hospital staff within overhead departments are allocated according to the proportion to total annual admissions for each department (one admission is equal to three outpatient visits). Table 7 illustrates the allocation statistics of overhead departments and personnel of intermediate and final service departments after the allocation of overhead department personnel. Only 0.98 percent of overhead department personnel were distributed amongst intermediate service departments and 99.02 percent of final service departments. The emergency unit received the largest share of overhead department allocations (40.9 percent).

b. Allocation of Intermediate Service Departments Personnel to Final Service Departments:

Personnel within intermediate service departments were distributed among the final service departments according to the number of procedures or services used (see Table 6 for allocation criteria for distributing intermediate service department personnel). The distribution of costs from intermediate service departments to final service departments for procedures and services are shown in Table 8.

Cost Analysis and Efficiency Indicators

Cost Analysis

For the year 1993-1994 the total annual cost for the Suez General Hospital was L.E. 4.3 million. Personnel costs amounted to 33 percent of the total annual cost, followed by 25 percent for drugs and medical supplies (these figures represent averages for the hospital). Inpatient departments varied from 10 to 36 percent for FTE personnel, and from 1.3 to 14 percent for drugs and medical supplies, depending on the total number of annual admissions (see Graph 14). Table 28 presents the distribution of cost per admission by cost categories.

The study included the actual cost of renal dialysis patients as an example of an intervention financially supported by the MOHP in spite of its high cost. The average cost per visit for renal dialysis is L.E. 136 which adds up to L.E. 14,000 per patient per year as a renal failure patient requires 2 visits weekly (104 visits yearly). The cost of drugs and medical supplies constitute 52 percent of the total cost which is a higher drug and medical supply cost compared with other

MOHP general hospitals. This results from drug donations from several oil companies in the Suez governorate. See Table 31 for distribution of cost per outpatient visit.

The average cost per admission is L.E. 442. The highest cost per admission is L.E. 719 for the Orthopedics department, while the cost is L.E. 232 for the pediatric department, depending on the occupancy rate and average length of stay in the departments (see Table 33). Some departments were very well-staffed with an average of one physician per two beds.

The average cost per day is L.E. 48, which varies depending on the occupancy and turnover rates. It was found that this daily cost could vary from L.E. 100 (incubator department) to L.E. 180 (ICU) due to the large difference in the annual admissions in these departments.

The average annual bed cost is L.E. 8,000 and varies between L.E. 17,000 in the ICU to L.E. 5,000 in the general surgery department. The ophthalmology department had the minimum cost of L.E. 1,500 per bed (see Graph 22 for total annual cost per bed). The total cost of maintenance in this hospital is about L.E. 78,312, which represents 2.57 percent of the annual recurrent cost. Although this figure seems very low, it is still higher than the maintenance cost in other MOHP general hospitals. The international average percentage of maintenance costs ranges between 10 to 15 percent of the recurrent cost.

In general, drugs and medical supplies absorb a larger proportion of total costs for outpatient visits: 4 to 60 percent of total costs for outpatient visits, versus 1 to 14 percent of total costs per admission. These variations are due to the absence of ambulance, operating rooms, food costs and the relatively fewer investigate procedures in outpatient clinics. Salaries and drugs together take up a higher share of outpatient clinics. Salaries and drugs together take up a higher share of outpatient than inpatient expenditures.

International literature indicates that 20 percent of total hospital expenditure goes to outpatient clinics (Mills 1990). Outpatient care of SGH absorbs 40 percent (L.E. 1,707,582) of total hospital expenditure. The difference in the two numbers is a result of the high cost of the renal dialysis unit which consumes 9 percent of total hospital recurrent expenditures.

Outpatient visits in the Suez Hospital cost an average of L.E. 5.31. The cost of drugs reaches 24 percent of the total amount while the personnel cost consumes more than 41 percent. The costs of outpatient visits depend on the number of visits to each clinic. The cost varies from L.E. 10 per visit in the psychotherapy clinic, which see 40 patients daily, to L.E. 14 per visit in the psychiatric clinic, which sees 6 patients daily (see Table 31 for distribution of costs per outpatient visit; see Graph 20 for the cost of an outpatient visit).

The cost per visit for the emergency unit reaches L.E. 5.13. Drugs and medical supplies represent 39 percent of the total costs (which is more than the cost of drugs and medical supplies for outpatient clinics).

Efficiency Indicators in Inpatient Departments

The study prepared some efficiency indicators in the general hospitals that will help decision makers to evaluated the level of performance in both the inpatient and outpatient departments.

Occupancy Rate

The average occupancy rate in 1993-94 was 46 percent. This rate varies from 90 percent in the ENT department to 12 percent in the ophthalmology department. See Graph 21 for the occupancy rate versus the turnover rate.

Turnover Rate

Both the pediatrics and ENT departments have the highest turnover rate (42 and 36 patients per bed per year, respectively). This rate decreases for the orthopedics department with 14 patients and reaches the minimum of 3 patients in the ophthalmology department. This translates into an average length of stay of 14 to 18 days, respectively, for these departments. The average turnover rate in the Suez General Hospital is 18 patients per bed per year.

Number of Inpatient Days per FTE Physician

The average number of inpatient days per full-time equivalent physician was 785 patient days. Based on the fact that each physician works 270 days a year, this means each physician treats 3 patients during his/her 6 working hours a day. This number decreases to 241 treatment days per year for a physician in the incubator department, meaning he/she is responsible for only one patient per month, which is a very low ratio. See Graph 25 for the number of FTE physicians per bed against bed days per FTE physician.

Number of Physicians per Bed

The average number of FTE physicians per bed is 0.12, if we base our computations on an occupancy rate of 46 percent, this means there are 1.23 physicians for each occupied bed. The incubator department had the highest number of 3.96 FTE physicians per occupied bed.

Hospital Staff

Using the step-down technique for the allocation of overhead and intermediate service departments, the study obtained an estimation of the total hospital staff working for final service departments. The general surgery and obstetrics and gynecology departments have the largest number of hospital FTE staff (50 FTE personnel for each). The emergency unit absorbs 22.4 percent of hospital FTE staff (131 personnel).

Number of FTE staff per Bed

The study used the step-down technique to allocate the personnel of the overhead and intermediate departments to the final service departments. The average number of hospital personnel per bed is 0.96 or 2.09 per occupied bed. The ICU department has the highest figure at 4.52 FTE staff per occupied bed.

Number of Nurses per Physician

The average number of nurses per physician is 1.72. The number of nurses per physician varies from 5 nurses in the orthopedics department to 0.01 nurses in the ophthalmology department.

Number of Annual Admissions per FTE Physician

The average annual admissions per FTE physician is 86. This figure drops to 9 admissions per year (less than one case a month) in the ophthalmology department (see Figure 26 for the annual number of admissions per FTE physician).

