

**AN ESTIMATION OF THE COSTS AND EFFICIENCY OF PUBLIC HEALTH
CARE FACILITIES IN NAIROBI, KENYA.**

By

ONYANGO, HUGH CHRISTOPHER

**UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION**

Research paper submitted to the Department of Economics, University of Nairobi, in
partial fulfillment to the requirements for the degree of Master of Arts in Economics.

**JOMO KENYATTA MEMORIAL
LIBRARY**

September, 2001

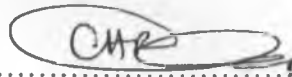
University of NAIROBI Library



0444742 1

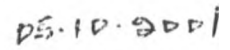
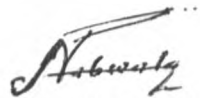
DECLARATION

This Research paper is my original work and has not been presented for a degree in any other university.

A handwritten signature in black ink, appearing to read 'CHC', enclosed within an oval shape. Below the signature is a horizontal dotted line.

ONYANGO HUGH CHRISTOPHER

This Research paper has been submitted for examination with our approval as university supervisors.

A handwritten signature in black ink, appearing to read 'Hellen Ommeh', followed by the date '05.10.2001'. Below the signature and date is a horizontal dotted line.

DR. HELLEN OMMEH

.....

MR. W. OCHORO

TABLE OF CONTENTS

	Pages
List of tables	(iv)
Abbreviations	(v)
Acknowledgements	(vi)
Dedication	(vii)
Abstract	(viii)

CHAPTER ONE INTRODUCTION

1.0: Background.....	1
1.1.0: Demographic and socio-economic profile of Nairobi.....	4
1.1.1: The public health sector in Nairobi.....	8
1.2: Statement of the problem.....	10
1.3: Objectives of the study.....	11
1.4: Significance of the study.....	12
1.5: Organization of the study.....	12

CHAPTER TWO: THEORETICAL AND EMPIRICAL LITERATURE REVIEW

2.0 Introduction.....	14
2.1 Theoretical literature review.....	14
2.2 Empirical literature review.....	17
2.3 Summary of literature review: a critique.....	20

CHAPTER THREE: METHODOLOGICAL FRAMEWORK

3.1	Analytical framework..	21
3.2	Type of data and sources.....	24
3.2.1.	Data collection methodology	24
3.2.2:	Sampling of health facilities	25
3.2.3:	Data limitations and reliability.....	26
3.3	Model specification.....	27
3.4:	The hypothesis	29
3.5	Estimation methods.....	29

CHAPTER FOUR: ASSESSMENT OF EFFICIENCY INDICATORS WITHIN HEALTH FACILITIES IN NAIROBI

4.0	Introduction.....	32
4.1	Assessment of efficiency indicators within health facilities.....	33
4.1.1:	Staffing and adequacy.....	33
4.1.2:	Patient to health staff ratio	34
4.1.3:	Drug use and management.....	35
4.2.	Discussion of the survey findings	38

CHAPTER FIVE: EMPIRICAL RESULTS AND ANALYSIS

5.0:	Introduction.....	39
------	-------------------	----

5.1	Descriptive statistics	40
5.1.1:	The average and marginal cost variables	40
5.2	Empirical results of the cost functions	42
5.2.1:	Interpretation of cost function and hypothesized coefficients	42
5.2.2	Efficiency estimations and interpretation	44
5.2.3	Interpretation of the OLS efficiency function	46
5.3:	Summary of empirical results	47

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1:	Summary and Conclusion	49
6.2:	Policy recommendations	50
6.3:	Limitations of the study	52
6.4:	Indicators for further research	52

References

Appendices

LIST OF TABLES

	Title	Page
Table 1.1:	Distribution of health facilities in Kenya in 1998	4
Table 1.2:	Population census and public health facilities for Nairobi between 1962-1999	5
Table 1.3:	Socio-Economic Adjusted status of Nairobi's population	8
Table 4.1:	Average level of staff deficits per health facility	34
Table 4.2:	Average patient to staff ratio per health facility	34
Table 4.3:	Patient to staff ratios per health facility	35
Table 4.4:	Cost of drugs supplied to health facilities during 1999 – 2000	37
Table 5.1:	Average and marginal cost estimations	41
Table 5.2:	Maximum likelihood estimates of the short run cost function	42
Table 5.3:	Facility specific efficiency and inefficiency levels during 1999-2000	45
Table 5.4:	OLS Efficiency regressions	46

ABBREVIATIONS

ALS	-	Aigner, Lovell and Schmidt model
DP	-	Development Plan
ES	-	Economic Survey
ESAF	-	Enhanced Structural Adjustment Facility
FY	-	Financial Year
GDP	-	Gross Domestic Product
HPFP	-	Health Policy Framework Paper
MCH/FP	-	Maternal Child Health & Family Planning
MLA	-	Ministry of Local Authorities
MLE	-	Maximum Likelihood Estimates
MOH	-	Medical Officer of Health
MPH&MS	-	Ministry of Public Health & Medical Services
NCC	-	Nairobi City Council
NGO's	-	Non-Governmental Organizations
NHIF	-	National Health Insurance Fund
OLS	-	Ordinary Least Squares
PMO	-	Provincial Medical Officer of Health
SES	-	Socio-Economic Status
WHO	-	World Health Organization

ACKNOWLEDGEMENTS

This research paper was completed with the help of many people. Most sincere thanks go to my supervisors for their professional support and guidance. I am also grateful to Professor Germano Mwabu and Dr. Owino Wasunna for their profound support during my studies and useful contributions towards this paper.

I owe much gratitude to my sponsors, the Government of Kenya for awarding me a scholarship through the Ministry of Tourism, Trade & Industry. Without the financial assistance, it would have been impossible for me to get postgraduate education.

I wish to thank the 1999-2000 M.A. class for supporting me in various ways during the MA Programme. I am greatly indebted to Prof. Kimuyu of IPAR for availing the FRONTIER 41 package used in the analysis. I also wish to thank NCC and MoH personnel who provided the data for this study.

Finally, I wish to thank my family in a big way for giving me every support I desperately required to complete my postgraduate studies. My greatest thanks go to my wife Susan and daughter Fridah. I also acknowledge the assistance of the entire staff of the Department of Regional cooperation i.e. the COMESA & EAC desks for supporting my work in various ways during the entire course.

DEDICATION

This research paper is dedicated to my beloved daughter Harriet 'Fridah' Achien'g.

ABSTRACT

This study estimated the costs and efficiency of selected public health facilities in the provision of outpatient care in the city of Nairobi during the years 1999 and 2000. Both Secondary and primary data were used. The combinations of purposive and judgmental sampling procedures were used to collect data, while the stochastic frontier model provided the framework for our analysis.

Generally, the estimated results strongly indicated that the number of outpatient visits and costs of labour and drugs were important determinants of the costs and efficiency of public health facilities in Nairobi. On average, the study revealed an average of about 6.6% level of inefficiency within the facilities. This was particularly attributed to limited funding, shortages of medical and non-medical staff, and lack of appropriate drug distribution and management/dispensation practices among others. The results further showed that the health facilities operated with declining average costs and increasing returns to variable factor inputs.

The most notable implication of these findings to policy is that, in the short run, increased coverage and access to outpatient health care services in Nairobi can be achieved at relatively lower incremental costs. These and other results were used to make recommendations.

CHAPTER ONE INTRODUCTION

1.0 BACKGROUND

The allocation and management of health sector resources have become critical concerns in both the developed and developing countries. The concerns are a product of multiple factors, but mainly hinging on pressures to reduce public spending and address account imbalances in the wake of increased demand for health services. In Kenya, the demand for health services has been rising over the years. However, dismal negative economic growth rate of 0.3 per cent resulted into reductions in real public health expenditures (Economic Survey, 2001).

In order to cope with the increasing demand for health care services, governments have been forced to adopt policies geared towards enhancing efficiency and cost effective use of available health resources. Efficiency in the health sector requires that once an activity or mix of output has been determined (e.g. the mix of curative & preventive services), the activities are carried out without wastage of inputs (staff, drugs etc) and at minimum possible costs (McPake et al, 1997).

Health sector policies and strategies in Kenya are geared towards reducing the incidence of diseases and improving the health status and quality of life of the population (Health Policy Framework paper, 1994). The objectives of these policies and strategies have included the promotion of primary health care, increasing access to health care services and encouraging the private sector to play a bigger role in the delivery and financing of health care.

In response to the growing demand for health services, the Kenya government embarked on a series of health sector financing policy reforms. The reforms first began in 1989 in response to the growing demand for health services amid constrained resources, under the World Bank's Structural Adjustment Programme (Akin et al, 1987). The components of the reform programme included: - expanding cost sharing in government facilities, increasing the role of social insurance in funding public and private health care, and improving efficiency in resource use and management.

The specific reform objective, as it related to the costs and efficiency of the public health sector, was the institutionalization of management tools for cost containment and cost control, particularly for the hospital and curative sector (Policy Framework paper, 1994). The Government recognized the need for the improvement of local management of resources, especially within the resource constrained public health care facilities. To improve this more effectively, the Ministry of Health and Medical Services became involved in setting up limits on local expenditures to encourage more effective management and maintaining defined standards of quality of care within strict cost limits. In addition, the other proposed strategy was the allocation of resources to institutions on the basis of historical workload data. This was particularly, aimed at promoting greater efficiency and minimizing inequality in resource allocation between facilities of the same type and capacity.

The Kenyan, health sector comprises the public health care system with major players being the Ministry of Public Health & Medical Services and the Ministry of Local Government. Other players are Non-Governmental Organizations, missions and the private sector. While the non-

governmental providers focus on curative services with limited provision of preventive services, government providers engage in preventive, promotive, curative and rehabilitative services, and other essential public health activities.

The overall mandate for the health services promotion in Kenya is vested with the Ministry of Public Health & Medical Services under the Public Health Act cap 242 of the laws of Kenya and under the various subsidiary legislations dealing with specific areas of health services provision. The ministry is assisted to administer health services by various boards and councils, which regulate the performance of service institutions and of the health workers. The ministry has the responsibility to formulate policies, establish and enforce standards and mobilize resources for health services development.

