

**AN EFFICIENCY ANALYSIS OF HOSPITALS OWNED BY FAITH BASED
ORGANISATIONS IN KENYA.**

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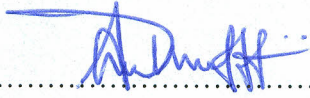
**A research project submitted to the Department of Economic Theory in partial fulfillment
of the requirements for the award of the Degree of Master of Economics (Policy and
Management) of Kenyatta University.**

May, 2014.

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DECLARATION.

This research project is my original work and has not been presented for any award in any other University.

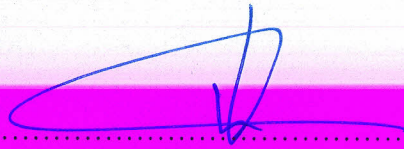
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DEDICATION

To *Mum* and *Dad*: Their Love is immeasurable.

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LIST OF ABBREVIATIONS

DEA	Data Envelopment Analysis
SFA	Stochastic Frontier Analysis
DMU	Decision Making Unit
CRS	Constant returns to scale
VRS	Variable returns to scale
TE	Technical Efficiency
VRS TE	Variable Returns to Scale Technical Efficiency.
CRS TE	Constant Returns to Scale Technical Efficiency.
SE	Scale Efficiency
PBO	Public Benefit Organization
FBO	Faith Based Organization
CBO	Community Based Organization
LP	Linear programming
SUPKEM	Supreme council of Kenya Muslims
KCCB	Kenya Council of Catholic Bishops
CHAK	Christian Health Association of Kenya

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OPERATIONAL DEFINITION OF TERMS.

Data Envelopment Analysis: A linear programming model that measures efficiency levels of firms that have multi-input and multi-output variables. It is non-parametric.

Stochastic Frontier Analysis: This is a parametric model where the regression line passes on top of the observations thus forming a frontier.

Efficiency measure: It is a ratio of actual output to maximum potential output that can be achieved given some input level.

Hospital: Health facility that provide inpatient, outpatient, and maternity services. The services are provided by doctors and specialists, supported by nurses among other health personnel.

Inefficiency: The amount by which actual output falls short of the maximum potential output.

Allocative inefficiency: extent to which the cost of producing a specific level of output can be reduced without altering the level of output.

Technical inefficiency: This is the level of adjustment that can be done downwards on inputs while maintaining the level of output unchanged or the extent to which possible reduction in cost of producing a given level output can be achieved while holding input ratio constant.

Crude Birth Rate: Ratio indicating the number of births occurring in a year per 1000 population.

Crude death rate: Ratio indicating the number of deaths occurring in a year per 1000 population.

Rate of Natural Increase: The difference between crude birth rate and crude death rate. Also known as rate of population change in the absence of migration.

Total Fertility rate: Represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates. Current child bearing years is 50.

ABSTRACT

The desired goal for Kenya's Vision 2030 and the millennium development goals is to provide efficient and reliable healthcare that will reduce child mortality rates, improve maternal health and combat HIV/AIDS, Malaria and other diseases by the year 2015. Kenya's health care sector has been among the most inefficient in the world characterized by high disease prevalence, high mortality rates, low life expectancy, and poor access to healthcare services and corruption. Addressing the above challenges and attaining the millennium development goals on reduction of child mortality rates, improvement of maternal health and combating of HIV/AIDS makes efficiency in health care services delivery a requisite obligation in addition to sound government policies and stakeholder goodwill. Hospitals owned by the faith based organizations are a vital component of health care institutions in Kenya. They form a key component of the private sector healthcare provision with about 40 percent dominance. The operations of these hospitals depend on donor funding, user fees and government subsidies. Dwindling donor assistance, falling government subsidy, poor human resource for health employment and distribution coupled with financially poor citizenry that seek the services of hospitals owned by faith based organization has been a compelling datum to pursue efficient ways of providing healthcare. Therefore, the question on how the scarce resources allocated to the hospitals owned by faith based organizations are been utilized, has been of urgent need for address. This study sought to unravel the technical and scale efficiency of hospitals owned by faith based organizations in Kenya. The study employed the Data Envelopment Analysis which is either input oriented or output oriented. Input orientation was adopted for this study. The input variables included medical officers, nurses, beds and cots and an aggregate of other hospital workers; while the number of inpatients and outpatients were the output variables for the analysis. The sample size included 30 FBO hospitals drawn from the Kenya Conference of Catholic Bishops (KCCB), the Christian Health Association of Kenya, (CHAK) and the Supreme Council of Kenya Muslims (SUPKEM) as the major FBO blocks in the country. The results were that only 36.67 percent of FBO hospitals were operating efficiently under the Variable Returns to scale technical efficiency. Scale efficiency revealed that approximately 20 percent of the FBO hospitals were scale efficient. In general the study concluded that if FBO hospitals operated as a group, the technical efficiency would be 79% while scale efficiency would be 59 percent. The key recommendation of this study is that FBO hospitals and the other health facilities need to have a yearly efficiency analysis to ascertain proper resource allocation.

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND

After the colonial administration in Kenya, there was need for the country to face the major economic problems and foster mechanisms to mitigate them. Most pronounced national problems were ignorance, diseases and poverty (Republic of Kenya, 2008). The colonial administration had discriminated Africans from enjoying basic rights such as quality health care, education and food. Health care was inaccessible and unaffordable for the Africans. It was therefore paramount to avail affordable and efficient health care services to Kenyans who had suffered for more than two decades.

The government at independence embarked on promoting coverage and access to modern health care services, (Korir, 2010). In the same effort, the government institutionalized free health care service delivery to its citizens in the belief that a healthy nation would foster economic productivity and sustainable development, (Kimalu *et al.* 2004). Critics have however argued that the free health care provision by the independence government was a populist agenda than a well thought out government policy and as such, it facilitated its own ending in 1989 (Anangwe, 2008). The government had a feeling that it needed to be famous amongst the Kenyans by doing what the colonial government failed to do.

Notable infrastructural developments followed as the government leveled the ground for private health investments. Owino (1997) suggests that the infrastructural growth was attributable to increased government expenditure, favourable donor support, private sector investment, religious and non-governmental organization (NGO) investment and an overall individual and community support.

By 1980, health indicators had already recorded improvement in health facilities to present a relatively healthier nation. There were more public health facilities that offered health services for free. Private facilities mainly supported by the faith based organization had also mushroomed with accessibility and affordability.

According to the Republic of Kenya (1994) total fertility rates had recorded an increasing trend reaching 8.1 in 1980's. However there was a considerable drop to 5.4 by 1992 while by 2010 the total fertility rate was recorded at 4.6. This could be attributable to pronounced population check measures alongside the growth and spread of the HIV/AIDS epidemic. Infant mortality went down from 98 deaths per 1000 live births between 1974 and 1977 to around 63 deaths per 1000 live births by 1993. By early 1990's the crude death rate had dropped from the 20 per 1000 births recorded at independence to 12 per 1000 while the crude birth rate dropped from 50 per 1000 population to 46 per 1000 in the same period (Owino, 1997). Child mortality was recorded at 93.2 deaths per 1000 live births by 1993, (Republic of Kenya, 1994; 1999).

Various governments have grappled with reversals and gains in health system instrumentation all through their terms. Major policy institutionalizations geared towards availing national health systems that are efficient and affordable have taken centre stage in any government of the day.

1.2. KENYA HEALTH POLICY REFORMS.

Health policy reforms in Kenya started soon after Kenya attained her independence. The design and implementation of the policies has been an aim to promoting access to modern healthcare in an attempt to attain the long-term objectives of health for all. Although the physical infrastructure for health rapidly gained increased growth after independence,

maintenance and upkeep of public sector health facilities has continued to be an inseparable burden for the ministry of Health recurrent budget (Mwabu et al, 2004).

The first independent government reformed the health sector that for a long time marginalized the blacks by making it universally accessible to all Kenyans. Health care became a basic right to all individuals. At the same time, individuals were not expected to pay any fees to access health care. However, various constraints made it impossible for the government to continue financing increased demands for health care. According to Ngugi, (1999), the government faced inefficiencies and inequities in the health care delivery process owing to poor management and inappropriate pricing of services. By 1989, the government introduced user fees in all public health facilities (Anangwe 2008).

It was however feared that user fees threatened the accessibility of health care services by the poor and vulnerable groups. In response, the government introduced the system of waivers and exemptions (KDHS 1994). Under exemptions, various categories of health care seekers were automatically exempted from user fees. Such groups included those seeking family planning, children under five years, sexually transmitted disease patients and those suffering from HIV/AIDS (Anangwe, 2008). Waivers on the other hand were supposed to take care of those who could not afford to pay user fees due to their inabilities. Both policy interventions were put under care of medical staff and social workers at individual facilities who were charged with the responsibilities of assessing the financial position of the health care seekers and waiving part or all of their bills. Due to change rigidities and its complexity, the user fees were suspended in the first quarter of 1990 and later reintroduced in 1991.

Decentralization was also another notable health sector reform that basically aimed at efficiently providing health care services to the people.

Decentralization is the transfer of responsibility for planning, management, resource generation and allocation away from the central government and its agencies (KDHS 1994). In Kenyan health sector, decentralization reduced the user's cost of travel to the health facilities, provided more time for policy analysis and formulation, and increased their performance in financial respect (Obonyo et al, 1997). The objectives of decentralization are to improve management, efficiency, accountability and responsiveness of health services and control of modern health care (Kimenyi et al, 2004). Started in 1983, Kenya has continually decentralized her health sector through restructuring and strengthening of the ministry's district level management capacity under the District Focus for Rural Development Strategy programme, creation of District Health Management Teams (DHMT) and the District Health Management Boards (DHMB) in 1992 (KDHS 1994). The role of the management levels was to represent community interests in health planning in addition to coordinating the implementation of health projects at the district level. In 1987, Kenyatta National Hospital was notably granted autonomy. The new constitution promulgated in 2010 outlines further decentralization of some key components of the health sector from the Ministry of Health to the county governments.

1.3. KENYA HEALTH SECTOR COMPOSITION.

Currently the Kenyan health sector is unilaterally supervised by the government through the Ministry of Health. However, different categories of health facility ownership exists from the two broader sectors; public and private health sectors. The public health sector accounts for about 51% of the national health care while the rest is taken up by the private sector, (KHSSP II, 2013). The public health sector depends greatly on budgetary allocation from the government ex-checker while most private institutions especially those owned by faith based organizations depend on government subsidies on inputs such as drugs; Medical personnel; transport and donor funding which is sometimes not consistent.

With such inconsistent funding sources, government commitment to other areas of the economy other than health coupled with the fact that hospitals owned by faith based organizations are expected to charge low user fees, efficient management of inputs and outputs becomes inevitably compelling. These hospitals must efficiently utilize whatever resource that is at their disposal.

Private health sector comprises of not-for-profit private and private for profit health sub-sectors. Ownership of private health facilities ranges from individuals, Faith Based Organizations, Public Benefit Organizations and also Community Based Organizations. In 2010, private health care facilities were about 1440 of which 43 were private for profit hospitals while 63 were private not-for-profit hospitals, (Korir, 2010). The rest were other health facilities such as dispensaries, health centres, clinics and nursing homes spanning from private for profit to private not for profit institutions. According to The Republic of Kenya, (2012) the Christian Health Association of Kenya, (CHAK) oversees 15 full-fledged hospitals in Kenya, the Kenya Conference of Catholic Bishops, (KCCB) oversees 49 hospitals while the Supreme Council of Kenya Muslims, (SUPKEM) runs 11 hospitals. Despite largely depending on donor funding and government subsidy for operation, hospitals owned by faith based organizations have since independence offered critical and specialized health care services to the population. This is evident from the government referral system to such hospitals for specialized health care services which are otherwise unavailable in the public hospitals (Collins *et al.*, 1996).