Average Length of Stay By Diagnosis

The study measured average length of stay by diagnosis for 125 diagnoses at Suez General Hospital from July 1993 to June 1994. The data was collected from the admissions and discharge sheets of the hospital to assure the accuracy of results. Tables 12, 13, 14, and 15 present the average length of stay and number of cases for November 1993, March and April 1994. Unfortunately, the diagnoses do not follow the international classification of diseases. Gastroenteritis presents the highest number of admissions (5.8 percent of total hospital annual admissions, ALOS 4 days), and lower segment cesarean sections present the second highest number of admissions (5.4 percent of total hospital annual admissions, ALOS 7.7 days). Appendectomy was the fifth highest cause of admission with ALOS 5.3. In general, average lengths of stay appear appropriate for many of the diagnoses. However, without further information about the severity of cases, it is not possible to assume that the patients are hospitalized appropriately.

Graph 21 summarizes some of the efficiency indicators of the Suez General Hospital. The x-axis represents the occupancy rate while the y-axis represents the annual turnover rate. The Graph is divided into four regions by two intersecting lines, the vertical line representing the average bed occupancy rate and the horizontal line representing the average turnover rate. As it deals only with two indicators, the Graph is more useful for descriptive than policy purposes as it does not answer the question of whether a given department is performing efficiently. Other efficiency indicators (unit cost, number of FTE personnel) are required for policy purposes (see Appendix I for glossary).

Departments in Region I account for 24 percent of the total annual cost of inpatient departments and 34 percent of total annual admissions. Departments in this region (orthopedics, general surgery, general medicine and incubator) may be characterized by:

- small proportion of unused beds.
- High bed turnover rate.

Departments in Region II (urology and orthopedics) accounted for 24 percent of the total annual cost of inpatient departments and 16 percent of total annual admissions. Departments in this region may be characterized by:

- Small proportion of unused beds.
- Low bed turnover rate.
- Long length of stay.

Departments in Region III (ICU and incubator) accounted for 14 percent of the total annual cost of inpatient departments and 11 percent of total annual admissions. Departments in this region may be characterized by:

- Excess bed availability.
- High bed turnover rate.

Departments in Region IV (Obs/Gyn and general surgery) account for 38 percent of the total annual cost of inpatient departments and 39 percent of total annual admissions. Departments in this region may be characterized by:

- Excess bed availability.
- Low bed turnover rate.

Efficiency Indicators In Outpatient Clinics

Using the step-down technique, the study was able to obtain some indicators of the efficiency level in the outpatient departments.

The average number of visits per physician in outpatient clinics is less than 9 visits a day (see Graph 27 for annual outpatient visits for each clinic). The highest number of visits was in the diabetes clinic with an average of 90 patients daily and 0.3 FTE per physician (see Graph 28 for annual outpatient visits per physician). This larger figure may be attributed to the fact that 60 percent of the cost of an outpatient visit goes to drugs (see Graph 29 for distribution of cost per outpatient visit) implying that patients are only visiting the hospital to pick up their prescriptions.

The number of staff in each clinic (physicians, nurses, administration and support services which includes personnel at overhead and intermediate departments) can reach 20, as in the general surgery clinic with 4 physicians and 16 support services personnel. The total number of personnel working for outpatient clinics (including overhead and intermediate personnel) is 180, with an average of 0.0014 personnel per outpatient visit. For the emergency unit this figure is 131 personnel with an average of 0.0011 personnel per emergency unit visit.

Department Specific Results

A. Ear, Nose and Throat Department

Cost Analysis

- Annual cost of the department; L.E. 137,000 (6.47 percent of total annual expenditures of inpatient departments)
- Cost per inpatient admission: L.E. 471
- Cost per day: L.E. 52
- Annual cost per bed: L.E. 17,125

Efficiency Indicators

- Annual admissions: 291 (6.07 percent of total annual admissions)
- Number of beds: 8 (3.05 percent of total hospital beds)
- Annual patient-days of stay: 2,638 (6.02 percent of annual patient-days)
- Occupancy rate: 90.34
- Bed turnover rate: 36
- Average length of stay: 9.07

Department Staff

- Number of full time equivalent physicians: 5.4
- Annual admissions per FTE physician: 54
- Annual patient-days per FTE physician: 489
- Number of FTE physicians per bed: 0.68
- Number of nurses per FTE physician: 0.09
- Staff in the department (including overhead and intermediate departments personnel):
 - Number of FTE staff: 17.54
 - Number of FTE staff per bed: 2.19
 - Number of FTE staff per bed (according to occupancy rate): 2.43
- Staff in the inpatient department (only personnel working for the inpatient departments, not including overhead and intermediate department personnel):

- Number of FTE staff: 6.89
- Number of FTE staff per bed: 0.86

This department has the highest occupancy rate (90 percent) as well as the highest turnover rate (36 percent). Therefore, it is located in region I in Graph 21 which includes departments having a small proportion of unused beds and a high bed turnover rate. Note that the number of beds is quite low at about 8 beds (3 percent of total hospital beds).

The annual cost per bed in this department is the highest in the hospital reaching more than L.E 17,000 due to the limited number of beds. However, the total annual cost of the department of L.E. 137,000 is not the highest of all the departments.

The operating rooms absorb 70 percent of the total admission cost per patient, equal to L.E 471, while drugs and medical supplies constitute only 4 percent equal to L.E. 17.4.

The number of annual patient days and admissions per physician are relatively low (489 and 54 respectively) due to the high number of FTE physicians (5.4 FTE physicians for the inpatient department).

The numbers of nurses per FTE physician is 0.09. This is the second lowest figure in the hospital after the ICU department which is 0.85 nurses per physician. Step-down allocation of hospital staff shows that the total number of FTE staff per bed is the highest figure in the hospital at 2.19, reached 2.43 personnel per occupied bed.

B. General Medicine Department

Cost Analysis

- Annual cost of the department: L.E. 228,389 (10.78 percent of total annual expenditure of inpatient departments).
- Cost per inpatient admission: L.E. 346
- Cost per day: L.E. 29
- Annual cost per bed: L.E. 7,137

Efficiency Indicators

- Annual admissions: 660 (13.77 percent of total annual admissions).
- Number of beds: 32 (12.21 percent of total hospital beds)
- Annual patient-days of stay: 7,798 (6.02 percent of total annual patient-days)
- Occupancy rate: 66.76
- Bed turnover rate: 21
- Average length of stay: 11.82

Department Staff

- Number of full-time equivalent physicians: 6.85
- Annual admissions per FTE physician: 96
- Annual patient-days per FTE physician: 1,,138
- Number of FTE physicians per bed: 0.21
- Number of nurses per FTE physician: 1.86
- Staff at the department (including overhead and intermediate department personnel):
 - Number of FTE staff: 26.06
 - Number of FTE staff per bed: 0.81
 - Number of FTE staff per bed (according to occupancy rate): 1.22
- Staff within the inpatient department (only personnel working for inpatient departments, not including overhead and intermediate departments personnel):
 - Number of FTE staff: 20.68
 - Number of FTE staff per bed: 0.65

The cost of L.E. 29 per day is the lowest of the inpatient departments in the hospital due to the long duration of stay at 12 days. Fourteen percent of the total cost of admission goes for drugs and medical supplies, the highest percentage of the inpatient departments.