Health care services in Kenya are delivered through a network of about 4,200 health facilities with the public delivery system accounting for 51% of the total as shown in the table 1.1. Beyond treatment of illnesses, the system provides other integrated programmes aimed at preventing diseases, promoting good health and protecting Kenyans from environmental, industrial and other health risks.

According to the Economic Survey (2001), the government has remained the major source of funding of health services, accounting for 47% of the total health budget, the Ministry of Health 42%, and the ministry of local government 5%. Private individuals account for 41%, while the National Health Insurance Fund (NHIF) and donor agencies for 4% and 3% respectively.

Table 1.1: Distribution of health facilities in Kenya 1998

Facility Type	GoK No	%	NGO	%	Private	%	Total
Hospital	109	50	67	30.7	42	19.3	218
Health centre	460	80	100	17.4	15	2.6	575
Dispensary	1537	60.9	595	23.6	391	15.5	2523
Nursing & maternity Home	0	0.0	11	5.8	180	94.2	191
Clinics & Medical centres	43	0.1	72	10.2	592	83.2	707
Total	2149	51.0	845	20.1	1220	29.0	4214

Source: Health Information System, MoH 1999

Generally, the decline in real earnings following the poor economic performance have had direct negative implications on expenditures on health by both the government and the individual households. For instance, although the recurrent budgetary allocations to health increased in nominal terms, in real terms however, there was a secular decline of the expenditures. The recurrent government expenditures fell from 9.26 % to 3.09 % during the 2000/2001 financial year. The per capita expenditures also declined over time, from US\$ 9.8 in 1980/81 to US\$ 3.4 in 1997.

1:1:0 DEMOGRAPHIC AND SOCIOECONOMIC PROFILE OF NAIROBI

Demographic information are important for health sector planning. For instance, reliable

population figures are essential for determining coverage of services, and sound projection into the future are the framework for determining where new facilities should be built or additional inputs provided in order to reach to a growing population. Important statistics such as annual visits per person can not be calculated without basic demographic information. So far, there has been six population censuses taken in Kenya since independence. The first one taken in 1948 reported Nairobi's population to be 118, 794. Subsequent censuses were taken in 1962, 1969, 1979, 1989 and lastly, 1999 with the following results.

1.2: Population census and public health facilities in Nairobi between 1962 -1999

Year	Population	Hospitals	Health Centres	Health centres & Dispensaries	Total No. of Health facilities
1962	343,500	-	-	-	-
1969	509,286	-	-	-	-
1979	827,775	26	2	112	140
1989	1,327,000	30	18	116	158
1999	2,143,254	54	36	312	402

Source: Ministry of planning, 2000

Thus the annual population growth rate for Nairobi between the first two censuses (1948 and 1962) was about 6.9%. Subsequent annual growth rates were as follows:- 5.55% (1962 & 1969), 4.9% (1969 & 1979), 4.7% (1979 & 1989) and 4.8% (1989 & 1999). At the same time, the number of health facilities has also been increasing as shown in table 1.2.

The NCC classifies the city in terms of housing into three major groups i.e. low, middle and

high, based on Socio-Economic Status (SES). Free standing or single family houses or large plots predominate high income groups, while attracted houses and walk up flats comprise most of the middle income areas. Low-income areas consist of one storied site and service housing, inexpensive attached houses, flats and slums.

Thus, areas such as Karen, Lan'gata, Woodley, Golf Course, Kenyatta hospital, Kilimani, Westlands, Parklands and Roysambu are all classified as high income. Within these areas however, there are pockets of middle or low-income groups. Low population densities characterize most of the high-income areas. This is true of Karen, Lan'gata, and Westlands whose densities are less than 7,000 persons per square kilometer. On the other hand, middle income groups are found in Nairobi West, Southland's and the surrounding estates, South B/C, Ngara, Pangani, Buruburu, Donholm and Kenyatta University. Finally, low-income areas include Starehe location, Kamukunji, Pumwani and Eastleigh locations, Kaloleni, Maringo, Makadara, Embakasi, Njiru. Dandora, Mathare, Kariobangi and Kasarani locations. Most of the low-income areas have high population densities.

In general, those areas classified as 'low' contain the major target ('user') populations for public services. For many residents in these areas, the costs of private services, and even bus fare, are factors they consider. For planning purposes, all residents in the low SES areas are considered potential clients.

In contrast, the population of both locations in the Westlands division (Parklands and Kilimani) is classified as 'high SES'. The percentage of potential clients in these areas is much lower than

in Dagoretti. While more will have to be done to determine the actual percentages of potential clients, it is estimated that high SES areas should have a user population of about 25% of the actual residents. The implication of planning is that facilities in Westlands should have the capacity to service a population of between 30,000 and 40,000, rather than 200,000. This will influence the planning of physical facilities, staffing and other decisions.

Areas where the SES is medium, the estimated user population is about 50%. This is due to the fact many people in this group choose private practitioners and have a wider range of options for the lower socioeconomic status. Table 1.3 presents a divisional summary of the SES adjusted population for the year 1999 according to the Welfare Monitoring Survey Report (1999). The socioeconomic coefficient used in this table represents the weighted average of the location coefficient for each of the representative divisions.

Overall, the use of this approach reduces the size of the actual population to the 'Adjusted population' by approximately 15% in the city of Nairobi. These estimates of the level of user populations will require further refinements, but indicate a way in which information can be used for planning and resource allocation decisions.

However, no single area exists entirely in isolation. Facilities close to the border of two or three divisions might have catchment areas that include residents in other divisions. Likewise, facilities on major access roads tend to serve populations greater than the division in which they are located.

Table 1.3: Socio-economic Adjusted Status of Nairobi's Population

Division	Socioeconomic Coefficient	1999 population	1999 population SES adjusted
Makadara	0.91	197,434	179,664
Kamukunji	0.95	202,211	192,100
Starehe	1.00	234,942	234,942
Lan'gata	0.77	286,739	220,078
Dagoretti	1.00	240,509	240,509
Westlands	0.25	207,610	51,912
Mathare	0.93	338,924	315,199
Embakasi	1.00	434,884	434,884
Total	0.85	2,141,253	1,820,065

Source: Ministry of planning, 2000

1:1:1 THE PUBLIC HEALTH SECTOR IN NAIROBI

There is a wide range of health facilities in Nairobi. They include single purpose clinics, integrated service centres, private medical clinics and the Kenyatta National Hospital; a national referral hospital. Currently, Nairobi is served by 402 health institutions out of, which 54 are hospitals, 36 health centres and 312 health sub-centres & dispensaries.

Public health facilities are run by two major entities i.e. the Nairobi city Council under the Ministry of Local Authorities and Provincial Medical Office under the Ministry of Health & Medical Services. The NCC is the largest public health provider operating about 80 facilities.

The NCC facilities operate under the municipal authority of the Ministry of Local Authority and are directed by Public Health department headed by the Medical Officer of Health. The council revenues, funds from the ministry and revenue from user charges finance health services in the city. The NCC facilities provide the bulk of the services to residents of the low income and slum areas of the city. Populations in the middle and higher income brackets tend to rely more on alternative health care providers. The NCC runs 8 hospitals, 20 health centres, 3 dispensaries and 46 clinics and 3 others.

On the other hand, the Ministry of Health (MoH) provides health services to organizations like military, police, Public service, Prisons etc. In Nairobi, the provincial medical office (PMO) manages a diverse range of general and specialized facilities and one district hospital. Most of the PMO outpatient dispensaries serve clients from government institutions. The health services are financed by the Ministry of Health budget as well as by the parent organizations, which provide buildings, nursing personnel, transport and most of the other support staff. The PMO provides staff and services in 48 health facilities. They include 1 district hospital, 19 health centres, 23 dispensaries and 5 clinics.

There are restrictions on access to MoH facilities. The outpatient facilities serve clients from government institutions and organizations rather than the general population. In some cases such as the Kamiti Prison Hospital and GSU Headquarters, access is restricted to carefully defined categories of users. In Moi Educational Centre, the location and internal policies of the sponsoring organization lead to a de facto limitation to the use of the facility. The MIH Chandaria in Dagoretti which, is operated by the Minnesota Volunteer Group is open for

provision of services to the general public.

The major differences between MoH and NCC facilities are the client population served. For instance, while NCC facilities are open to the general public, the MoH facilities primarily serve specific groups. Public accesses to all but a few MoH facilities are restricted. Another major difference between them is the provision of maternal & child health/family planning (MCH/FP) services. NCC operates about 20 MCP/FP clinics, while MoH has none.

1.2 STATEMENT OF THE PROBLEM

Although the country has achieved considerable progress in the improvement of the health status of Kenyans since 1963, persistent poor economic performance has negatively affected the promotion of coverage, access and quality of health services to the populations. Today, it is clearly evident that the ability of the government to provide effective health services has been outstripped by the increasing demand (HPFP, 1994; Development Plan 1997-2001).

In Nairobi, increasing numbers of people lack access to basic health care and preventable and/or easily treatable diseases continue claiming many lives. Meanwhile, many public health facilities lack basic diagnostic and treatment equipment, while overcrowding and shortages of basic pharmaceuticals & medical supplies are largely evident. Yet, these facilities are critical in the provision of health care for all Kenyans, particularly the poor and the vulnerable, who can barely afford the more costly private health services (Wasunna & Korir, 1997).

A close look at the operations of these facilities reveal evidences of wastage of resources, inappropriate utilization of staff and physical capacity, malfunctioning of equipment and lack of expenditure containment measures, among others (Wasunna & Korir, 1997). Besides, some facilities have been built but have not been opened, or are operating below capacity (Wan'gombe et al, 1998). These and other problems have led to failure or breakdown of the referral system and general deterioration of services (Mwabu, 1989; WHO, 1992; Development Plan, 1997-2001).

In view of the deteriorating conditions and the poor state of health care financing, the need to address efficiency issues in the health sector is what is of interest to us. For instance, can increased coverage and promotion of access to health care services by the population be achieved through improved allocation patterns within and between the health facilities in Nairobi? If so, which components of the health inputs can be more or less responsive, and why? If not, which components are more rigid, and why? Lastly, what lessons do the above outcomes have to health policy-makers in Nairobi, the country as a whole and elsewhere?