Non-governmental providers are a significant part of Kenya's overall health care provision capacity. They account for 50% of all hospitals and 36 % of Kenya's hospital beds. They also account for approximately 21% of health centers and 51% of all other outpatient treatment facilities, although these include a wide variety of different levels of quality and capacity.

Of the private health care facilities, more than 40% are owned by faith based organizations (World Bank, 2010). They offer specialized healthcare with subsidized user fee through medical camps and missions. Owing to their great contribution to national health care coupled with decreased donor funding this study attempts to estimate the technical efficiency of hospitals owned by faith based organizations in Kenya.

1.4. CHALLENGES IN THE KENYAN HEALTH SECTOR.

The health sector in Kenya has faced a lot of challenges since independence. Various factors in the past have manifested heightened challenges that have threatened the survival of the sector. Such factors include slow economic growth, implementation of the structural adjustment programs (SAPs) that required reduction in social sector spending including health, rapid population growth, wide spread poverty, inequalities, inadequately enforced sector laws, increased costs and prevalence of AIDS and inefficiency in the use of resources, (Kimuyu, 2001). In the centre of all the challenges, efficient and affordable health service delivery has been the aim for all policy reforms and revolutions. The health sector like any other should be as ultimately efficient in health service delivery as possible.

Ever since independence, the Kenya health sector reported significant growth in terms of infrastructure, (Republic of Kenya, 1994). The physical infrastructure meant for health care provision grew across the country and across the various levels and sizes. This growth was however not equally distributed across the country and therefore certain parts became relatively endowed in health sector investment than other parts. Berman (1995) depicted that whereas Western, Nyanza and Eastern provinces had a relatively higher concentration of mission health facilities; Nairobi had the highest number of private health facilities with districts in the northern frontier of the country having acute shortages. The rapid growth of health facility investments was attributable to various reasons which included government policy to allow doctors employed in the civil service to engage in private practice in the

1970s coupled with the extension of the same privilege to clinical officers, nurse-practitioners and pharmaceutical technologists in the 1980s, (Kimuyu, 2001). It therefore follows that such rapid growth was highly aligned to private health sector. Private health sector thrived on increased government subsidies, donor funding, community goodwill and ample policy environment (Korir, 2010). Figure 1.1 depicts a trend of the growth of total health facilities in Kenya from 1999 to 2011.

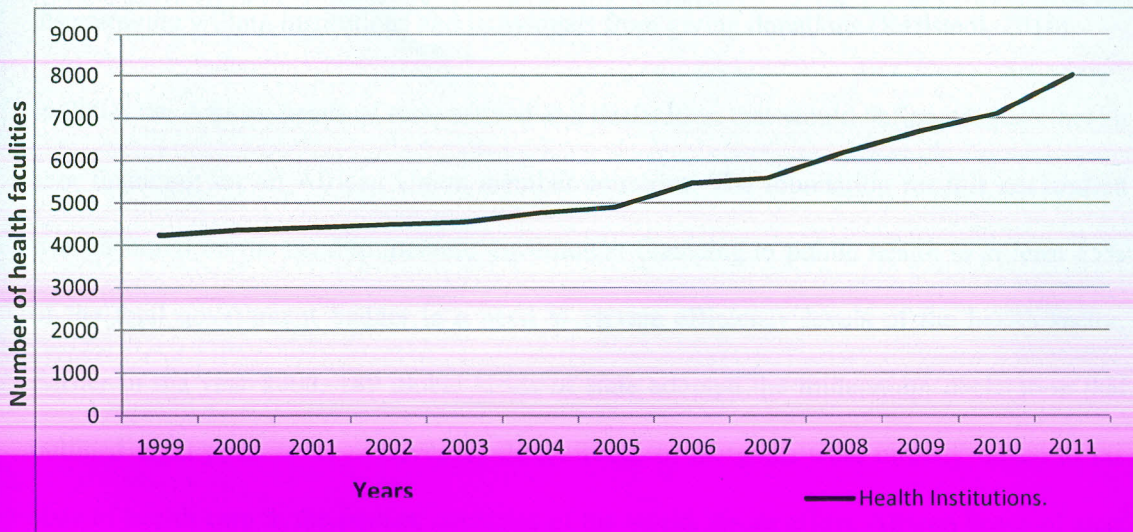


Figure 1.1: Kenya health facility trend from 1999-2011.

Source: Kenya Economic Survey; 1999 - 2011.

The trend in figure 1.1 depicts considerable growth in health facilities over the years from approximately 4235 facilities in 1999 to around 8006 in 2011. The growth in averagely 10 years nearly doubled.

Despite the infrastructural growth circumventing the health care sector, the Kenya health sector has remained highly inefficient (Kirigia *et al*, 2004).

Over half of these facilities have old and dilapidated infrastructure and it is worse for hospitals some of which were constructed in the 1920s.

Given these different forms of infrastructure, most of the existing facilities do not conform to current norms and standards with respect to expected staffing, infrastructure and equipment, (KHSSP, 2013). This manifests a situation of uncertainty in quality of output and efficiency.

Health care financing is critical to the sector's success. However, this has been a challenge both to the government and the stakeholders. Donor funding has become stringent. Donor countries have enacted laws governing donor remittances to developing countries thus further discouraging willing institutions and individuals from giving donations (Karlstedt, 2010).

In 2001, the African heads of state arrived at a declaration that would define adequate health care financing for all African Union member countries. The foundation for this declaration was anchored on the need to increase government financing to public health to at least 15% of the total government budget in a need to elevate efficiency levels of the health sector. Earlier in the year 2000, 189 global heads of state adopted the millennium declaration that outlined eight goals to be achieved by 2015. Three of the goals were directly linked to the state of health care in the poorest countries of the world. As an effort, African heads of state adopted the 15% government financing for health as a proportion of total government earnings. This would further the efforts geared towards realization of the millennium development goals by 2015. However, more than 10 years on, 99% of the African countries have never achieved the Abuja Declaration owing to poor governance, heightened poverty levels, inconsistency in donor remittances and general treasury reluctance (WHO, 2011).

Kenya as a member of the Abuja Declaration has continually failed to meet the minimum funding of at least 15% of total government expenditure for public health care.

Figure 1.2 furthers a discussion on the trend of government financing against the requirement of the Abuja declaration.

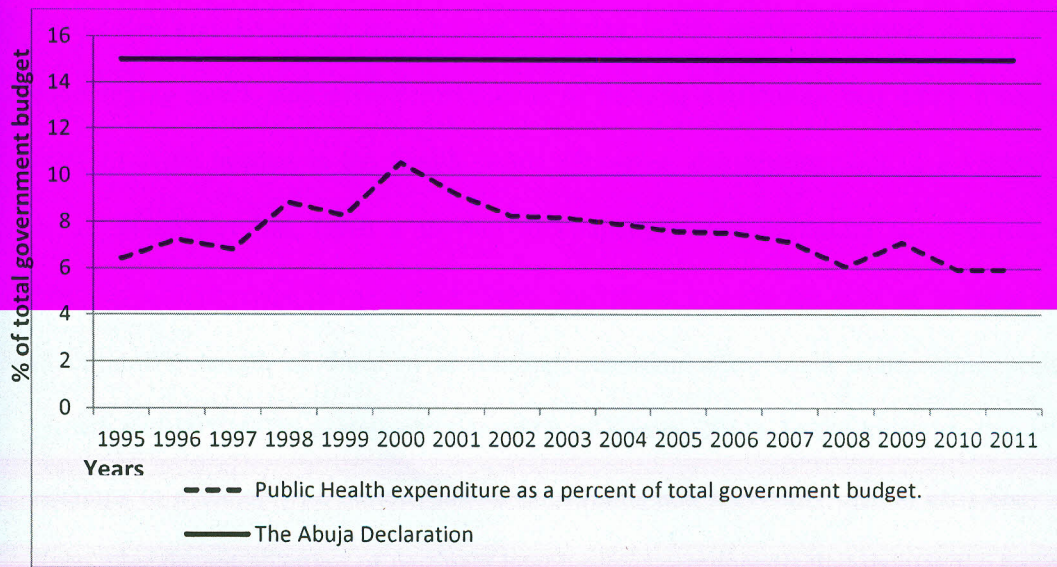


Figure 1.2: Kenya public health expenditure as a percentage of total government budgets.

Source: World Bank data.

Since 1995, health financing as a percent of the government budget increased significantly up to the year 2000. Dramatically, in 2001 and after the Abuja declaration, the level of health financing as a proportion of government budget considerably declined from 11% to as low as 6% by 2011 further declining from the 15% mark. As such, the government continually reduced the proportion of health care financing posing serious constraints to health sector development and efficiency. This situation occasioned a high resource constraint at the advent of increased health care demands owing to rising HIV/AIDS prevalence, population growth and heightened disease exposure. It is fundamentally important to look at the ripple effect on the health sector. As such, private health care in the light of serious constraints in the public health sector is indeed inevitably complementary. Faith based organization facilities as part of the private health sector, are transitively significant. Their efficient operation therefore cannot be overlooked.

Qualified human resource capacity is inevitably a requisite condition for economic efficiency and development.

Kenya has endeavored in training and retaining health sector personnel since 1970s by encouraging public and private institutions to develop curriculum that equip trainees with relevant skills needed in the health sector. However, the development of a vibrant health sector manpower has faced a myriad of challenges thus curtailing achievement of the intended efficacy and development. Such challenges include the cost of training medical practitioners, length of duration at training, retention rates, brain drain, rapid population growth and HIV/AIDS prevalence (Republic of Kenya, 2011). In the long run, this situation revamps to a sector with serious labour constraints and inevitably dismal efficiency levels. Even after decentralization of pertinent health sector components that include the health care labour supply, efficiency remains far from achievement. The foundation for health care devolution to the county governments is anchored on promoting community participation in health sector policy development that will guarantee an efficient health care sector (Republic of Kenya, 2013). A shortage in health personnel however threatens the achievement of this goal.

Figure 1.3 depicts a comparison of the approximate number of doctors operating in selected Kenya County Governments both in the public and private health facilities and the minimum required doctors in regard to the population densities in those counties. The trends across the sampled counties are meant to bring out disparities on current approximates of doctors and the minimum required number of doctors for a further efficiency analysis.