Personnel working in the general medicine inpatient department only, receive 29 percent, L.E 89, of the cost of admission, L.E. 346. Utilities account at 18 percent, and the radiology and lab departments account for 17.3 percent. See Graph 12 for the average distribution of the cost per admission for the general medicine department: see Graph 15 for the distribution of costs per admission at SGH.

The occupancy rate in the department is the second highest in the hospital at 67 percent after the ENT department. The turnover rate is relatively low, at 21 patients, due to the relatively long lengths of stay.

C. General Surgery Department

Cost Analysis

- Annual cost of the department: L.E. 355,823 (16.7 percent of total expenditures of inpatient departments).
- Cost per inpatient admission: L.E. 316
- Cost per day: L.E. 36
- Annual cost per bed: L.E. 4,983

Efficiency Indicators

- Annual admissions: 1,120 (23.36 percent of total annual admissions)
- Number of beds: 71 (27.1 percent of total hospital beds)
- Annual patient-days of stay: 9,905 (22.6 percent of total annual patient-days)
- Occupancy rate: 38.22
- Bed turnover rate: 16
- Average length of stay: 8.84

Department Staff

- Number of full-time equivalent physicians: 7.65
- Annual admissions per FTE physician: 146
- Annual patient-days per FTE physician: 1,295
- Number of FTE physicians per bed: 0.11
- Number of nurses per FTE physician: 3.17
- Staff of the department (including overhead and intermediate departments personnel):
 - Number of FTE staff: 50.35
 - Number of FTE staff per bed: 0.71
 - Number of FTE staff per bed (according to occupancy rate): 1.86
- Staff of the inpatient department (only personnel working for inpatient departments, not including overhead and intermediate departments personnel):
 - Number of FTE staff: 36.93
 - Number of FTE staff per bed: 0.52

This department has the highest number of admissions in the hospital with 1,120 admissions representing 23 percent of the total admissions. In addition, as a result of longer ALOS (9 days), the department has the highest annual patient-days of stay with 23 percent of total annual days of stay. The occupancy rate is quite low at 38 percent due to a greater number of beds, 71, than nearly all inpatient departments.

The department's total annual costs are L.E 354,000, which makes it second only to the Obs/Gyn department with an annual cost equaling L.E 424,000. The high costs are due to the large number of FTE personnel (at 37, it is one of the highest number of FTE personnel for an inpatient department). Using the step-down technique for allocation of hospital personnel, the number of personnel serving this department (including overhead and intermediate departments) is equal to about 50 FTE personnel. This is the highest number of FTE personnel to for an inpatient department (see Graph 2 for distribution of hospital personnel to final service departments).

In spite of the long lengths of stay, the number of patient-days per physician is still low. This is because the department has a large number of FTE physicians at 13.5, which is the second highest number of FTE physicians after the gynecology and obstetric department at 15 FTE physicians.

In spite of the high annual cost of the department, the annual total cost per bed is relatively low at L.E. 5,000. This is due to the large number of beds, representing 27 percent of total hospital beds (see Graph 22 for annual cost per bed).

The cost per admission is L.E. 316 which is classified as grade 1 (L.E. 201 to L.E. 400) for cost per admission at SGH (see Graph 15 for the cost per admission). Of this cost per admission, the operating theater absorbs 29 percent (L.E. 92) and drugs and medical supplies absorb 8.2 percent (L.E. 26) of the total cost per admission. (see Graph 13 for average distribution of cost per admission for the general surgery department).

D. Gynecology and Obstetrics Department

Cost Analysis

- Annual cost of the department: L.E. 424,311 (20.03 percent of total annual expenditures of inpatient departments)
- Cost per inpatient admission: L.E. 589
- Cost per day: L.E. 64
- Annual cost per bed: L.E. 10,103

Efficiency Indicators

- Annual admissions: 720 (15.02 percent of total annual admissions)
- Number of beds: 42 (16.03 percent of total hospital beds)
- Annual patient-days of stay: 6,605 (15.07 percent of total annual patient-days)
- Occupancy rate: 43.09
- Bed turnover rate: 17
- Average length of stay: 9.17

Department Staff

- Number of full time equivalent physicians: 13.05
- Annual admissions per FTE physician: 55
- Annual patient-days per FTE physician: 506
- Number of FTE physicians per bed: 0.31

- Number of nurses per FTE physician: 0.92
- Staff at the department (including overhead and intermediate departments personnel):
 - Number of FTE staff: 50.3
 - Number of FTE staff per bed: 1.20
 - Number of FTE staff per bed (according to occupancy rate): 2.78
- Staff within the inpatient department (only personnel working for the inpatient department, not including overhead and intermediate department personnel):
 - Number of FTE staff: 30.01
 - Number of FTE staff per bed: 0.71

This department has the highest annual total cost of L.E. 424,000 constituting 20 percent of the total annual expenditures for inpatient departments. As a result of the low annual admissions rate of 720 patients, the total cost reaches only L.E. 600, which is considered the highest cost in grade II (L.E. 400 to L.E. 600) of cost per admission. See Graph 15 for cost per admission.

The high annual total cost in the department is a result of:

- High number of hospital staff at 30 FTE, personnel is considered to be the second highest number of personnel after the general surgery department.
- As 39 percent of operations are gynecological or deliveries, 39 percent of the cost of operation theaters is attributed to the Obs/Gyn department (see Table 25). As a result, operating theaters absorb 44 percent of the total annual cost of the department.
- Drugs and medical supplies account for 14 percent of the total annual cost, which is considered as the highest percentage of drugs and medical supplies in all inpatient departments.
- At 71, the number of beds represents the highest percentage (27 percent of total hospital beds) in the hospital.

The number of annual patient days and admissions per physician is relatively low at 506 and 55 respectively due to the high number of FTE physicians (13.05 FTE physicians within the inpatient department).

Intermediate departments, including the operating theaters, account for 51.21 percent of the total cost per admission, while overhead departments account for 4.11 percent. The five main broad categories of equipment, building, personnel, utilities and drugs of the Obs/Gyn department represent 44.68 percent of the total cost per admission. See Table 28 for the distribution of costs per admission.