1:3 OBJECTIVES OF THE STUDY

The broad objective of our study is to analyze the costs and efficiency of public health facilities in the city of Nairobi. The following constituted our specific objectives: -

1. To compute the average costs, marginal costs and efficiency estimations of various public health facilities in Nairobi.

2. To analyze the factors, which influence the efficiency of public facilities in Nairobi.
3. To make policy recommendations based on the study findings.

1:4 SIGNIFICANCE OF THE STUDY

In the past decade, the study of efficiency of the health delivery system in the developing world has intensified. As a result, a number of problems have emerged in studying the subject. These span from the simple definition of the efficiency of health service delivery to the more complex problems relating efficiency to the coverage and access to health care services. However, despite it's importance, only a few empirical studies have been directed at addressing efficiency issues. A leading justification for the interest in public health sector efficiency is it's potential influence on health service delivery and access.

In the city of Nairobi, the interest on public health sector efficiency emanates from the pressure to increase health expenditures during a period of limited resource availability and gross inefficiencies in the health system. Furthermore, the increasing demand for health care services require efficient use of the available resources in order to cope with increasing demand. The findings of this study are therefore considered useful to public health sector managers in promoting efficiency within the entire health system.

1:5 ORGANIZATION OF THE STUDY

The rest of this study is organized as follows: - Chapter two deals with the review of theoretical

and empirical literature. In chapter three, the methodological framework used to estimate the efficiency of the public health delivery system in Nairobi and data sources and collection methods is presented. Chapter four focuses on the assessment of efficiency indicators within the health facilities in Nairobi. Chapter five is devoted to the presentation of the empirical results and data analysis. The final chapter gives a summary, conclusion and policy recommendations. The study limitation and indications for further research are also given in this chapter.

CHAPTER TWO THEORETICAL AND EMPIRICAL LITERATURE REVIEW

2.0 INTRODUCTION

In this chapter, general literature on costs and efficiency of the public health sector and specific literature on Kenya are reviewed with special emphasis on both theoretical and empirical studies.

2: 1 THEORETICAL LITERATURE REVIEW

A number of early studies estimated hospital costs functions using unit costs specifications, where the average hospital cost was considered as a function of interrelated explanatory variables such as occupancy rates, patient flows, length of stay, and capacity or size. These studies laid the foundation for hospital cost estimations. For instance, in a study of the relationship between cost to hospital size in the United States of America, Carr and Feldstein (1967) estimated an average hospital cost as function of some of the above variables. Their general conclusion was that costs are higher as the complexity of service offered by the hospital rises and that diseconomies existed for the largest hospitals.

In addition, Lave and Lave (1970) also estimated hospital cost functions for 74 hospitals in western Pennsylvania over the period 1961-1967 using two distinct. Their estimated equations implied that the average cost curve was a function of utilization, size of the hospital and a time trend. With trials from various specifications, the coefficients for utilization and size were negative, while time had a positive coefficient. One of their conclusions was that the average-cost curve for hospitals appeared to be L shaped.

Another example is the Francisco study of the cost curve for short-term general hospitals (Francisco, 1970). Using data on 4710 hospitals from the American Hospital Association annual survey for 1966, he estimated an average cost curve in which the occupancy rate, an un-weighted index of facilities and services (F), and a dummy variable (D) for location were the explanatory variables. Utilization had a positive coefficient, while the coefficients for (F) and (D) were both positive. Similarly, they concluded as did Lave & Lave that the average-cost curve for hospitals is L-shaped.

These studies, among many others, paved the way for improvements in the formulation and application of the cost functions in different fields. For instance, Anderson (1980) estimated a single hospital output (bed days) unit cost function for 51 district and provincial hospitals in Kenya, to determine scale efficiency. The results indicated that Kenyan public hospitals were operating in short run economies of scale. However, the formulation adopted to capture inefficiency is difficult to apply to hospitals as is also argued by Wagstaff and Barnum (1992) and Wasunna & Korir (1997). Besides, the study paid less attention to inefficiency as a cost-increasing phenomenon.

In 1987, Dor estimated an average cost curve in a study of Peruvian health facilities. The data showed that the average-cost curves were u-shaped and that half of the hospitals had increasing returns to scale. However, the study was limited by having only 11-19 observations.

In a study of hospitals in Ethiopia, Bitran & Dunlop (1989) pooled cross-section and time series data from 15 hospitals. The explanatory variables in the study included inpatient days and

outpatient visits, number of deliveries, laboratory tests surgical operations and beds. They found nearly constant returns to scale for inpatient services and mild economies between inpatient and outpatient services. Apart from failure to measure efficiency indices, the other shortcoming of the study was its inability to provide results for individual hospital sizes. However, the researchers suggested that additional data would be required to disintegrate the sample by hospital size and by functional level.

Barnum and Kutzin report (1993) estimated hospital cost functions for five developing countries (Kenya, Ethiopia, Nigeria, Columbia and China). There was country specific variability in their findings. The basic conclusion was that the variability of the results indicated the caution that should be used in estimating and interpreting such functions by considering the country specific context within which hospitals operate. However, generally, the study found that there were diseconomies of scale with regard to bed days. So rather than expand hospital size or the number of facilities to reduce occupancy rates, a reduction in the length of stay was recommended to expand capacity and labour costs.

The other findings were that there were, in general, constant or decreasing returns to scale and no economies of scope. Specifically, community and district level hospitals showed constant returns to scale; tertiary level hospitals showed diseconomies of scale or outpatient visits; while with respect to in-patient days, all hospitals exceeded the optimal scale. The implications of these findings were that hospitals constructed in developing countries should not be too large and that the large hospitals should not expand their outpatient facilities. This is to say that there should be increased interest in strengthening the capabilities of first referrals to provide better integration

into the referral and support system for hospitals. However, these studies ignored the measurement of efficiency as a cost increasing or decreasing factor in the delivery of outpatient health care services.

2.2 EMPIRICAL LITERATURE REVIEW

A number of empirical studies have estimated hospital cost functions and predicted facility level efficiencies. For instance, a study of Nigerian hospitals by Wouters, A. M. (1993) employed production and cost frontier functions to conduct an efficiency analysis using data from 24 facilities in Ogun State. The sample was composed of 21 public and 3 private facilities. The efficiency index was obtained by computing the ratio of the marginal productivity of the two categories of workers and their wages.

Economic theory states that firms which, minimize costs, will hire inputs such that the equality shown in equation below holds.

$$\frac{\text{Marginal product (HHW)}}{\text{Wage(HHW)}} = \frac{\text{Marginal product (LHW)}}{\text{Wage(LHW)}} \dots\dots\dots(1)$$

From the above ratio, he calculated an efficiency index, which measured the extent to which this inequality did not hold. If the ratio of marginal productivities to wages is greater than one, too few low-level health workers relative to high-level health workers are used. The relative productivity of low-level health workers is greater than their relative wage. The opposite is true

if the ratio is less than one. As shown, this was translated into the efficiency index (E) presented in equation below.

$$E = \{[(MMPlhw/ MPPPhw)/ (WAGElhw/WAGEhhw)] -1\} \dots\dots\dots(2)$$

This index was then used as an independent variable in the multiple regression estimate of the cost function of health services.

Results showed that while public facilities had an average of 0.63 efficiency index, the private facilities scored an average of 0.51. However, this study was limited by the use of a single input variable i.e. the productivity of labour, in the estimation of efficiency. Apart from labour costs, our study uses drug costs and outpatient visits in the estimation of the efficiency variables. According to the production estimates in this study, if all inputs were increased by 1 percent, there would be at least 17 percent increase in output. The ray -specific scale measure, which assumes constant mix of services, also showed nearly constant returns to scale as shown in table (III) in appendix 3.

Furthermore, the results suggested that for inpatient services, the facilities operated below capacity; high fixed`costs distributed over relatively few admissions. Increased availability of drugs and other supplies would increase average and marginal costs. As expected, in-patient services were more costly to provide than outpatient services with respect to average and marginal costs. Finally, these results suggested that many public health providers were not operating at technically efficient levels i.e. they were not using cost-minimizing combinations of

high- and low-level health workers. The estimated results are presented in tables (IV) and (V), respectively in appendix 3.

Finally, Wasunna and Korir (1997) estimated short-run cost functions in the analysis of the public health sector efficiency in Kenya. They employed a single equation Translog short run Cobb-Douglas function with average wage, admissions, outpatient, operations and beds as explanatory variables. Their estimated model was specified as in equation (3) below.

$$\ln \text{Cost} = \alpha_0 + \alpha_1 \ln \text{Average Wage} + \alpha_2 \ln \text{Admissions} + \alpha_3 \ln \text{Outpatients} + \alpha_4 \ln \text{Operations} + \alpha_5 \ln \text{Beds} + (v - u) \dots \dots \dots (3).$$

Where α 's defined the estimated parameters while (v-u) indicated the composed disturbance term. They obtained the results shown in table (VI) in appendix 3.

The results showed that (1) wages, outpatient visits, inpatient and beds were significant but in elastic, (2) there existed economies of scale with respect to hospital output, inpatients visits and operations and that the facilities were operating below long run efficiency, (3) increasing returns to variable factor inputs. These results were contrary to the earlier conclusions by Barnum and Kutzin for developing countries. On average, inefficiency levels were about 30%. However, the study did not consider drug use and management as an important determinant of efficiency within health facilities. Furthermore, the study fell short of explaining variations in efficiency levels across health facilities.

2.3: SUMMARY OF LITERATURE REVIEW: A CRITIQUE

In the beginning, the estimation of hospital cost functions employed unit cost specifications where the average hospital cost was considered as a function of interrelated explanatory variables such as occupancy rates, patient flows, length of stay, and capacity or size. Even though such studies paved way for an improvement in the formulation and application of the cost functions, they have largely been criticized for using cost formulations that were not derived from theory, but were rather defined for convenience of estimations (Barnum and Kutzin, 1993; Wasunna and Korir, 1997).