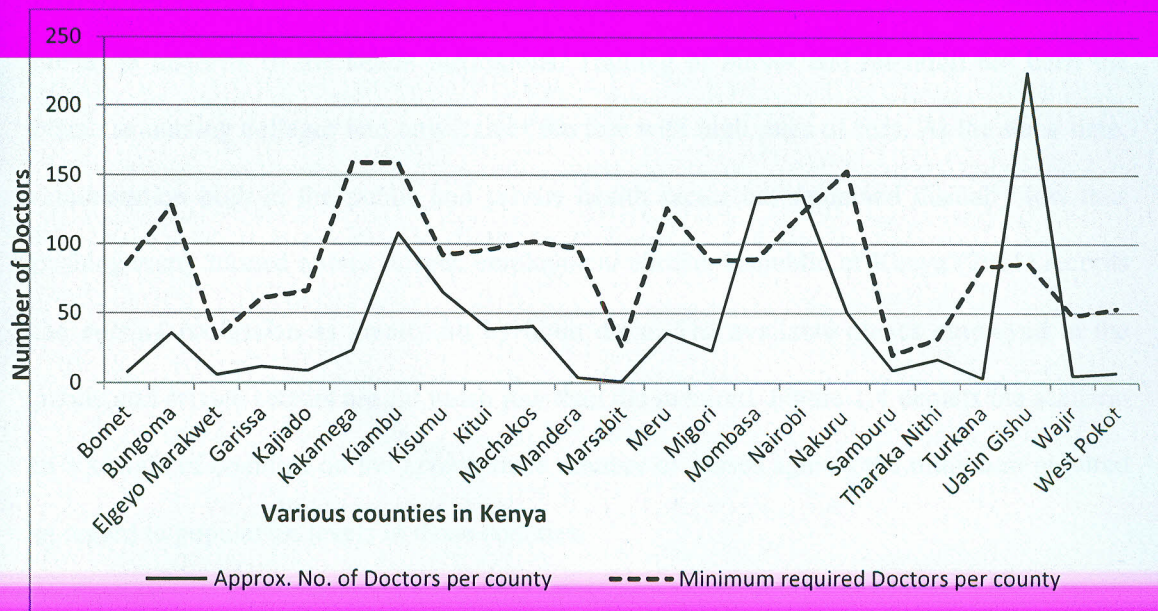


Figure 1.3: Approximate number of doctors against the minimum required doctors in various counties in Kenya, 2013.

Source: Kenya Economic Report, 2013.

Apart from Mombasa, Nairobi and Uasin Gishu counties of Kenya, all the others in the sample counties operate with below required minimum number of doctors while others like Marsabit desperately operate with almost no doctor. The trend also depicts the inequities in doctor distribution across the country with some counties like Uasin Gishu having more than doubled the required number. It further points out to serious efficiency issues where a limited number of doctors are expected to serve an increasing demand for health care.

Nurses are arguably complementary to doctors during post diagnosis services. Some of the nurses have gone through on-job trainings that make them rather equipped for diagnosis of less complex health problems, (WHO, 2010).

This makes the nurses very crucial in health care delivery. In most health institutions in Kenya, there are no designated doctors and therefore the nurses operate as their proxies unless on critical health complexities.

Despite the critical role they play in health care, the health sector is highly understaffed with nurses in majority of the health institutions. Training of nurses and retention has been the blame as nursing colleges and universities are few with high rates of fees. At the same time, remuneration both in the public and private health sector has remained dismally low thus pushing many trained nurses to seek employment abroad. Republic of Kenya (2011) records the nursing profession as greatly hit by brain drain. The available nurses employed in the public and private sectors are far much low than the required. Figure 1.4 depicts the scenario in a sample of counties on the approximate number of nurses against the minimum required in regard to population levels in those counties.

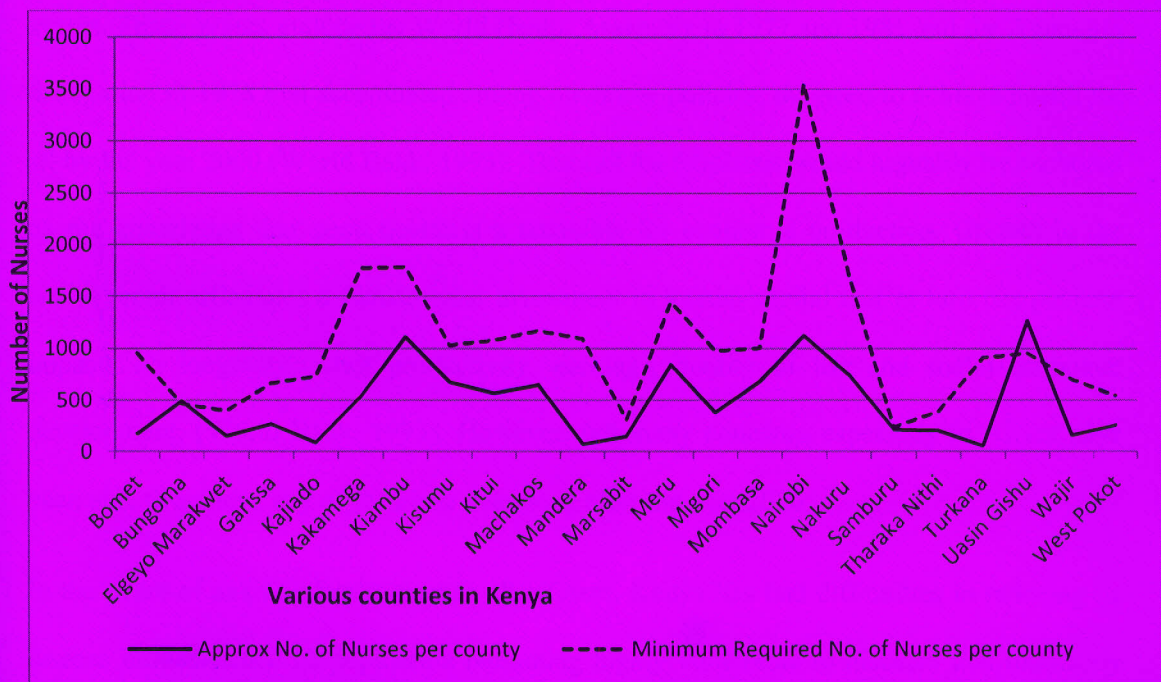


Figure 1.4: Approximate number of nurses against minimum required number of nurses in various Kenyan counties.

Source: Kenya Economic Report, 2013.

Figure 1.4 reveals that from the selected sample of counties, only Uasin Gishu has slightly more than the required number of nurses all summed up from public and private sectors. All the other counties have far much lower number of nurses than the World Health Organization recommends.

This situation translates to severe inefficiency issues as majority of this counties have large institutions including referral hospitals that deal with complex health problems. It further reveals that a single nurse is occasionally overworked with long hours of duty which in the end compromises his or her real output. Increased demand for health care occasioned by rapidly growing population which means that an individual nurse faces a stiffer work load every day, coupled with low remuneration threatens the achievement of a proper nurse workforce as many more will opt to seek employment elsewhere. This further cripples efficiency operation of the Kenyan health sector as a whole.

The development of the Kenyan health sector circumvents the direction set by three key events. These events include the World Health Assembly in 1977 and 1981 and the Alma-Ata declaration of 1978 that accentuated among other key policies, the need to achieve health for all by the year 2000 (World Bank, 1993). This call for emphasis would arguably be anchored on the knowledge that good health is a preamble for economic production. Growth in the health sector articulates a fundamental investment in human capital that in turn has positive impacts on longevity, adult productivity, earnings, quality of life and social economic development, (World Bank, 1993). However, not many countries especially in Africa have been able to achieve any of the goals even long after the year 2000.

In the event of availing health care to all citizens, Kenya has had difficulties in reducing its disease burden hence its population remaining highly vulnerable to diseases that ultimately case death. Malaria remains the greatest challenge for Kenya's disease burden taking the greatest share of both the morbidity and mortality rates. Figure 1.5 shows the trend in the growth of reported cases of malaria for years 2000 to 2011.

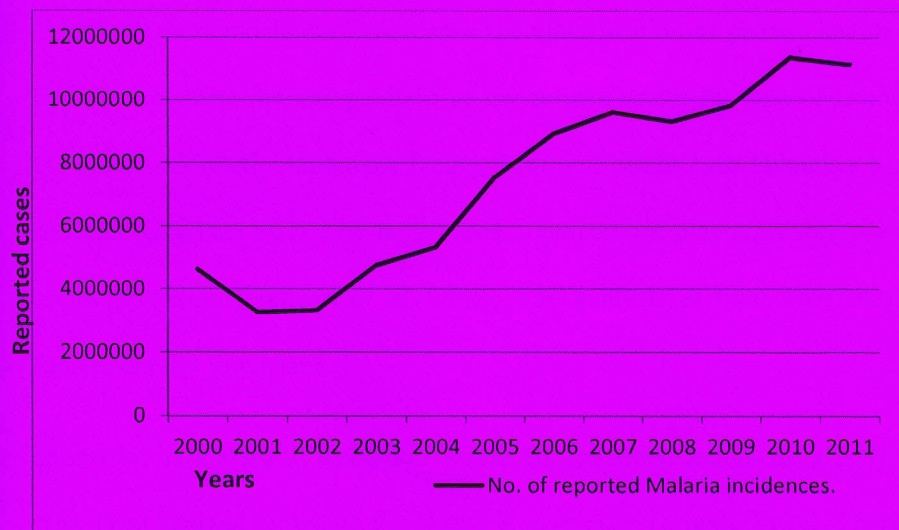


Figure 1.5: Trend on reported cases of malaria Incidences.

Source: Kenya Economic Survey; 2000 – 2011.

Although the cases reported relative to population decline considerably over the years in consideration, the number of malaria cases reported in health facilities across the country is overwhelmingly increasing. This is a major concern to the health sector since further data allude to close to 30% of the reported cases lead to death (Republic of Kenya, 2007; 2010). More than 40% of the cases are reported when the malaria causing virus has highly reproduced itself in the body. Reasons for the delay of both reporting and diagnosis have arguably revolved around high facility user fees facing poor Kenyans, distance from homesteads to the facility, inappropriately equipped facilities for diagnostic tests, long waiting queues at the facility that discourage hospital visits and an overall inefficiency of the health sector (Owino, 2001). Figure 1.5 reveals that by 2011, approximately 12 million cases of malaria were reported and recorded at various health facilities across the country. Further, if 30% of the reported cases led to death, approximately four million people both adults and children would have died of Malaria in 2011.

Efficiency of the health sector as a major challenge is therefore inevitably in need. Both the public and the private sectors ought to operate efficiently with the resources at their disposal to yield the maximum of their services.

Although there exists confusion over the classification of private health care providers such that documenting the composition of the private sector by type of health care organization, the nature of health challenges facing them and health care financing has proven to be very difficult, hospitals owned by faith based organizations play a pivotal role in the private health sector provision (Berman *et al.*, 1995). The analysis of their efficiency levels is therefore fundamentally important.

Efficiency is a state of operation where all economic inputs have fully and with minimum cost, been utilized by which the output is maximum (Lovell, 1993). There can be many types of economic efficiencies. However, Farrell (1957) proposed that the efficiency of a firm consists of two components; technical efficiency that concentrates on the input mix that yields maximum output under minimum cost conditions and the allocative efficiency which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices and the production technology. In theory, there is almost a perfect substitutability of cost functions and the firm's technology. This means that in efficiency determination, cost of production in a firm is a vital component that can be used to determine efficiency. The two measures of efficiency are then combined to provide a measure of total economic efficiency (Coelli *et al.*, 2005). Whereas technical efficiency may not be cumbersome in determining, allocative efficiency requires that data on input prices used in DMUs be available. This is not only a challenge in accessing the data but also the data may not truly reflect the true opportunity cost of using the inputs. Therefore this study sought to analyze the technical and scale efficiency levels of hospitals owned by faith based organizations.

The latter measure is a product of dividing the CRS and the VRS efficiency measures of each DMU in consideration.