E. Intensive Care Unit

Cost Analysis

- Annual cost of the department: L.E. 175,452 (8.82 percent of total expenditures for inpatient departments)
- Cost per inpatient admission: L.E. 647
- Cost per day: L.E. 182
- Annual cost per bed: L.E. 17,545

Efficiency Indicators

- Annual admissions: 271 (5.65 percent of total annual admissions)
- Number of beds: 10 (3.82 percent of total hospital beds)
- Annual patient-days of stay: 965 (2.20 percent of total annual patient-days)
- Occupancy rate: 26.44
- Bed turnover rate: 27
- Average length of stay: 3.56

Department Staff

- Number of full time equivalent physicians: 4.00
- Annual admissions per FTE physician: 68
- Annual patient-days per FTE physician: 241
- Number of FTE physicians per bed: 0.4
- Number of nurses per FTE physician: 0.85
- Staff at the department (including overhead and intermediate departments personnel):
 - Number of FTE staff: 11.96
 - Number of FTE staff per bed: 1.20
 - Number of FTE staff per bed (according to occupancy rate): 4.52
- Staff of the inpatient department (only personnel working for the inpatient department, not including overhead and intermediate departments personnel):
 - Number of FTE staff: 10.39

- Number of FTE staff per bed: 1.04

The annual cost per bed in the ICU department is the highest of the inpatient departments at L.E. 17,500. As a result of the high annual depreciation costs, equipment and furniture in the ICU constitute 62 percent of all annual depreciated costs of the inpatient departments and 13 percent of the total hospital equipment depreciation costs. These are the third highest depreciation cost in the hospital after the radiology and renal dialysis departments. Cost per admission is L.E. 647 of which equipment and furniture depreciation costs represent 58 percent and drugs and medical supplies represent 3 percent.

Cost per day is the highest of all the inpatient departments reaching L.E. 182. The 4 day average length of stay is the lowest ALOS in the hospital. See Graph 23 for annual bed days against cost per day.

The number of annual patient days per FTE physicians the lowest at only 241 per FTE physician. This is equal to 0.89 of a patient day per FTE working day (annual working days are 270).

The step-down allocation of hospital staff shows that the total number of FTE staff per bed reached 1.2 and 4.52 personnel per occupied bed, the highest figures in the hospital.

F. Incubator Department

Cost Analysis

- Annual cost of the department: L.E. 111,717 (5.27 percent of total annual expenditure for inpatient departments)
- Cost per inpatient admission: L.E. 445
- Cost per day: L.E. 97
- Annual cost per bed: L.E. 10,156

Efficiency Indicators

- Annual admissions: 251 (5.24 percent of total annual admissions)
- Number of beds: 11 (4.20 percent of total hospital beds)
- Annual patient-days of stay: 1,146 (2.61 percent of total annual patient-days)
- Occupancy rate: 28.54
- Bed turnover rate: 23
- Average length of stay: 4.57

Department Staff

- Number of full time equivalent physicians: 2.25
- Annual admissions per FTE physician: 112

- Annual patient-days per FTE physician: 509
- Number of FTE physicians per bed: 0.20
- Number of nurses per FTE physician: 4.08
- Staff at the department (including overhead and intermediate departments personnel):
 - Number of FTE staff: 13.60
 - Number of FTE staff per bed: 1.24
 - Number of FTE staff per bed (according to occupancy rate): 4.33
- Staff of the inpatient department (only personnel working for inpatient department, not including overhead and intermediate departments personnel):
 - Number of FTE staff: 12.43
 - Number of FTE staff per bed: 1.13

The average cost per admission is L.E. 445. The cost per day reaches L.E. 100, of which 46 percent constitute the annual depreciated cost of equipment and furniture and 1.39 percent is for drugs and medical supplies (the lowest percentage in the hospital).

The ALOS is relatively short at 5 days. However, because of the low occupancy of 29 percent, the department is located in square III in Graph 21. This square is characterized by an excess of bed availability and low bed turnover rates.

The total number of personnel working within the incubator department is only 1.13 per bed, which is considered to be the highest percentage of the inpatient departments. See Table 33 for the number of FTE staff, inpatient department personnel per bed.

The step-down allocation of hospital staff reveals that the total number of FTE staff per bed reaches 1.24 and 4.33, this is the second highest rate in the hospital after the ICU department.

Overhead support departments absorb 7.4 percent of the total annual costs of the incubator department and 1.21 percent of intermediate service departments. The main five cost categories of the department, equipment, building, personnel, utilities and drugs represent 91.4 percent of the total annual costs of the department. See Tables 26, 27 for the distribution of annual costs.

G. Ophthalmology Department

Cost Analysis

- Annual cost of the department: L.E. 23,265 (1.10 percent of total annual expenditures for inpatient departments)
- Cost per inpatient admission: L.E. 582
- Cost per day: L.E. 32
- Annual cost per bed: L.E. 1,454

Efficiency Indicators

- Annual admissions: 40 (0.83 percent of total annual admissions)
- Number of beds: 16 (6.11 percent of total hospital beds)
- Annual patient-days of stay: 722 (1.65 percent of total annual patient-days)
- Occupancy rate: 12.36
- Bed turnover rate: 3
- Average length of stay: 18.05

Department Staff

- Number of full-time equivalent physicians: 4.25
- Annual admissions per FTE physician: 9
- Annual patient-days per FTE physician: 170
- Number of FTE physicians per bed: 0.27
- Number of nurses per FTE physician: 0.01
- Staff at the department (including overhead and intermediate department personnel):
 - Number of FTE staff: 3.57
 - Number of FTE staff per bed: 0.22
 - Number of FTE staff per bed (according to occupancy rate): 1.80
- Staff within the inpatient department (only personnel working for inpatient department, not including overhead and intermediate department personnel):
 - Number of FTE staff: 4.29
 - Number of FTE staff per bed: 0.27

Occupancy and bed turnover rates are 12 percent and 3 patients respectively, the lowest rates in the hospital as a result of its having the lowest annual admissions (40 patients). Again, the number of admissions per FTE physician is very low at 9 admissions per year, or less than one patient per month. These low figures increase the total cost per admission to L.E. 600, although the cost per day is quite low at L.E. 32 as a result of the very high ALOS (18 days).

This department is the lowest annual cost of L.E. 23,264 (1.1 percent of total annual expenditures for inpatient departments). Because of the low annual admission rate (0.83 percent of total annual admissions), the total cost per admission reaches L.E. 582, which is considered the highest cost in grade II (L.E. 400 to L.E. 600) for cost per admission. See Graph 15 for cost per admission.

The annual cost per bed in the Ophthalmology department is the lowest of the inpatient departments at L.E. 1,454. Drugs and medical supplies represent 3.6 percent and operation

theaters absorb 44 percent of the total annual cost as a full 100 percent of admissions require surgical procedures. See Table 25 for number of ophthalmology surgical operations. The Lab and radiology department represents 0.08 percent of the total annual cost.

Overhead support departments account for 7.25 percent of the total annual cost of the incubator department and intermediate service departments account for 45.93. The five main broad categories equipment, building, personnel, utilities and drugs of the psychiatry department represent 46.83 percent of the total cost per admission. See Table 28 for the distribution of costs per admission.

The number of FTE staff in the department is lowest at 4.29. It also has the lowest annual cost per bed in the hospital at less than L.E. 1,500.