However, more recent studies improved on the early hospital cost functions by tending to distinguish between short-run and long run production and cost functions and estimating total cost functions, rather than the traditional unit cost functions. But, they too had limitations. For instance, the studies do not empirically explain variations in efficiencies across health facilities.

Besides, most of the studies concentrated on studying the efficiency of hospitals thereby largely ignoring non-hospital health care providers. This was despite the fact that health centres and dispensaries are the entry points into the health referral system. Finally, the studies were based on the more limited assumption that all health facilities have the same cost function and that there were no variations in efficiency indicators across the health facilities.

3:1 ANALYTICAL FRAMEWORK

A theoretical model is constructed in this section to capture the factors, which affect the costs and efficiency of the public health delivery system in Nairobi. Costs and efficiency estimations enter the production and cost functions directly. A simple production function for a health facility may be explicitly specified as:

$$Y = f (X)(4)$$

where Y = healthcare services provided by the health care facilities e.g. outpatient services and inpatient care.

X = a vector of health facility inputs required for the provision of health care services for example medical doctors, nurses, laboratory equipment and drugs.

The cost of production or provision of health services solely depend on the objectives of public health providers and in what constraints they face i.e. the production function itself. Since the total costs will obviously be affected by the prices of inputs that the health facilities hire, the underlying cost function may be expressed as:

$$C_i = C_i (Y, WX).....(5).$$

Where C_i = total costs of providing health care services in the i th facility.

Y = the level of output or health services provided by the health facilities,

X = Inputs used by the health service providers in the provision of health care services.

W = The prices of inputs used in the provision of health services.

The cost function expressed in equation (5) has the output Y entered as a parameter². The level of output is jointly determined along with inputs as a function of factor and output prices (facility charges). This implies that changes in the total cost C , can be observed when an experimental condition, output, is varied autonomously, while holding factor prices constant.

Public health care providers can only achieve their objective if the cost of providing services is as small as possible. They therefore need to minimize costs subject to production constraints herein expressed as:

Minimize

$$C_i = \sum W_i X_i \quad i = 1 \dots n \dots (6a)$$

Subject to

$$F(X_1 \dots X_n) = Y \dots (6b).$$

Assuming that $f(X_1 \dots X_n)$ is sufficiently well behaved mathematically so that the first and

² Private or profit maximizing health care providers has Y as a decision variable, not as a parameter (see Silberberg, E. , 1990)

second order conditions for a constrained minimum are valid, this model yields, by the solution of first order langragian equations, the observable health services input demands (Silberberg E., 1990; Varian, H., 1992; Forsund et al, 1980). The input demands are expressed as:

$$X_i = \partial C / \partial W_i (w_1, \dots, w_n, y), \quad i = 1, \dots, n \dots \dots \dots (7).$$

Given the production function defined in equation (4), efficiency in provision of health care services is characterized by the transformation of health facility inputs into maximum obtainable output. For instance, the stochastic frontier production function introduced by Aigner, Lovell and Schimdt (ALS)- (1977) and by Meeusen and Van den Broek (1977) is defined as:

$$Y_{it} = \beta_{it} X + (V_{it} - U_{it}) \dots \dots \dots (8)$$

where

y is the production of the i -th firm,

X_i is a $k \times 1$ vector of inputs quantities of the i -th facility,

β i 's are the vectors of unknown parameters,

$V \sim N(0, \sigma^2)$ is the disturbance term which captures the random variation in output due to the factors outside control of the health facilities.

U_i are non-negative random variables, which are assumed to account for technical Inefficiency and is distributed as $N(0, \sigma^2)$.

α 's are the parameters to be estimated. Here i indexes firms and t indexes time periods.

Under duality conditions, the production function, the above is expressed as:-

$$Y_{it} = \beta_{it} X + (V_{it} + U_{it}) \dots\dots\dots(9)$$

where

- Y_i is the cost of production of the i-th firm,
- X is a $k \times 1$ vector of inputs prices and output of the i-th facility,
- β i's are the vectors of unknown parameters,
- $V \sim N(0, \sigma^2)$ is the disturbance term which captures the random variation in costs due to the factors outside control of the health facilities.
- U_i are non-negative random variables, which are assumed to account for cost Inefficiency and is distributed as $N(0, \sigma^2)$.

The stochastic frontier production and cost methods have been applied to various areas, including the study of Health Economics. Schmidt (1981), Green (1993), and Battese & Coelli (1993, 1994) present more recent reviews on frontier literature.

3.2' TYPE OF DATA AND SOURCES

3.2.1 Data collection methodology

In order to accomplish the objectives set out in chapter one of this paper, both secondary and primary data were used. Secondary data were extracted from the Central Bureau of Statistics, Ministry of Health and the Nairobi City Council. These included Statistical Abstracts and Economic Surveys, the GoK Appropriations and other accounts, Summary Reports on

Authorized and Actual personnel, outpatient morbidity statistics, Welfare Monitoring Survey etc. The data from these sources relate to healthcare outputs and inputs. They were used to determine the mean costs and efficiency estimations in individual health care facilities.

Furthermore, in order to ensure a more comprehensive study, it was necessary to ascertain the causes of the underlying inefficiencies in sampled health facilities. Therefore primary data was collected from 11 health institutions using informal oral interviews and/or discussions. The interviews were conducted with 15 senior health personnel managers. This was necessary to gather their views and other issues on the phenomenon under our study.

The questionnaire used to collect data (appendix 1) was considered crucial to generate more accurate answers to the research questions, among many, in objective 2. The health personnel were asked about the services offered in the various facilities, availability of appropriate diagnostic equipment, personnel and staffing issues, capacity of the health facilities cope with increasing health care demands and drug use and management practices.

3.2.2. Sampling of public health facilities

Initially, a sampling frame was constructed consisting of all public health sector providers in Nairobi, namely, the ministry of Health and the Nairobi City Council. The facilities are classified into hospitals, health centres, clinics and dispensaries. This was however constrained by serious data limitations. Purposive and judgmental sampling techniques were subsequently adopted in the selection of health facilities for the study. This was found necessary because some facilities

in both categories were not open to the general public, while others served special interest groups e.g. maternity hospitals. In the Nairobi city council facilities, the sample chosen for the providers was either representative or typical and accommodate varied categories of providers and population groups. Thus the sample of the conventional providers comprised 1 hospital, 9 health centres, 2 dispensaries and 1 clinic.

3.2.3 Data limitations and reliability

Statistical data on both morbidity and health expenditures was not readily available in appropriate and consistent forms. For instance, it was practically impossible to get any data for the year 1998 and before for the NCC facilities. Besides, the data on expenditures on health inputs could not be readily linked to services rendered and to the health facilities, which directly or indirectly supported those services. However, the investigator minimized the severity of these problems by restricting the study period to 1999 – 2000. Besides, the data on expenditures on drugs and wages was manually compiled from the drug supply/dispatch records and personnel records respectively.

The investigator also took necessary precautions to minimize the problems inherent in data collection through interviews. One such problem was the issue of informed opinions. While it is difficult to deal with this problem, we asked respondents to be frank and honest to the investigator.

The other problem was that of hostility and/or unwillingness on the part of respondents to divulge certain information. This problem was especially prevalent in the NCC facilities where

all kinds of information are considered 'classified', more so, those touching on finances. This we rectified by assuring city hall that this study was purely academic and that there was no way an efficiency study could ignore the cost elements in health service delivery.

Reliability of data was further affected by fear of revelation of certain information and non-confidentiality. We checked this problem by assuring the respondents that the information gathered from the discussions were strictly confidential and that the exercise was purely academic.

Generally, questions were simple, precise and clear. If a difficult question arose, it was explained much more clearly to the respondent. However, there were only two such cases.

Before the interviews, the investigator did a pilot survey to pre-test the questionnaire. This enabled the investigator to strike out questions that were not suitable.

3.3 MODEL SPECIFICATION

In this study, our ultimate goal was to analyze the costs and efficiency of public health facilities in Nairobi during the years 1999 and 2000. We selected the cost function model and generated maximum likelihood estimates of the parameters of the stochastic cost function following Schmidt & Lovell (1979) and Coelli, T. (1994).

We let the total cost of providing health services by the public health care providers using a homothetic Cobb-Douglas form the cost function³.

The short run total cost function for each facility may be expressed as: -

$$C_{it} = C_{it}(\text{VISITS}_{it}, \text{WAGES}_{it}, \text{DRUGS}_{it}) \dots\dots\dots(10)$$

Assuming a logarithmic Cobb-Douglas cost frontier specified as:-

$$\log \text{TCOST}_{it} = \beta_{i0} + \beta_{i1} \log \text{VISITS}_{it} + \beta_{i2} \log \text{WAGES}_{it} + \beta_{i3} \log \text{DRUGS}_{it} + (V + U)_{it} \dots(11)$$

where,

TCOST = short run total cost of a facility measured by annual recurrent expenditures

VISITS = The number of annual outpatient visits to a facility, also as a measure of output.

WAGES = This is a proxy for the price of labour measured as the annual wage bill for staff in a facility,

DRUGS = This is the annual facility bill on drugs and other medical supplies

V_i = Random variables which are assumed to be independent and identically distributed (iid) $N(0, \sigma_v^2)$.

U_i = Non-negative random variables assumed to account for the cost of inefficiency in production. They are assumed to be iid $|N(0, \sigma_u^2)|$.

³ The simple homothetic model implies that the cost minimizing input mix remains the same as output level changes.

From the theoretical framework developed in section 3.1, the following can be hypothesized :-

1. The number of outpatient visits to health facilities increases the recurrent costs of health services delivery.
2. The cost of delivery of health services increases with a rise in the price of labour.
3. Increased expenditures on drugs add to facility recurrent expenditures.
4. Total recurrent expenditures are expected to be directly related to efficiency levels.

The above are based on the fact that health services are believed to be largely under-funded in Nairobi and therefore increased expenditures or costs incurred could as well be as a result of increased availability of inputs of health care services.

Prior to our estimations, tests were carried out to establish the symmetry of the parameters characterizing the random outcome of the dependent variable. In this regard, tests for the existence of a frontier and the exact cost-estimation were performed.