1.5. THE STATEMENT OF THE PROBLEM

Korir (2010) asserts the existence of inefficiency in the health sector and that between Kshs. 1 billion and 1.4 billion in financial terms would be salvaged if public hospitals as a group operated efficiently. Efficiency measurements in health care are hence a vital component in policy formulation and implementation. Despite numerous health sector reforms and relatively sufficient financing anchored on efforts to solve inefficiency, little has been achieved in leveling efficiency in the Kenyan health care (Republic of Kenya, 1994).

Health care in Kenya is provided by both the public and the private sectors. Faith based organizations as part of the private health sector take over 40 percent of the available national private health care provision (World Bank, 2010). Hospitals owned by faith based organizations largely depend on donor funding and government subsidy for their operation. However, in the recent years, donor funding in general has significantly reduced while regulations by the donor countries have been heightened to efficient utilization of the donations (Karlstedt, 2010). Health sector personnel are also highly unequipped, unequally distributed and few relative to population density. There is therefore need for the healthcare providers to ensure efficient use of the donor funds, government subsidies and employment of the already scarce health personnel not only for better health care provision but also to ensure continued support.

There are studies that have attempted to measure efficiencies of public health facilities in Kenya. Kirigia *et al.* (2004) found out that 44 percent of Kenya's Public Health Centres (PHCs) were technically inefficient and Korir (2010) found out that productivity in Public Hospitals (PH) in Kenya increased over time.

But then measures of cost efficiency depicted that the average actual costs of hospitals exceeded the minimum cost.

The purpose of this study was to measure the technical and scale efficiency levels in hospitals owned by faith based organizations in Kenya and thereof draw policy recommendations.

1.6. RESEARCH QUESTIONS

This study sought to answer the following questions;

- i. What is the level of technical efficiency in the hospitals owned by Faith Based organizations in Kenya?
- ii. What are the corresponding levels of scale efficiency in the hospitals owned by Faith Based Organizations in Kenya?

1.7. OBJECTIVES OF THE STUDY

The main objective of this study was to analyze the efficiency of hospitals owned by Faith Based Organizations in Kenya while the specific objectives included:

- i. To measure the level of technical efficiency in hospitals owned by Faith Based Organizations in Kenya.
- ii. To determine the corresponding levels of the scale efficiency in hospitals owned by Faith Based Organizations in Kenya.

1.8. SIGNIFICANCE OF THE STUDY.

Although not widely used in the past, efficiency measures in healthcare using DEA are of paramount significance. Overdependence on donor funds and government interventions in terms of subsidies alongside a poor healthcare seeker are not only weak institutional policy measures but also not sustainable over time. Efficient uses of available resources guarantee maximum healthcare outcomes.

This study is therefore in a place to further knowledge on the efficiency measures of hospitals owned by faith based organizations. The results of this study will not only be useful to policy makers in the healthcare sector but also to the FBO health institutions and other private sector stakeholders who are confronted by dwindling resources coupled with increased demand for health care. The study will also inform donor agents on possibilities of continued support for an efficient health care sector.

1.9. LIMITATIONS OF THE STUDY.

This study addressed the analysis of efficiency of hospitals owned by faith based organizations in Kenya. Hospitals owned by faith based organizations are just a fraction of the entire private health sector. The study was therefore limited in explaining efficiency measures in hospitals owned by other private individuals and institutions other than the FBOs.

Due to difficulties in accessing data on private institutions especially expenditure and wage bill, this study narrowed down to technical and scale efficiencies only. Hence, the study may not offer information on the allocative efficiency of the hospitals that is centrally a focus on efficient costing.

1.10. ORGANIZATION OF THE STUDY

The organization of this study is such that, chapter one focuses on vital discussions on Kenyan health sector situation, composition and challenges in a bid to elevate the need for efficiency measurements. Chapter two is divided in to three sections. Section one focuses on the theoretical underpinnings of efficiency. This microeconomic explanation focuses on decomposing total economic efficiency into both technical efficiency and allocative efficiency. Much emphasis will lay on technical efficiency that will centrally be used in obtaining scale efficiency through CRS and VRS. Section two will endeavor on looking at an

in depth review of relevant and available literature on technical and scale efficiencies in the health sector. The last section will summarize the key issues unraveled in the review of literature in a bid to elevate key knowledge gaps. Chapter three gives a clear coverage of the research methodology that the study assumed. This includes the theoretical underpinnings of efficiency measures and the application of Data Envelopment Analysis in hospital efficiency measurement. Chapter four documents the results of the study and seeks to interpret such results in the context of the study objectives. It further gives the researchers general observations and probable causes of inefficiency. Finally, chapter five of this study seeks to summarize, conclude and cite policy implications for the research. It further touches on areas of further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter endeavored in bringing out arguments on the efficiency measures. After the theoretical address, literature specific to efficiency of health care sector was reviewed and on the basis of the underlying theoretical underpinning, the DEA non-parametric structural model assumed in this study was discussed. Finally an overview of the literature was covered.

2.2 THEORETICAL LITERATURE.

This section focuses on the technical efficiency and allocative efficiencies as the two components of total economic efficiency. A decomposition of the CRS technical efficiency into scale inefficiency and pure economic efficiency are digressed. Efficiency of any production unit consists of a comparison between observed and optimal values of its outputs and inputs (Lovell, 1993). With a bearing on the works of Debreu (1951) and Koopmans (1951), Farrell (1957) defined a simple measure of firm efficiency that could account for multiple inputs. Efficiency of a firm or any decision making unit consists of two components: technical efficiency, which simply reflects the ability of a firm to obtain maximal output from a given set of inputs, and allocative efficiency, which basically reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices and the production technology, Farrell (1957). The combination of the two measures provides a unit measure of total economic efficiency. There are two approaches to understanding the technical and allocative efficiency measures by use of input and output graphs. Section 2.2.1 and 2.2.2 further the discussion.

2.2.1. THE INPUT-ORIENTED APPROACH TO EFFICIENCY MEASUREMENT.

The input-oriented approach assumes, for simplicity, firms that use two inputs (x_1 and x_2) to produce a single output (q) under the assumption of constant returns to scale, Farrell (1957). Constant returns to scale simply imply that when the producer increases inputs x_1 and x_2 by a unit, output level q increases by the same unit margin. Figure 2.1 below helps to further the discussion.

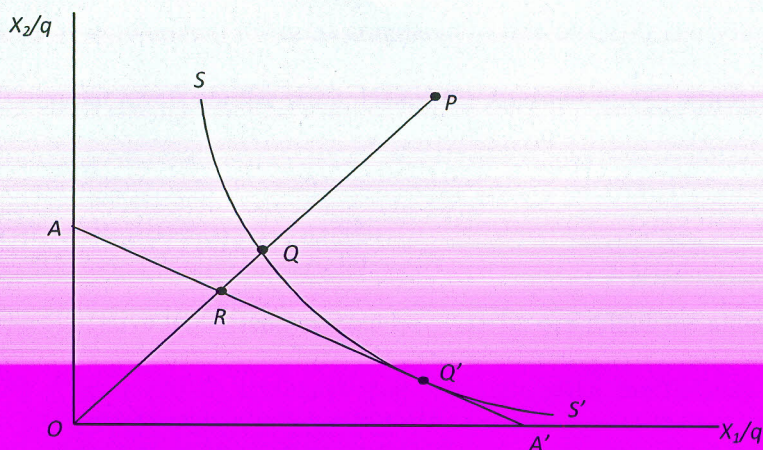


Figure 2.1 The input-oriented approach to efficiency measurement.

The unit isoquant SS' in figure 2.1 is important when its measure of fully efficient decision making units is known since it permits the measurement of technical efficiency, (Coelli et al, 2005). If a given firm uses quantities of inputs, defined at point P , to produce a unit of output, the distance QP represents its technical inefficiency (Farrell, 1957). This is a representative of the amount by which all inputs could be proportionately reduced without changes in the output level.

However the technical efficiency of such a firm could be given by the ratio of distances OQ to OP as follows.

$$\text{Technical Efficiency} = \frac{OQ}{OP} \quad (2.1)$$

The above relationship 2.1 is equivalent to one minus the firm's technical inefficiency ratio QP/OP . It takes a value between zero and one and hence provides an indicator of the degree of technical efficiency of the firm, (Coelli, 2005).

In measuring allocative efficiency, point Q' depicts an equilibrium point where cost is most efficient. However, the cost of production is equal at points R and Q' while level of output at point R is relatively lower as compared to that of Q' . It is also obvious that at points Q and Q' , output levels are the same. Hence the ratio OR to OQ represents the allocative efficiency as below.

$$\text{Allocative Efficiency} = \frac{OR}{OQ} \quad (2.2)$$

The allocative inefficiency would be given by one minus the allocative efficiency ratio OR to OQ . Korir (2010) stipulates that the allocative inefficiency measures the possible reduction in cost from using the correct input proportion.

In measuring the total economic efficiency, the measure of both the technical efficiency and allocative efficiency must be known with certainty. Total economic efficiency is product of both the technical and allocative efficiencies as below, (Coelli et al, 2005).

$$\text{Total Economic efficiency} = TE * AE = \left(\frac{OQ}{OP} \times \frac{OR}{OQ} \right) = \frac{OR}{OP} \quad (2.3)$$

It is important to note that the technical, allocative and total economic measures of efficiency are bounded by zero and one.

The above efficiency measurements operate under basic theoretical assumptions that the production technology is known, (Coelli et al, 2005). This is not true in practice and hence the efficient isoquant must be estimated from a sample data.

The above analysis has taken into consideration the input-oriented approach in measurement of efficiency.

However, it is practically possible to address efficiency measurement of decision making units with the help of output-oriented approaches to efficiency measurements.

2.2.2. OUTPUT-ORIENTED APPROACH TO EFFICIENCY MEASUREMENT.

Unlike the input-oriented approaches to efficiency measurements that seek to indicate the amount of inputs that can be reduced without altering the output, out-put oriented approach to measures of efficiency seek to unravel by how much can output quantities be proportionately expanded without altering the input quantities used, (Coelli et al, 2005).

Consider a production setting involving two outputs(q_1 and q_2) and a single input x . Assuming constant returns to scale, we can represent the technology by a unit production possibility curve in two dimensions. The graphical representation of the scenario in figure 2.2 helps to further the discussion.

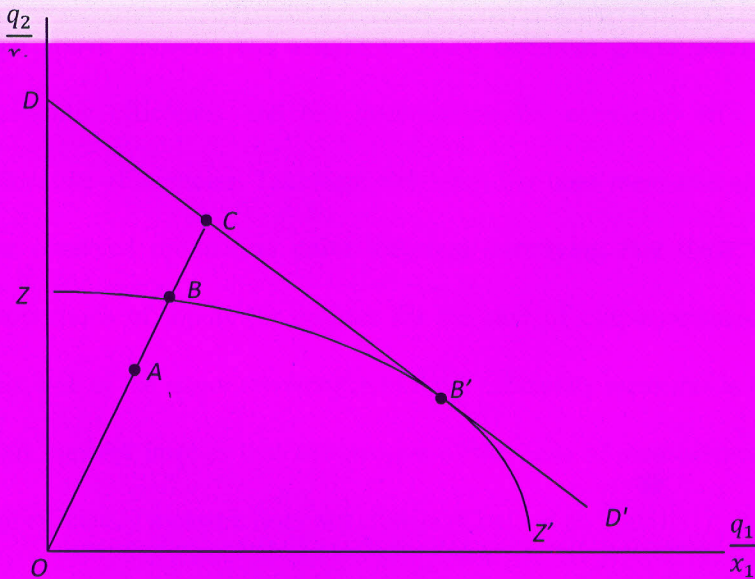


Figure 2.2 The Out-put oriented approach to efficiency measurement.