H. Orthopedics Department

Cost Analysis

- Annual cost of the department: L.E. 325,772 (15.38 percent of the total annual expenditure for inpatient departments).
- Cost per inpatient admission: L.E. 719
- Cost per day: L.E. 52
- Annual cost per bed: L.E. 10,180

Efficiency Indicators

- Annual admissions: 453 (9.45 percent of total annual admissions)
- Number of beds: 32 (12.21 of total hospital beds)
- Annual patient-days of stay: 6,291 (14.35 percent of total annual patient-days)
- Occupancy rate: 53.86
- Bed turnover rate: 14
- Average length of stay: 14.89

Department Staff

- Number of full-time equivalent physicians: 3.6
- Annual admissions per FTE physician: 126
- Annual patient-days per FTE physician: 1,748
- Number of FTE physicians per bed: 0.11
- Number of nurses per FTE physician: 4.69
- Staff at the department (including overhead and intermediate departments personnel):

- Number of FTE staff: 36.78
- Number of FTE staff per bed: 1.15
- Number of FTE staff per bed (according to occupancy rate): 2.13
- Staff within the inpatient department (only personnel working for the inpatient department, no including overhead and intermediate department personnel):
 - Number of FTE staff: 23.47
 - Number of FTE staff per bed: 0.73

Cost per admission is the highest in the hospital at more than L.E. 700. One of the reasons for this high cost is the long ALOS (18 days).

Intermediate departments account for 49.8 percent of the total cost per admission, while overhead departments account for 3.67 percent. The main five broad categories equipment, building, personnel, utilities and drugs in the orthopedics department represent 46.53 percent of the total cost per admission. See table 28 for the distribution of costs per admission.

The number of patient days per physician is relatively high (1,748 patient days per physician) as a result of:

- Limited number of FTE physicians at 3.6 and a low number of physicians per bed at 0.11 (or one physician per 9 beds).
- Long AOLS that is considered the highest number in the hospital.

I. Pediatrics Department

Cost Analysis

- Annual cost of the department: L.E. 154,278 (7.82 percent of total annual expenditure for inpatient departments).
- cost per inpatient admission: L.E. 232
- Cost per day: L.E. 42
- Annual cost per bed: L.E. 9,642

Efficiency Indicators

- Annual admissions: 665 (13.87 percent of total annual admissions)
- Number of beds: 16 (6.11 percent of total hospital beds)
- Annual patient-days of stay: 3,667 (8.37 percent of total annual patient-days)
- Occupancy rate: 62.79
- Bed turnover rate: 42

- Average length of stay: 5.51

Department Staff

- Number of full-time equivalent physicians: 7.50
- Annual admissions per FTE physician: 89
- Annual patient-days per FTE physician: 489
- Number of FTE physicians per bed: 0.47
- Number of nurses per FTE physician: 1.29
- Staff at the department (including overhead and intermediate departments personnel):
 - Number of FTE staff: 22.87
 - Number of FTE staff per bed: 1.43
 - Number of FTE staff per bed (according to occupancy rat): 2.28
- Staff within the inpatient department (not including overhead and intermediate departments personnel):
 - Number of FTE staff: 19.18
 - Number of FTE staff per bed: 1.20

The turnover rate of 42 patients per year is the highest in the hospital. The occupancy rate is substantially high as well at 63 percent and 6 days ALOS.

The total annual cost of the department is L.E. 154,278. The cost per admission is L.E. 232 which is considered the lowest cost per admission in the hospital. The cost of drugs and medical supplies represents 12 percent of the total cost and overhead and intermediate service departments account for 21.32 percent of the total cost per admission.

Intermediate departments account for 12.49 percent of the total cost per admission, while overhead departments account for 8.82 percent. The main five broad categories - - equipment, building, personnel, utilities and drugs of the department absorb 78.68 percent of the total cost per admission. See Table 27 for the distribution of costs per admission.

The pediatrics department has the highest number of FTE physicians. As a result, the number of physicians per bed reaches one physician per every two beds and 1.2 staff per bed (this number is the highest number in the hospital considering the total number of staff compared with the number of beds in the department).

The number of annual patient days per physician is low at 489 due to the high number of FTE physicians (7.5 FTE physicians for the inpatient department) and relatively low ALOS (5.5 days).

There are 32 personnel (including overhead and intermediate departments) in total serving the pediatrics department (see table 33).

J. Urology Department

Cost Analysis

- Annual cost of the department: L.E. 184,685 (8.72 percent of total annual expenditure for inpatient departments)
- Cost per inpatient admission: L.E. 572
- Cost per day: L.E. 45
- Annual cost per bed: L.E. 7,695

Efficiency Indicators

- Annual admissions: 323 (6.74 percent of total annual admissions).
- Number of beds: 24 (9.16 of total hospital beds)
- Annual patient-days of stay: 4,089 (9.33 percent of total annual patient-days)
- Occupancy rate: 46.68
- Bed turnover rate: 13
- Average length of stay: 12.66

Department Staff

- Number of full-time equivalent physicians: 1.25
- Annual admissions per FTE physician: 258
- Annual patient-days per FTE physician: 3,271
- Number of FTE physicians per bed: 0.05
- Number of nurses per FTE physician: 5.82
- Staff at the department (including overhead and intermediate department personnel):
 - Number of FTE staff: 17.85
 - Number of FTE staff per bed: 0.74
 - Number of FTE staff per bed (according to occupancy rate): 1.59
- Staff within the inpatient department (not including overhead and intermediate department personnel):
 - Number of FTE staff: 9.52
 - Number of FTE staff per bed: 0.4

There are five urologists who divide their time between the renal dialysis unit, inpatient department, emergency unit, outpatient clinic and the operating rooms. This results in only 1.25 FTE physicians available in the inpatient department (the lowest number in the hospital). The number of physicians per bed is very low at 0.05 physician per bed (or one physician per 20 beds). The annual number of patient days per physician and annual number of admissions per physician are very high at 3,271 and 258, respectively.

The average cost per admission is 600 L.E. Drugs and medical supplies constitute only 11 percent of this cost. The operating rooms constitute 17 percent, as most admissions do not require surgery, and the radiology department constitutes 33 percent.

Intermediate departments account for 54.75 percent of the total cost per admission, while overhead departments account for 2.99 percent. The five main categories--equipment, building, personnel, utilities and drugs of the urology department represent 42.25 percent of the total cost per admission. See Table 28 for the distribution of costs per admission.

IV. Conclusion

Average costs are customarily used to provide data needed to rate hospital performance. The average cost, however, is not sufficient to reach decisive conclusions regarding the sources of hospital efficiency. Ideally, a comparative study of the cost per unit of output for several hospitals would provide useful data on the hospitals that have provided optimal services with the greatest efficiency. Understandably, several minimum conditions, including the quality of services provided and the clinical composition of the patients for each hospital, would have to be known to give credibility to such results.