We began by considering the stochastic frontier model of Aigner, Lovell and Schimdt- hereafter ALS (1977) expressed as:-

$$Y_t = X_t \beta + V_t + U_t \quad t = 1, 2, 3, \dots, T \quad \dots\dots\dots(12)$$

Where Y_t is the dependent variable, X_t is a vector of exogenous variables, V_t are iid $N(0, \sigma_v^2)$ and U_t are iid as the absolute value of a $N(0, \sigma_u^2)$ variable i.e. as half normal. It is also assumed that the V_t and U_t are mutually independent.

The distinction between the frontier model and the usual regression model is the one-sided error U_t . We tested the existence of a frontier model by testing the null hypothesis that:-

$H_0 : \sigma_u^2 = 0$ against the alternative

$H_A : \sigma_u^2 \neq 0$

Basing our test on the sample skewness of the residuals considering the half normal distribution, we estimated the null distribution of $\sqrt{b_1}$ under the hypothesis of skewness defined as:-

$$\sqrt{b_1} = M_3 / (M_2)^{3/2} . \quad \dots\dots\dots(13)$$

where M_2 and M_3 are the second and third moments of residuals respectively.

From the estimated cost function by OLS, we tested the existence of a frontier. The second and third moments of the OLS residuals are 0.02599 and 0.0732 yielding $\sqrt{b_1} = 0.5528$. This

We began by considering the stochastic frontier model of Aigner, Lovell and Schimdt- hereafter ALS (1977) expressed as:-

$$Y_t = X_t \beta + V_t + U_t \quad t = 1, 2, 3, \dots, T \quad \dots\dots\dots(12)$$

Where Y_t is the dependent variable, X_t is a vector of exogenous variables, V_t are iid $N(0, \sigma_v^2)$ and U_t are iid as the absolute value of a $N(0, \sigma_u^2)$ variable i.e. as half normal. It is also assumed that the V_t and U_t are mutually independent.

The distinction between the frontier model and the usual regression model is the one-sided error U_t . We tested the existence of a frontier model by testing the null hypothesis that:-

$$H_0: \sigma_u^2 = 0 \text{ against the alternative}$$

$$H_A: \sigma_u^2 \neq 0$$

Basing our test on the sample skewness of the residuals considering the half normal distribution, we estimated the null distribution of $\sqrt{b_1}$ under the hypothesis of skewness defined as:-

$$\sqrt{b_1} = M_3 / (M_2)^{3/2} . \quad \dots\dots\dots(13)$$

where M_2 and M_3 are the second and third moments of residuals respectively.
From the estimated cost function by OLS, we tested the existence of a frontier. The second and third moments of the OLS residuals are 0.02599 and 0.0732 yielding $\sqrt{b_1} = 0.5528$. This

exceeded the 10% critical value (from Biometric Tables for Statisticians) of 0.543⁴.

Thus we rejected the Null Hypothesis and accepted the Alternative that there is skewness (positive), which is consistent with the existence of a cost frontier. The efficiency estimations and regression analysis was done using the Frontier 4.1 computer package.

⁴ see D'agostino & Tietjen (1993) who provide comparisons of approximations to $\sqrt{b_1}$

CHAPTER FOUR ASSESSMENT OF EFFICIENCY INDICATORS WITHIN HEALTH FACILITIES IN NAIROBI

4.0 INTRODUCTION

The findings of the assessment of efficiency indicators in the health facilities in Nairobi are presented in this chapter. This information is based on the survey interviews conducted with officers from the public health department and health facility managers from ten health facilities. Usually, the most important inputs for health service delivery include:- health manpower, diagnostic equipment & machines and drugs.

The analysis of these indicators is done by descriptive statistics and standard judgements. For instance, the indicators that link the work of health care providers to the utilization of the facilities per provider, gives useful information on the efficiency and effectiveness of health care delivery. This indicator might for instance, be reflected in the number of patient contacts per total number of skilled staff persons, per doctor or per nursing person.

The number of drugs per prescription and the percentage of prescriptions that include injections are meant to reflect the extent to which prescribing and drug dispensing practices are rational (i.e. appropriately used, from a qualitative perspective). Improvements in the quality through more rational prescribing practices are synonymous with greater technical efficiency and lower cost per patient. Brudon-Jacobowwicz, Rainhorn and Reich (1994, page 155) suggest there is a consensus that an average of more than two drugs per prescription will probably reflect a

problem in the prescribing practices. However, there is no global standard for the “correct” average number of drugs per prescription or percentages to include injections.

On the other hand, the average duration for which drugs are out of stock at the various facilities relates to the efficiency of the drug management system. Several factors could lead to drugs being out of stock. These include among others poor management, procurement problems, and delays in distribution, in adequate funding and/or unanticipated high demand.

4.1: ASSESSMENT OF EFFICIENCY INDICATORS WITHIN HEALTH FACILITIES

4.1.1: Staffing and adequacy

In all the 12 NCC facilities, there were a total of 3 doctors, 33 clinical officers and assistants, 169 nurses and 99 Non-Health workers. Only two facilities had doctors. Overall the doctor to clinical officer ratio for all the facilities taken together was 1:11. On the other hand, although some facilities had no clinical officers, the common clinical officer to nurses’ ratio ranged between 1: 2 to 1: 9. Either cadre or nurses alone provided services in most of the facilities. Finally, non-health workers were found in all the facilities. On average, the ratio of nursing staff to non-health workers ranged between 1:1 to 3:1 except one facility, which had a ratio of 1:2. Table 4.1 below presents a summary of the staffing levels in the facilities covered by our study. In the table, the negative signs show average staff deficits in the health facilities.

Table 4.1: Average level of staff deficits per health facility

Category of staff	Mean	Std dev	Skewness	Kurtosis	Minimum	Maximum
Doctors	-1.6667	0.7020	1.7	4.3	-2.0000	0.0000
Clinical Officers	-1.0000	1.1421	1.8	0.9	-2.0000	3.0000
Nurses	-10.2083	5.7859	0.3	2.1	-20.0000	1.0000
Assist. In Clinics	-2.5000	6.2970	-0.5	6.0	-22.0000	13.000
Non-health workers	-3.4167	4.6054	1.0	6.9	-4.0000	12.000

Source: Own survey, 2001

4.1.2: Patient to health staff ratios

The average staff to patient ratios for all the facilities studied are presented in Table 4.2. The statistics show that there was an average of about 433 patient contacts per 1 skilled medical staff during the period under review.

Table 4.2: Average patient to staff ratios for NCC health facilities

Item	Mean	Std dev	Skewness	Kurtosis	Minimum	Maximum
No. of staff	23.250	11.2492	0.3	2.0	6.0000	45.0000
No. of patients	8926.250	6017.0198	1.3	3.7	1885.000	23920.00
Patient to staff ratio	433.4167	307.1460	1.6	4.9	92.0000	1310.000

Source: Own Source, 2001

There were large variations in patient/health staff ratios across facilities. Table 4.3 shows that the highest recorded ratio was 1310:1 on the average, as compared to 92:1 during the two years. The

workload was highest in most facilities during 1999.

Table 4.3: Patient to staff ratio per health facility

1999				2000		
Facility code	No. Staff	No. patients	Patient to Staff ratio	No. Staff	No. patients	Patient to Staff ratio
1	30	15310	510	34	18354	359
2	20	23920	1196	38	23398	615
3	30	11743	391	25	11426	457
4	14	8918	637	34	5954	175
5	40	10966	274	23	11259	489
6	45	5820	129	17	4784	281
7	18	6719	373	17	5619	330
8	12	2568	214	8	1885	235
9	18	6451	358	14	3891	277
10	41	3795	92	27	4263	157
11	20	6155	307	21	8041	382
12	6	7864	1310	6	5127	854

Source: Own source, 2001

4.1.3: Drug use and management

The Central medical stores centrally does the purchase of drugs and medical supplies for the NCC facilities. Table 4.4 below shows provisional figures for the cost of drugs supplied to the facilities under the study during the years 1999 and 2000.

JOMO KENYATTA MEMORIAL
LIBRARY

The table shows that the supply of drugs to facilities was heaviest in 1999 as compared to the

year 2000. The reason given was that during 1999, there was better funding of the drug procurement unit. This was particularly so because revenues collected from drug user fees was ploughed back into the system to purchase drugs directly from manufactures. That system however changed in the year 2000, when all the revenues collected was remitted to the city treasurer's office together with all the other council revenues as a pool.

Also from the table, the supplies of drugs tended to be low during the last quarter of the year 1999 in most facilities. During the survey, it was revealed that patient turnouts were low during the months of November and December. Since majorities of the health facilities' clientele were of low to medium socioeconomic class, many of who have a tradition of travelling upcountry for the long Christmas festivities. This factor was attributed to the low drug supplies during that period.

On the consistency of the drug supplies to the facilities, there were problems of delays in distribution, under supplies of certain types of drugs, supply of drugs unresponsive to the morbidity patterns in the areas and also supply of drugs nearing expiry dates. Some facilities also reported oversupply at times. On average, apart from one facility, the respondents said it took between one to three months to receive new drug supplies. In one extreme case, one facility had not yet received drugs during the previous six months. However, the respondents admitted borrowing or sharing drugs among the facilities to overcome the problems of under supplies and/or over supplies.

In addition, most facilities reported issuance of between 3 to 6 drugs per prescription, depending

on the nature of the ailments. Also the percentage of prescriptions that included injections were said to be relatively low i.e. less than 10% in all the facilities except one.

Table 4.4: Cost of drugs supplied to health facilities during 1999 and 2000 (in Ksh.)