The curve ZZ' is the unit production possibility frontier while point A depicts a firm that is inefficient in its production process. This firm lies below the production possibility curve that is a representative of the upper bound of the production possibilities.

Fare *et al*, (1985, 1994) define the Farrell output oriented efficiency measures such that the technical efficiency is given by the ratio of the distances OA to OB.

$$\text{Technical efficiency} = \frac{OA}{OB} \quad (2.4)$$

On the other hand, allocative efficiency can be defined by the ratio of distances OB to OC such that the line DD' represents the isorevenue line which is simply a locus of optimal revenue points that accrue to the producer for any two outputs efficiently produced, (Coelli *et al*, 2005).

$$\text{Allocative Efficiency} = \frac{OB}{OC} \quad (2.5)$$

Similarly, to compute for total economic efficiency, a product of the technical and allocative efficiencies is obtained. This can be represented in ratio form as below.

$$\text{Total Economic efficiency} = \left(\frac{OA}{OB} \times \frac{OB}{OC} \right) = \frac{OA}{OC} \quad (2.6)$$

The above analysis has sought to show different graph aided theoretical approaches to economic efficiency and has decomposed the economic efficiency to the technical and allocative efficiencies. Technical efficiency has been measured along a ray from the origin to the observed production point therefore portraying that these measures hold the relative proportions of inputs (or outputs for the case of output-oriented approach). Drawing from this, one of the major advantages of these efficiency measures is that they are units invariant. This concept implies that irrespective of the units of measurement changing on the variable the efficiency measure does not change (Coelli *et al*, 2005).

There are several methods that can be employed to estimate efficiency of decision making units. They include the Stochastic Frontier Analysis (SFA) and the Data Envelopment Analysis (DEA). Stochastic Frontier Analysis (SFA) assumes a stochastic functional form to the frontier. When the functional form is specified, obtaining the unknown parameters of the function is done using econometric techniques.

The initial process to specify a functional form of the SFA makes it computationally challenging. However, SFA takes to account the stochastic noise in the data. It is therefore fundamental in conducting conventional tests of hypotheses. Data envelopment analysis (DEA) on the other hand dominates the non-parametric methods of estimating efficiency. There are several advantages that make DEA most preferred for use in efficiency estimation. Firstly, DEA method is computationally simple and has the advantage that it can be implemented without specifying the functional form of the frontier although it does not account for the stochastic noise. Secondly, DEA focuses on each decision making unit (DMU) in contrast to population averages thus producing a single efficiency measure for each DMU in terms of input-output relationships, (Kirigia, 2013).

Thirdly, DEA can adjust for exogenous variables that are beyond the control of the DMU. Such adjustments have a strong bearing on efficiency levels of DMUs. For instance, a health facility may be ranked inefficient after data on inputs and outputs are used to estimate its efficiency but say climate, civil unrest by workers or general political instability characterized the health sector. In themselves, the exogenous variables contract to causes of inefficiency and hence are in themselves agencies of inefficiency (Kirigia, 2013). In its variable returns to scale (VRS) method, DEA does not require a priori knowledge of prices for the inputs and outputs so as to compute allocative efficiency of DMUs.

Tests comparing the sensitivity of SFA results against those of DEA using the same data have revealed that results obtained were largely consistent even though the inefficiency scores yielded by DEA were lower than those yielded by SFA (Lundvall, 1999).

2.2.3. DATA ENVELOPMENT ANALYSIS.

Data Envelopment Analysis is a mathematical programming method that has been in use over the years in measuring efficiency, (Lovell, 1993). It measures performance of each producer relative to the best practice in the sample of producers concerned, (Korir, 2010). We initially determine which set of producers, as represented by observed data, fall on the locus of an empirical production function or envelopment surface. Ali and Seiford, (1993) postulate that efficient producers will form a locus, in that theoretically, the locus shall be the empirical production frontier or surface. Those whose plotting lies out of the locus of the efficient producers shall be the inefficient producers.

The theoretical framework of this study is adapted from Banker, Charnes and Cooper (1984).

The authors postulated a non-linear programming model which provides a new definition of efficiency for use in evaluating activities of private oriented entities participating in public programmes.

Their studies basically assumed the existence of a collection of Decision-Making Units (DMUs) with common inputs and outputs. The outputs and inputs are usually many and assume different forms that admit only quantitative values.

Hence in a health programme, the efficiency of various hospitals, seen as Decision-Making Units, may be measured by referring to the standard health outputs such as: deliveries, surgical operation, admission, outpatient visit and death. They are all regarded as valued outputs even when there is no apparent market for them or even when other possible sources for reasonably supportable systems of weights are not readily available.

Similarly, the inputs range from fairly easy to measure quantities like the number of doctors, nurses, beds, hospital rooms to difficult ones such as time spent in programme activities by doctors, nurses and other health personnel.

Banker, Charnes, and Cooper (1984) defined the efficiency of any decision-making unit as the maximum of a ratio of weighted outputs to weighted inputs, subject to the condition that similar ratios for every decision-making unit be less than or equal to unity. Expressed in quantitative form, the linear programming structure will be;

$$\text{Max } h_0 = \frac{\sum_{r=1}^s u_r y_{r0}}{\sum_{i=1}^m v_i x_{i0}}$$

Subject to:

$$\frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1 \quad (2.7)$$

$$u_r, v_i \geq 0;$$

$$y_{rj}, x_{ij} > 0$$

Let $r=1$ to s ; being reference set for output units r for the j^{th} DMU

Let $i=1$ to m ; being reference set for input unit i used by j^{th} DMU

Where:

x_{i0} = the i^{th} input used by 0^{th} DMU

y_{r0} = the r^{th} output given by 0^{th} DMU

y_{rj}, x_{ij} = known output and input of the j^{th} DMU respectively

u_r, v_i = variable weights to be determined by the solution to 2.7 above.

The efficiencies of one member of this reference set of $J=i, \dots, n$ Decision Making Units are rated relative to others. Hence, it is represented in the functional optimization, as well as in the constraints.

This is further distinguished by assigning a subscript 'O' to it in the function, while the original subscript is preserved in the constraint (Charnes, et al, 1978 and Coelli et al, 2005). The above methodology generalizes the single output and input without requiring pre-assigned weights. The data may be in the form of theoretically prescribed values or in observed form.

The weightings are objectively determined so as to obtain a dimensionless scalar measure of efficiency in any case (Charnes et al., 1994).

The implication is that the choice of weights is determined directly from observational data subject only to the constraints in equation 2.7. Under these observations and constraints, no other set of common weights will give a more favourable rating relative to the reference set. Hence, if a relative efficiency rating of 100% is not attained under this condition, then it will also not be attained from any other set. The above discussion gives simply the theoretical dimension of DEA and basically how observed data is used to determine a firm of best practice among many other firms. Discussions more related to the endeavours of this study are covered in the next section.

2.3. EMPIRICAL LITERATURE

This section will give an in depth review of related literature in measuring health care efficiency in Kenya and elsewhere. Adoption and use of the Data Envelopment Analysis (DEA) technique is gaining popularity in the third world countries and beyond. Through Data Envelopment Analysis (DEA) it is possible to identify the production frontier of a set of hospitals that are producing a given number of outputs with the fewest number of inputs (Kooreman, 1994).

Anderson, (1980) estimated the scale efficiency for selected public district and provincial hospitals in Kenya. The study employed the Cobb-Douglas functional form of a cost function, where the dependent variable was defined as average cost per inpatient bed-day.

The explanatory variables used were occupancy rate, outpatient visit per in-patient bed-day, level of hospital and weighted index of the number of associated sub-hospital facilities. The results showed that all the explanatory variables, except length of stay were statistically significant at five per cent level.

Although Anderson did not explicitly address the issue of efficiency, he interpreted the negative coefficient of beds in the occupancy rate to imply long run economies of scale with respect to the hospital size. However the interpretation has been criticised as incorrect because the estimated equation did not give direct estimates of economies of scale and the estimated function was a short run cost function (Barnum and Kutzin, 1993)

Kirigia (2001) investigated the technical efficiency of 155 primary health care clinics in Kwazulu-Natal province of South Africa using Data Envelopment Analysis. The study observed that 47 (30% of the clinics) were technically efficient while those that were technically inefficient were 108 that amounted to 70% of the total. Among the 108 technically inefficient clinics 17 (16%) had technical efficiency score of less than 50%. The study also noted that the presence of inefficiency indicates that the facility had excess input or insufficient output. This applied to Kwazulu-Natal clinics which had decreased input by 417 nurses and 457 general staff. At the same time, output had increased by 115,534 antenatal visits, 1,010 births (deliveries), 179,075 child care visits, 5702 dental visits, 121,658 family planning visits, 36032 psychiatric visits, 56068 sexually transmitted diseases visits and 34270 tuberculosis visits during the study period. This study therefore concluded that there was the need for more detailed studies in a number of relatively efficient clinics to determine why they are efficient with a view to documenting determinants of their efficiency.

Kirigia *et al.* (2004) carried out a study on the efficiency of public health centres in Kenya. The study used input and output data to evaluate the curve of the efficient decision making units against the other inefficient ones.

The findings of the study showed that 44% of Kenya's Public Health Centres (PHC) were technically inefficient although all the input variables used were statistically significant.

Those that were technically efficient were 56% of the total. Inefficiencies were attributable to other external factors out of the study explanatory variables such as corruption, poor budgeting and delayed supply of consumables

Masiye et al, (2006) estimated the technical, allocative and cost efficiency among 40 health centres in Lusaka, Central and Copper-Belt provinces of Zambia. Fifty eight per cent were government owned and 42% private-for-profit enterprises. The study used the numbers of clinical officers, nurses and other staff as inputs, and the number of outpatient visits as output. The average technical efficiency, allocative efficiency and cost efficiency scores for the private health centres were 70%, 84% and 59%, respectively. These scores were 56%, 57% and 33%, respectively, for government health centres. For the whole sample, the averages were 61.9% for technical efficiency, 68.5% for allocative efficiency and 44.5% for cost efficiency. Out of the 17 private health centres, 5 had a technical efficiency score of 100 and 4 had allocative efficiency and cost efficiency scores of 100%. Contrastingly, only 1 of the 23 government health centres had all the efficiency scores of 100%.

Amada and Santos (2009) assessed the performance of 337 health centres in Portugal in 2005. The study assumed a DEA model in the estimation of technical efficiency. The inputs were doctors, nurses, administrative and other staff. The outputs were family planning consultations, maternity consultations, consultations by patients grouped in ages of 0-18, 19-64, and 65 and above, home doctor consultations, home nurse consultations, curatives and other nurse treatments, injections given by a nurse, and vaccinations given by a nurse. The mean TE score was 84.4% (SD = 14.7%).

Kirigia (2010) using the Data Envelopment Analysis (DEA), investigated the technical and scale efficiency of hospitals in the republic of Benin.