Without an understanding of the differences in quality and the case mix across the different departments of Suez General Hospital, the efficiency implication of variation in average costs cannot be properly interpreted. High average costs may reflect high quality -- expensive equipment and adequate provision of drugs. Low average costs may be a result of inadequate provision of drugs and thus would represent poor quality -- as is the case in the general medicine, ICU and pediatric departments where drugs and medical supplies account for only 5 percent of the total cost of admission. If information on the quality of services and the case mix of patients is added to cost data, the efficiency implications of average cost information become comprehensible.

The average length of stay (ALOS) is an important indicator of the efficiency of hospital resource utilization. Differences in the average length of stay among comparable types of departments imply differences in prevailing treatment practices across the hospital. However, without information about case mix and severity, it is difficult to use length of stay as a direct indicator of efficiency. However, stays that are unusually long raise many questions regarding efficiency and prompt a closer look at the possible causes.

A high bed occupancy rate does not always indicate better hospital performance. Indeed, bed occupancy rates can be too high, meaning that the volume of services is above the designed level of the hospital. The implications of high occupancy for average costs and hospital efficiency are ambiguous without information on other service indicators. The explanation for such a case could be that a high occupancy rate may reflect a relatively efficient situation, as when many patients with modest lengths of stay are served (that is, the department has a high bed turnover rate). The pediatric department presents an example of this situation. Such departments are usually identified by having a relatively high average cost per day (L.E. 42 for pediatric department) along with a low average cost per admission (L.E. 232). On the other hand, high occupancy rates may result from deficient situations having a long length of stay (that is, the department has a low bed turnover rate). The general medicine department is an example of this situation, with a low average cost per day (L.E. 29) but relatively high average costs per admission (L.E. 346) and long lengths of stay (12 days).

Long lengths of stay tend to have lower than average costs per day because the treatment costs for the additional days are likely to fall below the average. Under the assumption that treatment cost profiles are relatively similar, high occupancy rates tend to result in lower than average costs per patient per day as overhead costs are spread over the beds that are usually filled and thus the lower than average cost would actually mask the inefficient hospital performance. preferably, following a policy to increase the bed occupancy rate through a greater number of admissions per bed rather than longer stays will allow more patients to be served and thus boost the hospital productivity.

The study demonstrated many inefficiencies in the operation of Suez General Hospital, particularly in low occupancy rates and excessive staffing in many departments. The following section details recommendations to improve management.

V. Recommendations to Help Improve the Performance and Cut Cost in Suez General Hospital

Hospitals perform a range of different functions: provision of inpatient treatment services within various medical specialties, specialist and general outpatient care, medical and paramedical support services, and other support services such as administration. It is important to know the balance of resources absorbed by different functions. To examine the efficiency with which departments of the hospital carry out their intended functions it would be desirable to have studies which specify cost functions and estimate average costs.

In nearly all countries, the largest share of public sector health expenditure is for hospitals, regardless of a country's health status and income level. It is both conventional and traditional to describe developing-country health systems as hospital dominated.

Hospitals internationally absorb approximately 30-50 percent of health sector expenditures, and 50-60 percent of current government health sector expenditures. General and central hospitals account for 60-80 percent of the total budget for hospitals, the remainder going to district hospitals (Mills 1990). In Jordan in 1987, the MOH spent 75 percent of the total recurrent health budget on hospitals. In Tunisia, hospitals represent 85 percent of national government health facilities (Mills 1990).

In Egypt, as in other developing countries, the distribution of recurrent resources within the government health sector strongly favors hospitals. The available data reveal that 50 percent of MOHP resources are assigned to hospitals (National health account, 1995).

Recommendations to improve the efficiency of Suez General Hospital include:

1. Hospital Autonomy

Currently, the hospital director has relatively little power for determining the number of staff, types and amount of items in the budget, drugs, maintenance, and equipment purchases. Increased hospital autonomy is the foundation for making hospitals more responsive and accountable to local conditions and demands for health services. In addition to increased hospital autonomy and decision making power for the hospital administration, an incentive system that reward increased efficiency and improved performance and good management is key. The rewards for good management and efficiency might include, for example, financial gain, recognition, or more rapid advancement. In the United States, the incentive to improve management, efficiency, and quality is frequently health insurance reimbursement and contracts only for those hospitals demonstrating the highest standards. Reimbursements are essential for the hospitals to remain in business.

A performance-based incentive system that incorporates efficiency indicators as those assessed in this cost analysis, plus additional indicators of quality of care, patient satisfaction, and rewards for the hospitals and managers that achieve outstanding gains is one feasible method for improving management.

In a system with greater hospital autonomy, the Ministry of Health and Population role could change into one of determining policies, developing incentive systems, guidelines and regulatory systems to ensure quality of care and access for the poor and underserved. This would diminish the role of the ministry in determining staffing, but would increase its role in developing standards of care, and potentially clinical guidelines.

2. Quality of Care

This cost study does not address how quality of care and efficiency interact. Quality of care depends upon technically skilled staff, effective operation of equipment used for diagnosis and treatment, adequate drugs, medical supplies, and proper sanitary conditions.

This hospital is deficient in several areas and ideally should improve both its efficiency and quality. Improved quality of care is likely to increase patient utilization, while improving the operating efficiency of the hospital.

3. Hospital Staff

There is no internationally accepted protocol for staffing ratios, because staffing choices must be made in the context of local constraints. Staffing ratios per bed or bed day are not an infallible proxy for quality of service. Training and skill level, supporting technology, drugs and supplies, team work, and organization of services are all essential complementary co-determinants of quality. In addition, differences in case mix between departments have an important role. For example, ICU patients need more staff than orthopedics patients.

An examination of staffing ratios reveals cross hospital variation in the total staff per bed and composition of staff. The numbers show that inpatient departments as well as outpatient clinics probably have excess personnel. The number of personnel (working in inpatient departments only) per bed is as high as 1 person, while 70 percent of time (more than 8 months per year) the bed is not used because of low occupancy rates (ICU department). These numbers will be translated to 4 persons per occupied bed in some departments. Using the step-down technique to allocate hospital staff to final service departments shows that the number of personnel per occupied bed goes up to 5. These numbers are the highest compared to other developing countries.

Each department has to assess its need for physicians and nurses in different specialties through the efficiency indicators and studies of patient case mix. Current figures imply discrepancies between the number of staff needed in each department with the actual patient number and occupancy rates. This study recommends linking the hospital needs for staff according to the level of occupancy rate for each department.

4. Drugs and Medical Supplies

Drugs and medical supplies account on average for 9 percent of the total costs per admission. This number decreases to 5 percent in the ICU. Increases in the budget for drugs and medical supplies will increase the total annual costs of the hospital: however, the availability of drugs will likely increase the quality of care and the utilization rate (number of admissions) and this, in turn, will decrease the total cost of admission. The correlation between drug availability and use of services is quite clear in the diabetes outpatient clinic where 60 percent of total outpatient visit costs goes to medications. See Graph 29 for the annual number of outpatient visits compared to drug costs. Graph 30 shows the annual bed days against the cost of drugs.