Facility code	1 st Quarter	2 nd Quarter	3 rd Quarter	Total 1999	1 st Quarter	2 nd Quarter	3 rd Quarter	Total 2000
1	867,924	642,755	387,053	1,897,732	64,329	116,365	242,790	423,484
2	232,140	205,054	34,136	471,330	40,945	49,982	90,060	180,987
3	94,303	128,814	9,335	232,452	40,202	284,468	25,755	350,425
4	184,264	56,307	78,400	318,971	22,838	20,621	29,550	73,,009
5	236,154	162,173	9,807	408,134	26,605	53,926	33,580	114,111
6	116,460	90,409	60,495	267,364	26,654	32,580	24,363	83,597
7	93,868	86,703	*	180,571	21,940	8,572	20,720	51,232
8	155,234	72,964	32,490	260,688	6,528	11,245	6,766	24,539
9	96,278	120,246	21,710	238,234	21,728	33,150	9,425	64,303
10	62,194	77,085	31,436	170,715	40,005	43,346	41,033	124,384
11	135,136	40,634	34,213	209,923	11,745	3,000	33,900	48,645
12	155,406	91,257	24,212	270,875	38,777	26,522	25,905	91,204

* There was no supply of drugs to the facility during the period

Source: Own Survey, 2001

All respondents denied pilferage of drugs within facilities. However, contrary to their denials, no concrete system was in place to ensure that acquired drugs were used appropriately for intended

purposes. Majority of the in-charges admitted that they did not regularly scrutinize drug registers to monitor the trends in prescriptions.

4.2 Discussion of survey findings

From the survey findings, there appeared to be serious health manpower and drug use and management problems. Generally, the workload estimates in most of the facilities showed there is under-staffing in all the categories of health workers i.e. doctors, clinical officers and nurses. Despite the inter-facility variations in staffing requirements, the differences in outpatient care were most marked for nursing staff, non-health workers and the assistants in clinics. Also, there prevails wide variations in the patient to staff ratios across the facilities from the mean ratio of 433 patients per health staff.

On drug use or prescriptions, most facilities appear to suffer from excessive use of drugs. Also there appear to be no harmonized drug dispensation policies at the public health departments. Furthermore, a combination of several factors are causing insufficiency of drug supplies to the health facilities viz.: - poor stock management, procurement problems, delays in distribution, inadequate funding, lack of zonal drug kit system, pilferage etc. A more detailed analysis is however required to establish the exact causes of changes of drug supplies to facilities over time.

5.0: INTRODUCTION

This chapter presents econometric results obtained after estimating the model specified in chapter three. The model was estimated using data collected from 13 public health facilities in the city of Nairobi for the years 1999 and 2000. The chapter is divided into 4 parts. Part two presents descriptive statistics. Part three presents the results after estimation of the cost functions for outpatient health services in the sampled health facilities. Finally, part four contains the analysis and discussion of results presented in parts two and three.

Marginal and average or unit cost comparisons are useful facility based indicators of technical and allocative efficiency. The marginal costs show how the costs of facility inputs (e.g. drugs and health staff) vary with output, in this case outpatient services. For a given mix and quality of services, a lower marginal cost implies better technical and allocative efficiency.

However for average or unit costs, there are important limitations, which indicate the need for caution. While lower unit costs imply better quality for given mix and quality of services, this is not necessarily the case in situations where health services are believed to be under-funded. In such cases, increases in unit costs (which might arise because drugs are now available when not before) may indicate technical efficiency improvement as a result of quality improvement. But for situations in, which cost containment rather than under-funding is the major concern, such facility-based indicators may be more straightforward. Thus, under-utilized staff, equipment or

facilities may explain higher unit costs.

The short run variables to factor inputs (SRVF) measure the effect on cost of a general increase in output (outpatient visits) when the output mix and fixed assets remain unchanged⁵. If the SRVF is more than one, the level of output is below optimum efficiency, and when it is less than one, the output level is above optimum efficiency. Thus, the resulting index provides a policy guideline on whether the facilities under consideration are producing above or below optimum output.

The coefficients of the estimated variables in part three should be interpreted as follows: - a positive coefficient implies that a change in that variable increases the costs of outpatient services and vice versa for a negative coefficient.

5.1: DESCRIPTIVE STATISTICS

5.1.1 The average and marginal cost variables

The mean values for the average and marginal cost variables are shown in table 5.1. As indicated, the mean average cost of treating a patient in all the facilities was about Ksh. 424 during the two years. On the other hand, the mean marginal costs incurred in treating an average patient at the margin within the studied health facilities were about Ksh. 121 during the same period.

⁵See appendix for formulas for calculating average & marginal costs and SRFV

Furthermore, the results show that both the average and marginal cost variables were higher during the year 1999 than 2000. However, there were significant variations in these figures across health facilities.

Table 5.1: Average and marginal cost estimations

Facility code	Average cost (1999)	Average cost (2000)	Marginal cost (1999)	Marginal cost (2000)
1	355	245	114	79
2	119	201	38	64
3	318	280	102	90
4	231	274	74	88
5	466	256	149	82
6	960	459	307	147
7	342	344	110	110
8	649	492	208	158
9	367	391	118	125
10	314	773	101	248
11	161	302	52	97
12	117	139	37	45
13	684	468	234	167
Mean	491	356	126	115

Mean Average cost variable = 424 Mean Marginal cost variable = 121

Own source, 2001

5.2: EMPIRICAL RESULTS OF THE COST FUNCTIONS

The MLE estimation of the frontier cost function (11) is given in table 5.2. The Cobb-Douglas results show a generally well-behaved cost function where all the coefficients have the expected signs. The results show that all the variable are significant at 5% level, except the DCOST variable, which is apparently significant at the 10 % level.

Table 5.2: MLE estimates of the short run cost function

Dependent variable: Incosts

Independent Variables	Coefficient	Standard Error	t-ratio
Constant	2.2269	0.7085	3.2023
lnVISITS	0.3540	0.1693	2.0906
lnWAGES	0.3064	0.1067	2.8721
lnDRUGS	0.1578	0.0982	1.6069*
Sigma^2	0.0649	0.0277	2.3399
Gamma^2	0.7598	0.2002	3.7940

N = 26

- significant at 10%

5.2.1 Interpretation of Cost function and hypothesized coefficients

- 1). The output variable (visits) was statistically significant at 5% level. The coefficient had the expected positive sign and a 10% increase in outpatient visits is associated with a

3.5% increase in total recurrent costs.

- 2). The wage elasticity of costs was found to be the most significant variable and had the expected positive sign. A 10% increase in the wages of health facility staff would result in a 3.1% increase in total recurrent expenditures on treatment.
- 3). The drug elasticity of cost was found to be the least significant variable. However, it also had the expected positive sign. As shown in the table, a 10% increase in annual expenditures on drugs would result in a 1.5% increase in recurrent expenditures on treatment.

Finally, using the estimated cost function and equation 3 (Appendix 1), the value of the short run return to variable factor inputs was found to be 2.8249 as illustrated below: -

$$SRVF = 1 / 0.3540 = 2.8249$$

This value shows that there are increasing returns to variable factor inputs, implying that the average output for the health facilities studied was below optimum efficiency levels. By implication therefore, an increase in the use of all variable inputs would result in more than proportionate increase in output than in costs. The latter implies that the average output for the health facilities studied was below optimum efficiency levels and therefore an increase in the use of all variable inputs would result in more than proportionate increase in output than in costs.

5.2.2 Efficiency estimations and interpretation

The results of the efficiency estimations from equation (12) are presented in table 5.3. The results showed that public health care facilities were significantly efficient in delivery of outpatient health care services in Nairobi. On average, efficiency levels were about 93.4% during the two years. This implied that there was a 6.6% level of inefficiency.

Furthermore, the results showed that majority of the health care facilities registered better efficiency levels during the year 2000 compared to the year 1999. In other words, health facilities were more efficient in the provision of outpatient health care services during 1999 than the year 2000. Specifically, there was a mean level of efficiency of 92.75 in 1999, compared to 94.0685 during in the year 2000.

However, the results show that with the existing resources, output could still be increased by a further 6.6%, suggesting increased coverage and access to health care services over the period. Alternatively, the present levels of output could be produced at a cost of 6.6% lower. This demonstrates that the public health facilities still have some potential to improve on their output performance through efficiency improvements.

Table 5.3: Facility specific efficiency and inefficiency levels during 1999 and 2000

Facility code	Efficiency (1999)	Efficiency (2000)	Inefficiency (1999)	Inefficiency (2000)
1	93.9496	94.0322	6.0504	5.9678
2	87.2652	93.9702	12.7348	6.0298
3	95.2255	93.0572	4.7745	6.9428
4	92.6302	93.5452	7.3695	6.4548
5	95.2411	95.3526	4.7589	4.6474
6	96.1159	95.4049	3.8841	4.5951
7	94.7118	95.3690	5.2882	4.6310
8	94.9294	83.5070	5.0707	16.493
9	95.2688	95.0388	4.7312	4.9612
10	92.8023	96.4871	7.1977	3.5123
11	88.3245	94.7620	11.6755	5.2380
12	84.8097	98.2268	15.1903	1.7732
13	94.5308	94.1370	5.4693	5.8630
Mean levels	92.7542	94.0685	7.2457	5.9315

Mean efficiency = 93.41114

Furthermore, four other regressions were performed using the estimated efficiency parameters as the dependent variable. Here, we are attempting to explain the variations in efficiency estimates across the health facilities. This is frankly an attempt to learn whether the efficiency indicators could explain the variation in each of the efficiency estimates. The results of these regressions are presented in table 5.4, while the interpretations are presented in sub-section 5.2.3.

Table 5.4: OLS efficiency regressions

Efficiency	$= b_0 + b_1 \log \text{TCOST} + b_2 \log \text{VISITS} + b_3 \log \text{WAGES} + b_4 \log \text{DCOSTS}$				
(1)	0.1436 (13.42)	-0.0196 (5.495)	0.0052 (2.004)	0.0089 (3.854)	0.0029 (2.000)
(2)	0.1334 (10.093)	-0.0041 (-2.0323)	-	-	-
(3)	0.1104 (8.194)	-	-0.0006 (-0.166)	-0.0001 (-0.057)	-0.00004 (-0.047)
(4)	0.1396 (10.726)	-0.0083 (-2.800)	0.0055 (1.862)	-	-

Source-: Own computation

The values in parenthesis are t-values

5.2.3 Interpretation of the OLS efficiency regressions

The regression (1) in table 5.4 included all the four variables. The results show that all the variables are statistically significant at 5% level. Furthermore, apart from the total cost variable, all the other variables are positively related to inefficiency index across the health facilities. The negative TCOST variable indicates that facilities with higher initial total recurrent expenditures had lower in-efficiency levels. Alternatively, facilities with higher initial total recurrent expenditures had higher efficiency levels. Specifically, a 10% increase in total recurrent expenditures is associated with a 0.1% decline in in-efficiency in the facilities. On the other hand, the positive coefficients for VISITS, WAGES and DCOSTS indicate that increased expenditures on those variables lead to increased facility in-efficiency levels.