The study employed the DEAP software to analyse the technical efficiency among a sample of 23 hospitals from a zone in the Republic of Benin over a period of five years, 2003 – 2007. From the study, the yearly analysis revealed that 20 (87%), 20 (87%), 14 (61%), 12 (52%) and 8 (35%) of the hospitals were inefficient in 2003, 2004, 2005, 2006 and 2007 respectively and they needed to either increase their output or reduce their input in order to become technically efficient. The average variable returns to scale (VRS) technical efficiency scores were 63%, 64%, 78%, 78% and 88% respectively during the years under investigation. The study also depicted that there was some window for providing out-patient curative and preventive care and in-patient care to extra patients without additional inputs. This would entail leveraging of health promotion approaches and lowering of financial barriers hindering access to health services, to boost the consumption of underutilized health services, especially health promotion and disease prevention.

Korir (2010) sort to measure the efficiency levels of different categories of public hospitals in Kenya. Using DEA and SFA to estimate cost efficiencies through the period of concern, the study found out that productivity in Public Hospitals (PH) in Kenya increased over time while both the Stochastic Frontier Analysis, (SFA) and Data Envelopment Analysis, (DEA) measures of scale efficiency of 20 public hospitals depicted that the average actual costs of the hospitals exceeded the minimum cost by 34.31% and 27.40% respectively. If the public hospitals as a group were operating efficiently, the savings in financial terms would have been over Ksh. 1 billion annually.

Sebastian and Lemma (2010) in the study of efficiency of the health extension programmes in Tigray, Ethiopia estimated the technical efficiency of 60 health posts. The inputs that were employed included, the number of health extension workers (HEWs) and the number of

voluntary health workers. The outputs were health education sessions given by HEWs, pregnant women who completed three antenatal care visits, child deliveries, number of persons who repeatedly visited the family planning service, diarrheal cases treated in children under five and malaria cases treated. The study revealed that fifteen (25%) health posts were technically efficient and 38 (63.3%) were operating at their most productive scale size.

In an effort to unravel the technical efficiency of primary health units in Kailahun and Kenema districts of Sierra Leone, Sambo et al, (2011) estimated the technical efficiency of samples of community health centres, community health posts and maternal and child health posts. The study employed the Data Envelopment Analysis approach on 36 MCHPs, 22 CHCs and 21 CHPs using input and output data of 2008. The findings of the study revealed that 77.8% of the MCHPs, 59.1% of the CHCs and 66.7% of the CHPs were variable returns to scale technically inefficient. The study further revealed significant technical efficiencies in the use of health system resources among peripheral health units in Kailahun and Kenema districts of Sierra Leone. As such, the study concluded that there is need to strengthen national and district health information systems to routinely track the quantities and prices of resources injected into the health care systems and health service outcomes to facilitate regular efficiency analyses.

2.4. OVERVIEW OF LITERATURE

The literature reviewed gives an in-depth analysis to the theoretical underpinning in measuring technical and scale efficiencies of health facilities using DEA. The theoretical literature analysis describes the simple approaches to estimation of efficiency by benchmarking other DMUs against the best practicing one in the sample. The empirical literature has furthered insights on related studies done with a view to show the gap left.

All reviewed studies have employed the Data Envelopment Analysis method in estimating technical and scale efficiencies. The DEA method is a non-parametric mechanism that seeks to identify the most efficient decision making unit among a pool of homogenous units and further attempts to benchmark the others by assigning efficiency scores equal or less than 1. However, this method runs under the assumption that there exists a decision making unit that is efficient even though it is practically impossible to attain full efficiency (Coelli et al, 2005). The DEA method has been widely used in estimating efficiency of firms for a long time in Africa and also in developing health sector policies by institutions and scholars. This study will employ DEA method in its efficiency analysis.

Apart from Masiye et al, (2006) that attempted to measure at least 42% of its sample as privately owned health facilities, all the other studies have concentrated on public health facilities in different parts of the world. Justifications for the inclination of the studies towards public health sector are scanty. Public health sector has barely over 50% of coverage to the entire world's health care demands (World Development Report, 1996). The other approximate 50% of the demand is anticipated to be complemented by the private sector. It is therefore a big oversight that studies endeavoring in efficiency measures for private facilities continually become scanty. Although private health sector has a wide classification ranging from facility type to type of ownership and operation, this study will attempt to donate to the bank of knowledge coverage of hospitals owned by faith based organizations in Kenya.

There are fewer studies that exhibit the technical efficiency alongside the scale efficiency. These two measures are key to matters total economic efficiency. Technical efficiency of hospitals owned by faith based organizations in Kenya alongside their scale practices would form a basis for further research and development. Therefore this study presented both the technical and scale efficiencies of hospitals owned by faith based organizations out of which policy recommendations have been drawn.

The literature reviewed affirms the choice for the variables to be used in this study. The studies reviewed have entirely depended on inputs and output variables for the health facilities under investigation. Where appropriate, proxy variables have been used successfully. Korir (2010) uses number of beds and cots as proxy variables for the hospital space or rather capital as would be represented in a Cobb-Douglas production functional form. Such articulate variable choices were instrumental in the choice of variables for this study. This study used number of nurses, number of medical officers, other hospital workers and bed capacity per hospital as inputs. The outputs were number of inpatients and outpatients visits recorded in individual hospitals per year.

Hospitals owned by faith based organizations serve a great deal of the Kenyan citizens seeking health care services. The vision for universal access to quality and efficient health care for Kenyans by 2020 can only be achievable if all health sector stakeholders participate in the process of quality and efficient service delivery. The world's millennium development goals to reduce infant mortality, improve maternal health care and combat HIV/AIDS, Malaria and other diseases require efficient allocation of health care resources by all healthcare facilities. Therefore, hospitals owned by faith based organization must inevitably determine their efficiency levels.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This section will give an insight on the methodological perspective that this study assumed based on the theoretical and empirical literature to estimate technical efficiency levels of hospitals owned by faith based organizations and the underlying scale efficiencies. It covers the research design, the theoretical considerations, definition and measurement of variables, Study area and target population, Sampling techniques and sample size, and lastly data type and source.

3.2 RESEARCH DESIGN

The study assumed the non-experimental research design in measuring technical and scale efficiencies of the DMUs. Data Envelopment Analysis was used and hence quantitative data on inputs and outputs for hospitals owned by faith based organizations was utilized.

3.3 THEORETICAL MODEL.

The key construct of a Data Envelopment Analysis model is the envelopment surface (Charnes et al, 1995). The envelopment surface will differ depending on the scale assumptions that underline the model. The efficiency projection path to the envelopment surface will differ depending on the nature of the model, whether output or input-oriented. The choice of model depends on the optimization production process characterizing the firm.

For hospitals, the input-oriented model was appropriate to determine how much input-mix the hospital would require to obtain the output level that coincides with the best practice frontier.

This is based on the assumption that the decision to use a particular hospital or not, is the full discretion of the patient who is the consumer. In such a case, output, therefore, is an exogenous variable that the hospital management has no control over. Banker et al. (1984) and Coelli et al (2005) postulate that the data envelopment analysis is a relative measure of efficiency where the general problem is stated in the form of constant returns to scale (CRS). Further, where interest to obtain the scale efficiency exists, the variable return to scale (VRS) method is employed. The CRS Data Envelopment Analysis linear programming is given below:

$$\text{Max } x_o = \sum_{r=1}^s \varphi_r y_{rj_o} = 1$$

Subject to;

}

3.1

$$\sum_{j=1}^m \lambda_j x_{ij_o} = 1$$

$$\sum_{r=1}^s \varphi_r y_{rj_o} - \sum_{j=1}^m \lambda_j x_{ij_o} \leq 0$$

$$\varphi_r \lambda_j \geq 0$$

$$j = 1, \dots, n$$

Where: y_{rj_o} is the amount of output r from hospital j

x_{ij_o} is the amount of input i to hospital j.

φ_r is the weight given to output r,

λ_i is weight given to input I,

n is the number of hospitals,

s is number of outputs and

m is number of inputs.

Model 3.1 is also referred to as the multiplier form and it indicates the general presentation of the CRS data envelopment analysis. Whereas the second constraint seeks to subject that all efficiency measures must be less than or equal to one, the first constraint is imposed to make the number of the possible solutions finite.

3.4. THE EMPIRICAL MODEL

The study assumed an input orientation for the analysis of hospital efficiency where the aim of the linear programming problem was to minimise the use of inputs without necessarily altering the output. Therefore, using the duality in linear programming, it was possible to obtain an equivalent form of model 3.1. This is stated below:

$$\begin{array}{ll} \min_{\phi, \lambda} \phi & \\ s.t. & \\ -q + Q\lambda \geq 0 & \\ \phi x_i - X\lambda \geq 0 & \\ \lambda \geq 0 & \end{array} \quad \left. \vphantom{\begin{array}{l} \min_{\phi, \lambda} \phi \\ s.t. \\ -q + Q\lambda \geq 0 \\ \phi x_i - X\lambda \geq 0 \\ \lambda \geq 0 \end{array}} \right\} \quad 3.2$$

Where ϕ is a scalar whose value once obtained shows the efficiency score for the i^{th} hospital. It satisfies $\phi \leq 1$, with a value of one indicating a point on the frontier which implies that the hospital in consideration is technically efficient (Farrel, 1957). λ is a 1×1 vector of constants.

Also, the linear programming must be solved (I) times, once for each firm in sample size.

Hence, a value of ϕ will be obtained for each firm.

The intuition behind linear programming model 3.2 above is that the problem seeks to radially contract the input vector, x_i as much as possible, while still remaining within the feasible input set.

The inner boundary of this set is a piece-wise linear isoquant which is determined by the observed data point (i.e. all the firms in the sample size); the radial contraction of the input vector, (x_i) produces a projected point $(x\lambda, Q\lambda)$ on the surface of this technology. This projected point is a linear combination of these observed data points. The constraint in the problem ensures that this projected point cannot lie outside the feasible set. According to Fare et al. (1994), the production technology associated with the linear programming problem above is given as

$$T = \{(xq); q \leq Q\lambda, x \geq X\lambda \}.$$

Furthermore, according to Fare et al (1994), this technology defines a production set that is closed and convex, and it exhibits constant returns to scale and strong disposability.

In order to account for the variable factor such as inclined government interventions, financial constraints, labour organisation advocacy among others and also to determine the scale efficiency, the constant returns-to-scale in model 3.2 is modified by the addition of a convexity constraint indicated as $\Pi'\lambda = 1$. The finding of the VRS technical efficiency and that of the CRS shall be instrumental in meeting the second objective. Thus, the Variable Returns to Scale (VRS) model is specified as follows:

$$\begin{aligned}
& \min_{\phi, \lambda} \phi \\
& s.t. \\
& -q + Q\lambda \geq 0 \\
& \phi x_i - X\lambda \geq 0 \\
& \Pi'\lambda = 1 \\
& \lambda \geq 0
\end{aligned} \tag{3.3}$$

Where Π is a 1×1 vector of ones. This approach forms a convex hull of intersecting planes that envelope the data points more tightly than the constant returns to scale (CRS) conical hull, and therefore provides technical efficiency scores that are greater than or equal to those obtained by using constant returns to scale model. Again, it should be noted that the $\Pi'\lambda = 1$ constraint is essentially to ensure that an inefficient hospital is only benchmarked against hospitals of similar size. That is, the projected point for that hospital on the DEA frontier is a convex combination of observed hospitals. This convexity restriction is not imposed on the constant returns to scale (CRS) case. Hence, in a Constant Return to Scale data envelopment analysis, a hospital may be benchmarked against hospitals that are substantially larger than it, and therefore, the λ -weights sum to a value less than one.