This study did not assess the availability of drugs in the hospital. However, during the study the team members heard informal comments about temporary lapses in drug supplies during which patients had to purchase their pharmaceuticals from private pharmacies to ensure a continuous supply to the hospital. A continuous, reliable supply of drugs is a **sine qua non** for quality care.

Increasing the autonomy of hospitals in managing the supply of drugs may assist in preventing these lapses in supplies and therefore maintaining a better quality of care. Hospitals could hold a portion of the drugs budget and not use it all to purchase drugs through the MOHP. The MOHP

may have access to favorable pricing: however, turn-around-time for drug orders can be many months. During this interim, hospitals could purchase needed drugs from the private sector in emergencies. Alternatively, some income from the hospital services could be set aside in an emergency drug purchase fund. Hospitals could consider joining with other private and public sector health agencies to pool drug purchasing and negotiate for lower prices.

5. Treatment Protocols

Physicians exert ultimate control over the way in which treatment procedures are used and the subsequent length of stay of patients. Diagnosis and treatment procedures for the same cause of admission vary among physicians of the same department. The quality of care may likely be improved by establishing a standard practice for specific admissions. However, there may be considerable professional controversy concerning the development of treatments standards.

6. Maintenance

Maintenance has important implications for the overall quality of the hospital environment and the services provided. Clean and attractive surroundings increase patient satisfaction and demand for services. The total cost of maintenance represents 2.57 percent of the annual recurrent costs. Unfortunately, maintenance costs are directed mainly towards repairing hospital equipment and not towards regular and preventive maintenance, for which there are no plans. The level of required maintenance depends on the operating environment, but the international average of maintenance costs ranges between 10-15 percent of the annual recurrent costs to uphold the hospital operation effectively (Mills 1991).

7. Average Length of Stay

Reducing the average length of stay by increasing occupancy rate would increase the turnover rate and would extend hospital benefits to a greater number of people. Without information about case mix and severity, it is difficult to use length of stay as a direct indicator of efficiency for departments. However, stays that are unusually long raise questions regarding efficiency and should provoke a closer look at possible explanations.

The study informally investigated the main causes of long average lengths of stay for different diagnoses. The following factors present some sources of extended lengths of stay:

- Most of the cases admitted to inpatient care for diagnostic tests are confined until results are received and then proceed for medical or surgical treatments.
- Physicians' lateness or absence due to the conflicting appointments arising from their dividing their time between hospital service and private practice. It is critical for the hospital to work out arrangements with the physicians to ensure that such conflicts are minimized.
- Absence of standard treatment practices, and treatment protocols for the same cause of admission vary among the physicians of the same department.
- Hospital infections as a result of poor sterilization (although very few data are available on the magnitude of hospital infections and their effect on ALOS). International data calculate 13.2 percent of surgery cases and 10.3 percent of orthopedics cases may obtain nosocomial infection (Blanpain 1987).

8. Information Systems

It is evident that the existing information systems rarely produce the required information. Research is required into how routine systems can best be altered and augmented to provide reliable data which will help identify resource allocation problems, planning changes in health sector resource allocation patterns, monitoring changes, taking adequate account of the recurrent cost burden of the hospital in investment decisions and implementation of plans. Collection and analysis of the data required to calculate average costs can be made a routine hospital activity

with the objective of improved planning, management and budgeting. A detailed, reliable information system for the collection of admissions, discharges, lab tests, drugs, personnel and other costs is needed for the implementation of any performance-based incentive system.

9. Use of Results for Pricing and Contracts

Suez General Hospital currently has a “economic ward” where private patients or patients covered by corporate plans stay when hospitalized. The results of this study will provide a definitive basis for negotiating a cost plus price for the daily reimbursement rate for these private patients based upon the average cost per day of L.E. 48. It can also be used for negotiating a reimbursement rate from health insurance companies and for health insurance companies to set insurance prices based on estimated annual costs for hospitalization and utilization in the population covered. In the current health sector reform environment in which the government is considering social insurance schemes, this information will provide a basis for estimating costs of hospitalization in the population.

10. Ambulatory Surgery

In industrialized countries, the hospital admission rate per capita has steadily declined. For example, in the United States, the number of occupied hospital beds per capita has declined more than 30 percent in the last 15 years despite the increasing age of the population. This phenomenon has resulted from an increasing transfer of inpatient services to outpatient care. most dramatically, surgical procedures have changed to outpatient services. The development of new techniques, instruments, better diagnostic tests and improved anesthesia with fewer side effects have resulted in short non-traumatic operations, rapid patient recovery and improved patient outcomes despite dramatically shorter hospitalizations.

Ambulatory surgery can be located either in hospitals or in independent sites. When located outside of the hospital, operations within the hospitals have decreased resulting in lower occupancy rates. However, when located within hospitals, the capacity to perform ambulatory surgery can assist in maintaining or even increasing utilization. In a study in Cali, Colombia, the costs per surgical case is about 30 percent of the cost of traditional surgical procedures, while patients satisfaction was greater for the outpatient procedure (Shepard, Walsh, et al., 1994). Other types of procedures have also been transferred to the outpatient department from inpatient, such as, long-term therapy for cancer or chronic infections and diagnostic procedures. In Cali, as an alternative to building new hospitals when the general hospital became overcrowded, ambulatory surgical and reference units were built around the city.

For Suez General Hospital, increasing the capacity of the general hospital to perform ambulatory surgery and other treatments would potentially assist in increasing efficiency in terms of cost per admission while fulfilling the patient demand for improved hospital care. This would require upgraded skills, on the part of the surgeons and anesthesiologist, as well as specialized equipment. The average length of stay for many operative admissions is many days longer than the US. See Table 14.

11. Nosocomial Infection

A study in one university hospital in Cairo revealed that the overall hospital-acquired infection rate was 5.6 percent of the total patients discharged. Post-operative wound infection is the most frequent infection site. The infection rate reached 10 percent of the total patients discharged in special surgery departments. Suez General Hospital should use a surveillance system for the continuous monitoring of hospital-acquired infection. Controlling hospital acquired infection will increase the bed turnover rate and reduce both the average length of stay and the total cost per admission.

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Annex I: Text Table

Annex II: Text Figures

Annex III: Definitions and Data Notes

Admission per physician: The average number of patient admissions per full time equivalent physician during one year.

= annual admissions / total number of FTE physicians

Allocative efficiency: The extent of optimality reached in the distribution of resources among a number of competing uses.

Ancillary service cost: These include the cost of all cost centers in intermediate service departments except kitchen and laundry cost centers.

Annual admissions: Total number of admissions during reference time (July 1, 1993 to June 30, 1994).

Annual days of stay: The total number of patient-days from admission to discharge during one year.

Annual cost of department: The total annual cost of the department after allocation of overhead and intermediate departments using the step-down allocation method (see table 17).

Annual hospital expenditures: Includes the annual cost of personnel, medications, depreciation of buildings and equipment, and food and utilities.