In regression (2), only TCOST was the independent variable. Although the coefficient was also negative as in the first regression, it was less significant. The regression (4), which had only two independent variables TCOST and VISITS, had results generally consistent with regressions (1) and (2).

In regression (3), the TCOST variable was left out. The results of the regression (3) were all statistically insignificant. The change in the sign of all the independent variables from positive to negative is however difficult to explain. The implication of the results is that increased visits and expenditures on wages and drugs lead to a decline in in-efficiency levels across the health facilities.

5.3: Summary of Empirical Results

As mentioned before, a major contribution of this study is to provide estimates of the efficiency of public health facilities in the city of Nairobi. First, the results of regressions of the total cost function show that the coefficients of wages and drugs are in elastic. In general, these results suggest that increasing expenditures on wages and drugs by a given proportion, increases the total recurrent expenditures by smaller proportions. Also, the in elastic coefficient of the variable output (visits) suggest that increases in outpatient visits to the public health facilities can be attained by relatively smaller increases in total recurrent facility expenditures.

In the second efficiency regression, results suggest that increasing total recurrent expenditures on health facilities reduce the level of in-efficiencies. Furthermore, these results show that over the

range of observed output levels, the marginal costs are less than the average costs. The indication is that the facilities are generally operating on the downward portion of their average cost curves. In other words, there can be increased coverage or accessibility of health care services in Nairobi at declining average costs. This is further confirmed by the SRVF Variable, which indicate that the facilities are operating below optimum efficiency levels.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1: SUMMARY AND CONCLUSION

The principle objective of this study was to estimate and analyze the costs and efficiency of public health facilities in the city of Nairobi. The cost measurements included the average costs, marginal costs and the short run returns to variable factors. On the other hand, the efficiency indicators included personnel & staffing and drug use and management. Data was collected from 13 public health facilities in the city out of which, 12 of the facilities were under the management of the Nairobi city council, while one was under the Ministry of Health & Medical Services.

Our descriptive and empirical analysis makes two overall contributions to the study of efficiency in health care in Nairobi and elsewhere. First, it promotes the improvement of a conceptual framework and a methodology to assess the efficiency of a public health care delivery system. Second, it provides the first estimates of marginal costs, average costs and efficiency for provision of outpatient health care services in Nairobi.

The study revealed that there is an average of about 6.6 % inefficiency level in the provision of outpatient health care services by public facilities in Nairobi. In essence, the inefficiency was a primary attribute to shortages of staff; lack of proper use and management of drugs and poor combination of medical and non-medical staff among others.

This study reveals that there existed some potential to promote access and coverage of health

delivery in Nairobi. This was evidenced by, among others, the existence of increasing returns to variable factor inputs; the fact that the health facilities were operating on the downward portion of their average cost curves and finally, recurrent costs being less responsive to changes in outpatient levels. These results imply that coverage and access to health care services can be increased at relatively low incremental costs.

However, although the question of efficiency has gained considerable currency during recent times, in Nairobi, the existing data base severely limited our ability to provide precise estimates of costs and efficiency. For instance, the uncharacteristically high efficiency levels could be attributed to inaccurate and/or misleading health information data base. But nevertheless, it is hoped that such kinds of studies will motivate the improvements in financial and management information systems by demonstrating what can be done when such information is available.

6.2: POLICY RECOMMENDATIONS

This paper has shown that micro-economic theory can assist in formulating policies for enhancing efficiency and planning for effective provision and delivery of health services in Nairobi. In view of the research findings, the following recommendations are hereby suggested to health care planners in Nairobi and elsewhere.

1. There is urgent need to address under-staffing in all the public health facilities in Nairobi. Since wage elasticity of total costs was found to be in elastic, this result suggests that additional staff could be employed at relatively cheaper costs to satisfy unmet health

needs.

2. In an attempt to improve the supply of drugs to the health facilities, there is need to plough back part of the revenues collected from drug user charges to the facilities to be used to purchase drugs whenever there are emergencies. This follows the indications that utilization of the facilities is directly related to the availability of drugs within the facilities. Health facilities which, had better supply of drugs have higher utilization rates. Furthermore, the regression results show that all facilities are generally operating on the downward portion of their average cost curves. Hence, increased use of health facilities as a result of availability of drugs would therefore lower the average operating costs.
3. There is need to introduce a facility improvement fund among small groups' of health facilities. Facilities could use revenues from these funds to purchase drugs incases of serious deficiencies. This would also help boost revenue collection at the facilities as people were reportedly willing to pay for the drugs.
4. There is also need to rationalize dosages and treatment protocols in the facilities to enhance better drug use and management practices.
5. A movement towards a 'zonal drug kit' based on the regional morbidity patterns is also recommended to reduce the problems of 'under supplies' and 'over supply of drugs'. Estimates for the requirement of all drugs should be done by individual health facilities in conjunction with heads of respective divisions.

6. Financial information system at the health care facility level must be carefully integrated with other information systems, which collect appropriate and adequate measures of service inputs, quality of health care and facility utilization. The data should provide information on costs in addition to expenditures, where costs can be easily linked to types of services rendered and to the department, which directly or indirectly support those services.

6.3: LIMITATIONS OF THE STUDY

The major limitation of this study was insufficient data base. The existing data gaps and lack of appropriate integration of health output and financial information severely restricted our ability to provide precise estimates of costs and efficiency. More reliable estimates could be produced with studies involving a bigger number of health facilities over a wider period of time. The other limitations were financial constraints and inadequate time especially for collection of primary data. These and other factors made the researcher to confine the study of efficiency to the providers' perspective, thus ignoring the health care users point of views.

6.4. INDICATORS FOR FURTHER RESEARCH

There is further scope to study the efficiency of the public health delivery system in Nairobi from both the providers and users point of views and to make comparisons between the public and the private health delivery systems.

REFERENCES

- Aigner D.J. et al (1977), Formulation and Estimation of Stochastic Frontier Functions, *Journal of Econometrics* 6: 21-37.
- Akin J. et al (1987) *Financing Health Services in Developing Countries; An Agenda for Reform*. World Bank Policy Study. Washington DC. The World Bank
- Anderson David L. (1980) A Statistical Cost Function Study of Public General Hospitals in Kenya. *Journal of Developing Areas*. 14(2): 223-235
- Barnum H. and Kutzin J. (1993), 'Public Hospitals in Developing Countries; Resource Use, Costs and Financing'. The World Bank. Baltimore; John Hopkins University Press.
- Battese, G.E. and Coelli, T. J. (1993), 'A Stochastic Frontier Production Function Incorporating a Model for Technical Inefficiency Effects' *Working Papers in Econometric and Applied Statistics*, No. 69, Department of Econometrics, University of New England, Armidale, pp. 22.
- Bitran-Dickosky, R. and Dunlop D. W. (1989), 'Determinants of Hospital Expenditures: An Analysis of Ethiopia', PPR Working Papers No. 249. World Bank.
- Brudon-Jakobowicz, P., J.-D. Rainhorn, and M.R. Reich (1994), 'Indicators for monitoring national drug policies: a practical manual. WHO/DAP/94.12. Geneva: World Health Organization, Action Programme on Essential Drugs, cited in McPake B. and Kutzin, J.(1997),
- Carr, W. and P. Feldstein (1967)' The relationship of Cost to Hospital Size', *Inquiry* 4(2):45-46, cited in Newbrander W. et al (1992).
- Coelli, T.J. (1993), 'Finite Sample Properties for Frontier Estimators and Associated Test Statistics', *Working Papers in Econometrics and Applied Statistics*, No. 70, Department of Econometrics, University of New England, Armidale.
- D'Agostino R.B. and Tietjen G.L.(1973), 'Approaches to the Null Distribution of $\sqrt{b_1}$ ' *Biometrika* 60: 60; 169 -173.
- Dor Avi (1987)'Estimates of Cost Functions for the Peruvian Hospital Sector; Some Policy Implications'. Unpublished report; Welfare and Human Resources Division. The World Bank, Washington DC, cited in Wouters Annemarie (1993).
- Forsund et al (1980)'A Survey of Frontier Production Functions and their Relationship to Efficiency Measurements', *Journal of Econometrics*, vol. 13: 5-25.

Siberberg, E. (1990), '*The Structure of Economics; A Mathematical Analysis*', 3rd published by McGRAW – HILL INTERNATIONAL EDITIONS.

Varian Hall R. (1992), '*Micro-economic Analysis*', 3rd edition Published by W.W. Norton & Company; New York.

Wan'gombe J.K. et al (1998), 'Capacity of Non-Governmental (NgoK) Providers in Delivery of Health Care in Kenya. Paper presented to Health Sector Support Programme, Ministry of Health.

Wasunna O. and Korir M.(1997), 'Public Health Sector Efficiency in Kenya; Estimation and Policy Implications', IPAR Discussion Paper Series DP No. 007/97.

WHO (1990), 'Support to Countries in Rationalizing the Financing of Health Care', Annex 2, Document EB85/35 for the Eighty-Fifth Session of the Executive Board.

Wouters Annmarie (1993), 'The Cost and Efficiency of Public and Private Care Facilities in Ogun State, Nigeria', *Health Economics* Vol. 2: 31-42.

APPENDIX 1

(i). **Average cost** = Annual total facility expenditures / Total number of outpatient
visits per annum

(ii). **Marginal cost** = Elasticity variable X average cost

Thus starting with the simplified C-D cost function:

Step 1: $C = \alpha_0 (\text{average wages}) \alpha_1 (\text{drugs}) \alpha_2 (\text{visits}),$

Step2: Derivation of the marginal cost for output i.e.visits

$MC_i = \partial C / \partial Y = \alpha. C / Y = \alpha_2 (\text{average cost}),$ where α_2 is the elasticity
variable.