Scale efficiency exists where there are differences between the CRS and the VRS technical efficiency scores. It can be obtained for each firm by conducting both a CRS and a VRS DEA and then decomposing the TE scores obtained from the CRS DEA in to two components, one due to scale inefficiency and one due to pure technical efficiency which is also VRS technical efficiency (Coelli et al 2005). Existence of differences in CRS and VRS TE scores for a particular hospital indicates that the hospital manifests scale inefficiency. Scale efficiency is then calculated as follows;

$$\text{Scale Efficiency} = \frac{\text{CRS Technical Efficiency}}{\text{VRS Technical Efficiency}} \tag{3.4}$$

As such, the CRS TE score can be decomposed into pure technical efficiency and scale efficiency such that;

$$CRSTE = VRS TE \times SE. \quad (3.5)$$

3.5 DEFINITION AND MEASUREMENT OF VARIABLES

The study undertook two broad types of variables in the analysis.

3.5.1 INPUTS.

The inputs for this study included;

i. Number of medical officers and medical specialists.

This study defined medical officers as all those medical practitioners with a Bachelor degree in medicine and surgery while medical specialists are medical practitioners with a specialization in healthcare. Such specializations are attained after a medical officer advances his or her bachelor degree to a master degree in healthcare related fields.

ii. Number of nurses in individual FBO hospitals.

For the purposes of this study, a nurse was defined as those registered by the nursing council and provide, coordinate patient care, educate patients and the public about various health conditions, and as well provide advice and emotional support to patients and their family members.

iii. Number of beds and cots in an individual facility.

Hospital beds are those beds specially designed for patients admitted in the hospitals while cots are meant for new born babies who are in need of health care.

iv. Other hospital workers, (other aggregated workers in individual health facilities).

This variable takes into consideration a pool of all other hospital workers in all departments of individual FBO hospitals.

3.5.2 OUTPUTS

It is difficult to measure the level of patient recovery that can be attributable to the impact of an efficient health service. Therefore inpatient and outpatient numbers in general for any hospital in a year were used.

The output variables included;

i. Total number of inpatients recorded in any hospital in a year.

Inpatients were defined as those patients recorded as admitted in the hospital records and who occupy space in the hospital wards.

ii. Total number of outpatients recorded in any hospital in a year.

Outpatients were taken to be all those patients visiting the hospital for health care but do not occupy space in the hospital wards and hence are not admitted.

3.6 THE TARGET POPULATION, SAMPLING TECHNIQUES AND SAMPLE SIZE.

The Kenya health Master Facilities List (MFL) categorizes health facilities into among other categories, type of ownership that include the Ministry of Health, FBOs, NGOs and private ownerships. The FBO hospitals are further classified as those under Christian Health Association of Kenya (CHAK), Kenya Conference of Catholic Bishops (KCCB) and the Supreme Council of Kenya Muslims, (SUPKEM). The three umbrella bodies oversee a total of 75 facilities made up of 15 hospitals under CHAK, 49 hospitals under KCCB and 11 under

SUPKEM. A simple random sample of 30 hospitals was selected for the study translating to 40 percent of the population. The sample of the 30 hospitals 10, 19 and 1 hospitals from CHAK, KCCB and SUPKEM respectively.

3.7 DATA TYPE AND SOURCE

The study used secondary data sourced from individual hospitals' records department and from the Ministry of Health's Master Facility List. Data on the number of beds and cots was obtained from the Master Facility List while the rest of the input and output variables were sourced from the individual hospital records.

3.8 DATA ANALYSIS

Collected data was tabulated in an excel sheet before analysis began. In a serialized format, the data was arranged in columns starting with outputs and finally the inputs as required in DEAP. Thereafter, with the aid of DEAP version II, which is a computer application for analyzing efficiency scores using DEA, input and output data was optimized and hence technical and scale efficiency scores obtained.

4.1. INTRODUCTION.

The research findings on both the technical and scale efficiencies of the sample hospitals are described in this section. There are various statistical tools used in the analysis to emphasize the outcome of the results. Although this study sought to give outcomes on technical and scale efficiencies, the DEA process further gives insightful results that researchers can use for further policy recommendations and studies. Such results seek to show the theoretical consistencies in the behavior of various microeconomic variables such as inputs and outputs. These results as discussed in this chapter show individual variable sensitivity analyses and individual firm performances in terms of input and output mixes. Their discussion is a rich input into further knowledge acquisition and research.

4.2. TECHNICAL AND SCALE EFFICIENCY.

This study aimed at estimating the technical and scale efficiencies of hospitals owned by FBOs. The Data Envelopment Analysis model was applied in estimation. This method follows a non-parametric approach and has ability to optimize firms with multiple outputs and multiple inputs. Where data is available for several time periods, DEA has abilities to optimize the input and output data and work with data averages to give scalar efficiency scores. As indicated in the theoretical literature in this study, technical efficiency using the input oriented method of optimization simply seeks to radially contract the use of already employed inputs without necessarily altering the output. This is however a relative measure in that a hospital's efficiency score is relative to the other hospitals' efficiency scores. The study of efficiency using DEA is quite intrinsic and exciting at the same time. This is revealed in the fact that even those DMUs whose technical efficiency scores are one; do not necessarily mean that they cannot improve their current efficiency.

Such results are relative to the other pool of DMUs and simply imply that in a cluster of such DMUs, the ones with their efficiency scores as one are considered more efficient. They therefore fall on the global frontier in that the input combinations are optimal relative to other DMUs.

In showing that there is still room for increasing efficiency, scale efficiency depicts the ability of a firm to reorganize its production relative to the input-output combinations. In analysis, scale inefficiency of a Hospital will occur if there exist a difference between the hospital's CRS technical efficiency and its VRS technical efficiency scores. As described in theory, scale inefficiency is the ratio of CRS technical efficiency to VRS technical efficiency.

Developed by Professor Tim Coelli, the Data Envelopment Analysis Program Version II was used to determine the efficiency scores. A sample of 30 hospitals drawn from the Kenya Conference of Catholic Bishops, Christian Health Association of Kenya and the Supreme Council of Kenyan Muslims was used.

The technical and scale efficiencies of the FBO hospitals with brief discussions on the efficiency scores and the averages are given in the preceding discussion. Table 4.1 aids in pitching the discussion concisely.

Table 4.1: Results on CRS TE, VRS TE, Scale Efficiency and Returns to scale.

Hospital Code	CRS TE	VRS TE	SE	RETURNS TO SCALE
1	0.355	0.45	0.789	IRS
2	0.474	0.475	0.998	DRS
3	0.653	0.863	0.757	IRS
4	0.364	0.706	0.515	DRS
5	0.6	1	0.6	IRS
6	0.696	0.785	0.887	DRS
7	0.399	1	0.399	DRS
8	0.321	0.689	0.465	DRS
9	1	1	1	-
10	0.517	1	0.517	DRS
11	0.294	0.772	0.381	DRS
12	0.391	0.55	0.704	IRS
13	1	1	1	-

14	1	1	1	-		23	1	1	1	-	
15	1	1	1	-		24	0.396	0.973	0.407	DRS	
16	0.215	0.338	0.635	DRS		25	0.594	0.632	0.939	DRS	
17	1	1	1	-		26	0.297	0.849	0.35	DRS	
18	0.545	0.794	0.686	DRS		27	0.242	0.35	0.693	IRS	
19	0.439	0.712	0.617	DRS		28	0.954	1	0.954	IRS	
20	0.28	0.284	0.984	IRS		29	0.602	1	0.602	IRS	
21	0.715	0.743	0.963	IRS		30	0.671	0.743	0.903	DRS	
22	0.634	0.651	0.973	DRS		Mean	0.588	0.779	0.903		

Source: Author.

4.2.1. TECHNICAL EFFICIENCY.

The variable returns to scale technical efficiency is arguably a more reliable measure of technical efficiency than the constant returns to scale technical efficiency due to its ability to optimize large firms together and also smaller ones together (Coelli et al. 2005). As such, smaller hospitals in scale would still be deemed efficient than large ones while large hospitals may be seen as inefficient. At the same time, VRS technical efficiency takes into consideration variable factors such as inclined government interventions, financial constraints, labour organisation advocacy among other structural shocks thus giving a more reliable measure of relative efficiency.

This study, in assuming the variable returns to scale, reveals that 11 out of the 30 hospitals were variable returns to scale technically efficient. This constitutes approximately 36.67 percent of the sampled hospitals. The 11 hospitals had technical efficiency scores of one but not all of them were constant to scale technical efficient. Only 6 of the hospitals were both constant returns to scale and variable returns to scale technically efficiency. This is consistent with theory that provides that VRS technical efficiency can never be smaller than the CRS

technical efficiency. The major difference between the two measures of technical efficiency is basically realized in the DMUs that are depicted inefficient where VRS TE seems to have higher scores than CRS TE. Further keynote observation revealed that of the 11 technical efficient hospitals, 9 were categorized under KCCB indicating that they were affiliated to religious congregations in the Catholic Church while only 2 were from the Christian Health Association of Kenya. None of the efficient hospitals was under SUPKEM. KCCB facilitates the running of all hospitals under the Catholic Church although the individual management of these hospitals is left to the appropriating religious congregation. For instance, St. Mary's Hospitals in Gilgil, Langata and Kisumu are owned and managed by the Assumption Sisters; a congregation of religious nuns while, The Mater Hospital Mukuru and its subsidiary facilities around the country are ran by a board of Trustees mainly drawn from religious congregations. These religious congregations only depend on KCCB for resource mobilization and government policy adherence. Such an arrangement gives the hospitals under KCCB a much higher possibility of optimal operation as decisions are centrally made and implemented at the facility level. Unlike the KCCB arrangement, the other two categories have left a larger mandate on management to their umbrella bodies. As such, centralized management presents challenges in decision making, implementation and even monitoring and evaluation. It follows therefore that most of the KCCB hospitals are optimally managed and could act as peers to others.

In addition, 65.33 percent of the hospitals were found to be technically inefficient with the lowest scoring 0.284 as the efficiency score. This meant that the lowest scoring hospital would reduce the use of each of its inputs by 71.6 percent and still achieve the same number of inpatients and outpatients efficiently. In other words, inputs in such hospitals have been greatly under-employed and in turn have manifested themselves as added costs in the long run.

Additional employment of units of inputs whether Medical officers, Beds and Cots, Nurses or even other workers only manifested increased costs without any changes to the output. With situations as in the health sector where the health care providers do not determine the outputs, the use of inputs remain the only decision making interventions to manipulate so as to efficiently provide health care.

Technical efficiency circumvents the various avenues in which a firm can reduce the use of its inputs without necessarily altering its output especially when the input orientation is assumed (Kirigia, 2013). Hospitals owned by FBOs are major importers of manpower from abroad especially from donating countries. Medical practitioners come into these hospitals to offer specialized services from abroad and to support medical camps; a phenomenon that is very common in FBO hospitals as they seek to reach service provision in far and remote areas. In so doing, FBO hospitals have acquired excess human resource that in turn presents a large cost to maintain. As such, the situation manifests a resource underutilization and hence poor efficiency scores.