Annual values: Values of the use of capital items for health services, such as equipment, vehicles and building, for one year.

Average cost (unit cost): Defined as the total cost divided by number of units of output, e.g., cost per admission, cost per patient-day and cost per outpatient visit. Similarly, marginal cost is the additional cost required to produce one more unit of output.

Average length of stay (ALOS): The mean number of days from admission to discharge for diagnosis and inpatient department.

ALOS = Annual number of inpatient days/Annual number of admissions.

Bed turnover rate (T): The average number of patient admissions per bed during one year.

T = Annual number of admissions/Average number of available hospital beds during a year.

Costs: The products of price (or unit costs) and the number of units consumed (or service intensity). The higher the average level of unit costs, the more important the variation in service intensity.

Capital cost: The annual cost of resources that have a life expectancy of more than one year, e.g., buildings, equipment and vehicles. Staff training also can be classified as capital cost if the new skills are expected to last for one year or more. The costs of refresher training courses that occur throughout the year should be classified as recurrent.

Cost-effectiveness analysis: The technique used for identifying which health interventions achieve the greatest level of health impact per unit of investment.

Cost per admission = Total annual cost of inpatient department/total annual number of admissions for the department.

Direct costs of department: The costs attributed to each cost center prior to the allocation of the cost centers associated with hospital outputs.

Disability-adjusted life year (DALY): The unit used for measuring both the global burden of disease and the effectiveness of health interventions, as indicated by reductions in the disease burden. It is calculated as the present value of the future years of disability-free life that are lost as the result of the premature deaths or cases of disability occurring in a practical year.

Equipment operation and maintenance: Cost of maintaining equipment in operating order.

Economic cost: Presents the opportunity cost of using resources and inputs in one intervention rather in their next best intervention use. More formally, it is the payment required to keep that input in its present employment, or... the remuneration the input would receive in its best alternative employment (Nicholson, W., *Microeconomics Theory: Basic Principles and Extensions*, Fourth Edition, Dryden Press, New York, 1989, p. 309).

Economic efficiency: Economic inefficiency occurs when the hospital is not using the least expensive combination of inputs for a given output (Barnum 1993).

Final service departments: Cost centers which provide services directly to patients and not to other departments, e.g. inpatient departments and outpatient clinics.

Financial cost: The actual expenditures or outlays made for a specific intervention.

Full-time equivalent (FTE) physician: FTE was calculated by dividing each physician's work by specialty by the ratio of his/her work in outpatient clinics, inpatient departments, operation theaters and the emergency unit (table 6 presents the percentage of working time per activity for physicians for each department).

FTE physician for inpatient departments: The total number of physicians working at inpatient departments and operating rooms.

FTE physician per bed: Measures the number of physicians working full-time per bed for inpatient departments.

= Total number of physicians working at inpatient departments and operating rooms/total number of beds.

FTE staff step-down: The study used the step-down allocation technique to allocate overhead and intermediate department personnel to final service departments to get the total number of full-time equivalent personnel working in each final service department.

Hotel services cost: This includes food and laundry costs.

Intermediate service departments: Intermediate service departments are those that offer services both directly to patients and to other final medical departments. Examples include: operating theaters, laboratory and X-ray. In this analysis, kitchen and laundry departments were also included in the intermediate category because costs in these centers were estimated and distributed in a way similar to those of other intermediate departments.

Intervention (in health): A specific activity meant to reduce disease risks, treat illness, or palliate the consequences of disease and disability.

Number of nurses per FTE physician: Measures the number of nurses working with a full-time physician.

= Total number of nurses/total number of FTE physicians

Overhead departments: Cost centers which produce only those services that are consumed by other departments (cost centers) of the hospitals, not by patients. Examples include: maintenance, legal affairs and finance.

Overhead cost: These costs remain essentially constant regardless of whether a bed is occupied.

Occupancy rate (OCC): Measures the percentage of total available beds that are occupied by patient during on year.

OCC = (Annual number of patient days) X 100 / (Average number of available hospital beds during a year) X 365 days.

Patient days per FTE physician:

= annual number of patient days at inpatient department/ Total number of FTE physicians working at the inpatient department.

Per Diem: Cost of daily stipends for health workers involved in supervision activities.

Personnel cost: Value of labor, including health professionals, administrative staff, and non-health personnel (e.g., drivers), used to provide health services during the reference period.

Present value (current values): Estimates the current value of the capital item – the amount you would have to pay to purchase a similar item at the present time (the replacement value rather than the original price). It is the market value of the item e.g., equipment, square meter of constructions (WHO cost analysis manual 1992).

Reference time: The period of data collection for costing of the health facilities from July 1, 1993 to June 30, 1994.

Recurrent cost: The cost associated with inputs that will be consumed or replaced in one year or less, for example, staff salaries, utilities, drugs and medical supplies.

Step-down method: The technique used to distribute costs from the overhead departments to other overhead departments and finally to intermediate and final service departments, according to allocation criteria devised to resemble as closely as possible the actual use of resources by each department. The term “step-down” is used because of the format in which the distribution of costs is made.

Technical efficiency: The extent to which choice and utilization of input of resources produces a specific health output, intervention or service at the lowest cost (WDR 1993).

Tertiary-based health services: A hospital or other health facility that offers a specialized, highly technical level of health care for the population of a large region. Characteristics include specialized intensive care units, advanced diagnostic support services and highly specialized personnel.

Useful life: Estimates the number of years of useful life the item realistically can be expected to have after being acquired.

Annex IV: Data Sources

I. Hospital Cost

A. Capital Cost

1. Building space:

- Engineering Department
- Maintenance Department

2. Equipment, vehicles and furniture:

- Physical inventory
- Log books no. 118, 112, and 121
- List of received items for nurses at different departments.
- Purchase dept. at health directorate.

B. Recurrent Cost

1. Personnel:

- Sheet no. 132 A.H.
- Sheet no. 50 A.H.
- Log book for salary
- Personnel Department

2. Drugs and medical supplies:

- Log book for inpatient, outpatient and emergency pharmacies

3. Utilities, include

- Water: Receipts for water
- Electricity: Receipts for electricity
- Telephone: Receipts for telephone
- Gas: Receipts for gas
- Benzene, oil: Receipt for benzene and oil

4. Others, include

- Food: Receipts for food
- Stationery: Receipts for stationery

5. Maintenance, include:

- Building: Receipt for maintenance
- Equipment: Receipt for maintenance
- Vehicle: Receipt for maintenance

II. Hospital Statistics

Number of admission: Admissions discharge log book for 1993-94.

ALOS: Admissions discharge log book for 1993-94.

Outpatient visits: Outpatient log book for 1993-94.

Surgical procedures: Log book for operation theaters for 1993-94.

Lab tests: Log book for inpatient laboratory for 1993-94.

X ray: Log book for inpatient and outpatient radiology departments.

Annex V: Data Collection Forms