(iii). **Short Run Variable Factors (SRVF)** = average cost / α_2 (average cost) = $1 / \alpha_2$

- Francisco, E. W. (1970), 'Analysis of Cost Variations among short-term Hospitals, cited in 'Econometric Models; Techniques and Applications'. Prentice-Hall, New Jersey.
- Green W. H. (1993) The Econometric Approach to Efficiency Analysis, cited in 'Technical Efficiency of the Ugandan Matoke Farms, unpublished paper edited by Almas H. and Yilma, M. Department of Economics, University of Gothenburg, Viktoriagatan 30, D-411 25 Gothenburg, SWEDEN.
- Lave J.K. and Lave L. B. (1970), 'Hospital Costs Functions', *The American Economic Review*, Vol. 60: 379-395.
- McPake B. and Kutzin, J.(1997), 'Methods of Evaluating Effects of Health Reforms', ARA Paper No. 13, by Division of Analysis, Research and Assessment, WHO.
- Meeusen W. and Van den Broeck (1977). Efficiency Estimation from the Cobb-Douglas Production Functions with Composed Error., *International Economic Review* 18, 435-444.
- Ministry of Health (1995), 'Kenya Health Policy Framework Implementation and Action Plans' by the Government of Kenya.
- Newbrander W. et al (1992), 'Hospital Economics and Financing in Developing Countries'. World Health Organization, Geneva.
- Republic of Kenya (1997), 'National Development Plan 1997-2001'
- Republic of Kenya, 'Economic Surveys', various issues.
- Republic of Kenya (1996), 'Economic Reforms for 1996-98; The Policy Framework Paper' prepared by the GoK, IMF ANF World Bank.
- Republic of Kenya, 'Outpatient Morbidity Reports', various issues from the Ministry of Health and Nairobi City Council.
- Schmidt P. and C.A.K. Lovell (1979) 'Estimating Technical and Allocative In-efficiency Relative to Stochastic Production and Cost Frontiers', *Journal of Econometrics* Vol 9 3:343-366.
- Schmidt P. and Tsai-Fe Lin (1984), 'Simple Tests of Alternative Specifications in Stochastic Frontier Models', *Journal of Econometrics*, Vol.24: 349-361.

APPENDIX 1

(i). **Average cost** = Annual total facility expenditures / Total number of outpatient visits per annum

(ii). **Marginal cost** = Elasticity variable X average cost

Thus starting with the simplified C-D cost function:

Step 1: $C = \alpha_0 (\text{average wages}) \alpha_1 (\text{drugs}) \alpha_2 (\text{visits}),$

Step2: Derivation of the marginal cost for output i.e.visits

$MC_i = \partial C / \partial Y = \alpha. C / Y = \alpha_2 (\text{average cost}),$ where α_2 is the elasticity variable.

(iii). **Short Run Variable Factors (SRVF)** = average cost / α_2 (average cost) = $1 / \alpha_2$

UNIVERSITY OF NAIROBI
DEPARTMENT OF ECONOMICS

Field Survey Questionnaire

Questionnaire No. _____ **Facility Code** _____

Welcome to this discussion about the efficiency of the public health delivery system in Nairobi. Our discussion primarily focuses on utilization, staffing and drug use & management in your facility as some of the most important indicators of technical efficiency. The results of our study will be used to recommend to the Nairobi City Council and the Ministry of Health ways of improving the delivery of health services to 'wanaichi'. We would be grateful if you could provide answers to all our questions. Any information you give is strictly confidential.

Name of respondent _____ **Professional/Administrative position** _____

A: UTILIZATION AND FACILITY-BASED EFFICIENCY INDICATORS

1. What health services are offered by your facility? a) curative b) preventive c) special d) Others (Please specify)
2. What are the leading causes of morbidity or ailments commonly reported by your facility? A) Malaria b) respiratory c) abdominal d) others
3. On average, how many patients do you attend to on a daily basis, given the available staff, medical supplies & equipment, and financial resources?
4. Do you always cope with the number of patients who visit your facility? Yes/No.
5. If yes above, what strategies do you use to cope with the situations? (please specify the coping mechanisms).
6. If no, what are the underlying reasons or factors?

B: STAFFING AND PERSONNEL MANAGEMENT

7. We would be interested to know the staffing status of diagnostic and nursing staff.

For each of the following categories, please indicate whether there is

Understaffing (US), Optimum staffing (PS) or Overstaffing (OS).

Doctors _____ Dentists _____ Pharmacists _____ Clinical Officers _____

Radiographers _____ Laboratory technicians _____ Nurses _____

Others _____

8. How often do professional staff transfers take place within the facilities?

9. What factors are considered when effecting these transfers?

10. How often do your staff go for update or other trainings?

11. How would you rate the level of motivation of your staff?

a) very high b) high c) moderate d) low e) very low

12. What measures do you take to improve on the motivation of your staff?

13. What is the rate of absenteeism from work by the staff in within facility?

a) High b) Moderate c) Low d) Very low

14. What are the reasons for 14 above? Please specify

C: DRUG USE AND MANAGEMENT

15. On average, how many drugs do you give patients per prescription?

16. Approximately, what percentage of the prescriptions given, include injections?

A)10% B)25% C)50% D) Others

17. What are the reasons for the above? Please specify

18. Do you have zonal drug kits ? Yes/ No. If no, what factors do you consider when making drug requisitions?

19. What is the average duration for which drugs for leading diseases are out of stock in

your facility? A) one week b) two weeks c) one month d) six months e) others

19. In your opinion, do you observe the extent of stockouts to change overtime or season? Yes/No

20. If yes, what do you think are the reasons for this?

21. Which of the following problems do you sometimes experience?

a) Pilferage of drugs b) Over supplies c) Under supplies d) Expiry of drugs e) All

f) Others

22. In your opinion, what are the most immediate problems facing your facility?

This is the end of our discussion. Thank you very much for your co-operation

APPENDIX III

Table 1: Ministry of Health Recurrent Budget Expenditures. (Internal Allocations, as percentage of Government Total and in US\$ per capita)

YEAR	Total K£	CURATIVE	Rural & P/PHC	Admin & Training	Non Drug supplies & Research	R11 as % GOK	US\$ per Capita
79/80	42,943,415	66.69 %	15.13 %	11.70 %	6.48 %	9.26 %	8.65
80/81	52,868,619	68.36 %	15.74 %	11.43 %	4.47 %	9.45 %	9.55
81/82	59,075,879	72.33 %	12.75 %	11.98 %	2.94 %	9.32 %	7.60
82/83	61,306,323	72.41 %	13.84 %	12.44 %	1.31 %	9.32 %	6.00
83/84	61,765,853	72.39 %	11.55 %	14.57 %	1.49 %	8.83 %	5.36
84/85	73,007,033	66.52 %	9.71 %	10.88 %	12.89 %	9.19 %	5.24
85/86	79,653,593	71.83 %	12.88 %	10.10 %	5.19 %	9.25 %	5.35
86/87	96,546,022	72.14 %	10.82 %	12.1 %	4.90 %	8.95 %	6.16
87/88	101,014,500	78.18 %	10.50 %	9.56 %	1.77 %	8.38 %	5.76
88/89	113,686,327	72.24 %	16.48 %	9.63 %	1.65 %	7.38 %	5.85
89/90	115,032,567	69.39 %	18.92 %	10.5 %	1.11 %	7.87 %	5.54
90/91	128,807,254	69.76 %	19.87 %	9.17 %	1.19 %	7.82 %	5.08
91/92	147,833,073	67.77 %	21.62 %	9.2 %	1.32 %	8.51 %	4.50
92/93	169,489,868	68.72 %	22.02 %	8.65 %	0.61 %	8.46 %	4.60
93/94	209,125,600	62.74 %	25.49 %	9.17 %	2.60 %	7.65 %	2.99
94/95	299,529,639	67.23 %	20.95 %	9.65 %	2.16 %	7.59 %	3.44
95/96	315,133,200	67.11 %	21.38 %	9.28 %	2.22 %	7.60 %	3.22
96/97	350,586,292	66.86 %	21.39 %	9.58 %	2.17 %	7.61 %	3.09

Source: Health Policy Framework

Table 2: HEALTH INSTITUTIONS AND HOSPITAL BEDS COTS BY PROVINCE (2000)

Province	HEALTH INSTITUTIONS				HOSPITAL BEDS & COTS	
	Hospitals	Health Centres	Health Sub centres & Dispensaries	Total	No. of Beds & Cots	No. per 100, 000
Nairobi	52	51	372	475	4579	17
Coast	61	37	321	419	7287	32
Eastern	60	75	684	819	6952	14
N. Eastern	6	9	59	74	1537	14
Central	57	81	356	494	7826	20
Rift Valley	91	153	981	1225	11752	16
Nyanza	92	109	318	519	10268	22
Western	62	86	182	330	6215	18
Total 2000	481	601	3,297	4355	57416	19
Total 1999	449	593	3,193	4235	54,378	17

TABLE 3: REGISTERED MEDICAL PERSONNEL 1999 –2001.

Type of personnel	1999		2000*		IN TRAINING	
	Number	No.per100,000pop	Number	No.per100,000 pop**	1999/2000	2000/2001
Doctors	4, 111	15.3	4506	15.4	817	821
Dentists	734	2.6	746	2.5	157	159
Pharmacists	1, 650	5.8	1682	5.7	212	210
Phical Tech	1, 167	4.1	1232	4.2	109	114
Reg. Nurses	8, 671	30.2	9211	31.4	1, 012	1210
End Nurses	27, 073	94.4	27902	95.2	3, 898	3841
Clinical ffs	4, 277	14.9	4492	15.3	841	852
PHO's	780	2.7	929	3.2	177	180
PH Techns	4, 849	16.9	5032	17.2	427	433
Total	53, 612	10.8	55732	190.1	7, 650	7820

Source: Health Information System – Ministry of Health 2000

* Provisional

** Based on population projections

UNIVERSITY OF NAIROBI
EAST AFRICANA COLLECTION

JOMO KENYATTA MEMORIAL
LIBRARY