The mean variable returns to scale technical efficiency and the constant returns to scale technical efficiency were 0.79 and 0.59 respectively. The intuition behind these averages is that all the hospitals would averagely be expected to reduce their use of inputs by 21 percent and 41 percent respectively. In other words the hospitals have exceeded their resource use by 21 percent and 41 percent respectively. This further depicts the earlier argument that VRS technical efficiency scores will always be higher than the CRS technical efficiency scores thus manifesting lower radial contractions on the input usage.

The VRS technical efficiency scores take into consideration environmental imperfections such that it gives more reliable scores than CRS technical efficiency. Therefore, reducing inputs in the light of CRS technical efficiency may not capture fully the considerations of other environmental variations.

Thus, if FBO hospitals were to operate as group, they would have to reduce the use of their inputs by 21 percent. However, the actual inputs to be reduced would depend on the marginal value of each inputs provided by the input slacks. This is discussed later in this chapter.

Kirigia et al (2002) carried out a study on the measurement of technical efficiency of public hospitals in Kenya. This study employed the DEA model in its analysis. The results of the study depicted that fourteen (26%) of the public hospitals involved were technically inefficient. In consistence with the current study on FBO hospital efficiency, this study revealed that there exist inefficiencies in various health institutions and that studies oriented on measurement of efficiency using DEA should be a common practice.

Further, Sambo et al (2004) estimated the technical efficiency of public health centres in Kenya using DEA. Employing the input orientation, the study sought to unravel technical efficiency scores of individual primary healthcare facilities in Kenya, estimate the magnitudes of excess resource use and to recommend what should be done with those excess resources. In its findings, the study revealed that 44% of public health centres are inefficient. Such findings further reveal the need for efficiency estimation in all types of health facilities as they show the existence of resource wastages in the health sector.

4.2.2. SCALE EFFICIENCY.

Coelli et al, (2005) postulate that scale inefficiency is obtained where there exists a difference between the VRS TE and the CRS TE. This can be obtained for each firm by conducting both the CRS and VRS DEA and then decomposing the technical scores obtained from the CRS DEA into two components; one due to scale inefficiency and one due to pure technical inefficiency which is basically the VRS TE. Therefore the ratio of CRS TE to VRS TE principally gives the measure of scale inefficiencies to a particular firm.

Although the value of scale inefficiency or efficiency does not give an indication as to whether the firm is operating at decreasing, constant or increasing returns to scale, VRS DEA in its optimization is able to show the nature of the returns to scale.

Large hospitals have an advantage pegged on their size that may assist them operate at lower than average costs. This means that it is vital to take into consideration the size in terms of inputs and output of a particular hospital, so as to verify the unbiased efficiency scores in the pool.

Using the VRS technical efficiency approach, the average scale efficiency was 0.76 which meant that as a whole, the hospitals failed to utilize their scale by approximately 24 percent. Out of the 30 hospitals optimized for efficiency scores, only six hospitals showed 100 percent scale efficiency. The intuition behind this was that 20 percent of FBO hospitals have the best input mix blended with their relative size in the optimization. Therefore 80 percent of FBO hospitals underutilize their scale by about 24 percent.

Probing the technical and scale efficiency of public hospitals and health centres in Ghana, Osei (2005) employed an input oriented DEA to obtain efficiency scores of 17 district hospitals and 17 health centres. The output of the analysis revealed that 10 hospitals and 8 health centres were scale inefficient. The average scale efficiency scores were 81 percent and 84 percent for the public hospitals and health centres respectively. In consistency with the current study, Osei, (2005) sought to elaborate the availability of scale inefficiency in the health sector. As a further observation, health facilities can therefore be known to fail to make use of their size and hence present scale inefficiencies.

4.3. RETURNS TO SCALE.

In economic theory, the returns to scale is a vital component of sensitivity analysis in that it endeavors in showing by how much an output would change if every input is increased by a scalar. For instance, in the health sector context and with the existing inputs data, we would be interested in knowing the amount of outpatients and inpatients that would increase or decrease if a unit of input say; medical officers, nurses or even an extra bed is increased or decreased. The increasing returns to scale show a scenario where inputs may be changed by a unit while the end results are that the output increases by more than unitary. Constant returns to scale means that a unitary increase in inputs means the same unitary rise in outputs. Finally, the decreasing returns to scale mean that if inputs are increased by a factor say, one, the output would actually decline by a larger than unitary amount. It is therefore crucial to describe the nature of returns to scale for any optimizing firm.

From the output, 9 out of the 30 hospitals depicted increasing returns to scale. This implies that about 30 percent of the FBO hospitals have increasing returns to scale and therefore enjoys economies of scale. A proportionate increase in their use of inputs would increase their outputs by more than proportionately.

The study also revealed that approximately 50 percent of the FBO hospitals experienced decreasing returns to scale and faces diseconomies of scale where a proportionate increase in the use of inputs would increase output by less than proportionate. Only 20 percent of the FBO hospitals depicted constant returns to scale.

Majority of health workers in FBO hospitals such as medical officers and nurses are on call in more than 18 hours. For instance, majority of the nurses are in the wards working for more than 12 hours non-stop attending to patients. According to international standards, long hours on work duty have been proven to have diminishing service returns that not only present

inefficiencies but also pose health risks to the involved individuals. Since medical officers and nurses are major inputs in the health sector, this would probably explain why 50 percent of the FBO hospitals face diseconomies of scale.

4.4. AN INTERPRETATION OF SLACKS.

In linear programming, the interpretation of slacks cannot be overlooked. In DEA, slacks are viewed as being the artifacts of the chosen frontier (Coelli et al, 2005). It is on the fundamentals of the slacks that a locus of efficient points is projected. Lovell et al, (1990) argue that slacks may essentially be viewed as allocative inefficiency in that slacks give an indication of the level by which efficiency has been missed. Although some efficiency estimation authors have supported a second-stage linear programming DEA so as to ensure the identification of an efficient frontier point by maximizing the sum of slacks required to move the first-stage projected point to a Koopmans-efficient frontier point, Coelli et al, (1998) suggests the use of a multi-stage DEA method to avoid the problems inherent in the two stage method.

The multi-stage method assumed in this study involves a sequence of radial DEA models and hence more computationally demanding than the other two methods. The advantages of this method are that it identifies efficient projected points and that it is also invariant to units of measurement (Coelli et al, 2005).

In adding to the pool of knowledge on health facility efficiency in Kenya, this study has identified the input overstatements and the output understatements. However, theoretical underpinnings on input slacks especially when the input orientation has been assumed in analysis are that inputs have to be reduced by the marginal amounts depicted by individual input slacks. This is however economically unfavorable in the health sector where the demand for health care has for a long time met a stiff and scarce resource availability.

It would not sound economically viable to reduce the number of doctors and nurses in particular health facilities whereas these two variables are hardly enough in reality. This therefore follows that the discussion in such markets should endeavor in showing by how much the inputs have been underutilized as opposed to their numerical reductions. It therefore made it purposeful for this study to discuss the output slacks that endeavor in revealing the amounts of output that the current inputs are potentially able to produce. Table 4.2 depicts the amount of outputs that can be increased without increasing the input matrix alongside the peer counts to be discussed in section 4.5.

Table 4.2: Output Slacks and Hospital Peer Counts.

Firm	Output: 1	2	Peer Counts					
1	2237.025	398.025	0		16	0.000	0.000	0
2	0.000	0.000	0		17	0.000	0.000	11
3	5012.432	0.000	0		18	31608.284	0.000	0
4	16805.464	0.000	0		19	20760.992	0.000	0
5	0.000	0.000	4		20	0.000	0.000	0
6	0.000	0.000	0		21	0.000	15.224	0
7	0.000	0.000	3		22	0.000	0.000	0
8	24939.480	0.000	0		23	0.000	0.000	3
9	0.000	0.000	8		24	26415.285	0.000	0
10	0.000	0.000	4		25	0.000	8.472	0
11	11823.340	0.000	0		26	56345.686	0.000	0
12	4782.712	0.000	0		27	2224.714	392.624	0
13	0.000	0.000	5		28	0.000	0.000	0
14	0.000	0.000	12		29	0.000	0.000	1
15	0.000	0.000	3		30	0.000	0.000	0
					Mean	6765.181	30.478	

Source: Author.

The first output was the number of outpatients recorded and the second output was the number of inpatients recorded in a year.

In table 4.2 the output slacks demonstrate by how much output would be increased without necessarily altering the level of inputs. For instance, Hospital code 27 could increase the number of outpatients by 2224.714 and inpatients by 392.624 without changing the input mix. This could be achievable in occasions where the management has decisions over the outputs. 17 out of the 30 hospitals do not require any output adjustments. This implies that about 57 percent of the FBO hospitals do not require output adjustments and hence the current numbers of inpatients and outpatients should remain the same. Another key observation is that if all the hospitals operated as a group, they would be able to increase their outpatients and inpatients annually by 6765.181 and 30.478 respectively on average without changing the quantity of inputs. This indicates a possibility of resource under-utilization in the FBO hospitals which may be attributed to scale inefficiency and inadequacy of technological efficiency. This is commonly exemplified in inadequate man-hour engagement, staff service input and sub-optimal utilization of other capital equipment in the affected hospitals.

4.5. THE HOSPITAL PEER COUNTS.

A fundamental advantage of the DEA model in linear programming is that it has ability to give output based on peer counts or as commonly referred as the efficiency reference sets. In other words, DEA seeks to inform about which firms were grouped together in the process of optimization. Further, peer counts depict an understanding that in the process of radially contracting inputs in the DEA input orientation, DMUs that are of the same relative size are pooled together where the most efficient of them has a higher efficiency score. It follows from this discussion that a sample of optimized firms would give one or more DMUs with

majority of peer counts. These DMUs with majority peer counts thus indicate that they have better input-output mixes that would rather be emulated by others.

The last column in table 4.2 depicts the peer counts for each hospital. It shows how many times each firm was a peer for another. From the output results, hospitals 14 and 17 had the most peer counts of 12 and 11 respectively. Others had less than 10 peer counts while a majority of them had 0 counts all together. Generally, the results indicate that about two thirds of FBO hospitals do not have a peer count implying that they cannot be used to benchmark other hospitals in the sector. We could draw observations from the results that hospital 14 operates at the most desirable point on the frontier thus it has the most preferred input combination that is employed to produce its outputs and therefore, the linear programming problem benchmarks other 12 hospitals with it so as to determine their relative efficiency. This could be explained by the fact that FBO hospitals operate under different religious rules and regulations and may therefore not be peered. Furthermore, some FBO hospitals serve the most remote areas of the country and face structural challenges such as connections to the national energy grid such that refrigerator medicines are hard to store, telephone services for distress calls, poor roads for emergency accessibility in times of dire need and water. These factors among others influence the peer counts.

CHAPTER FIVE.

SUMMARY, RECOMMENDATIONS AND POLICY IMPLICATIONS.

5.1. INTRODUCTION

In this chapter, a concise summary of the results is given briefly and recommendations cited. The chapter further suggests policy implications anchored on the findings of this study. Areas for further research are also proposed.

5.2. SUMMARY.

The Kenyan health sector has been a focal point for address by all successive governments. Kenya has, in the efforts to enhance its health systems, entered into international declarations that seek to address efficient, accessible and affordable healthcare services by its citizens. Major health oriented policies have been instituted to govern the health sector while scientific and social research has been enhanced to avail new health facts and modify existing ones.

These milestones have not gone without challenges that continually pose serious threats to the achievement of the universal health coverage goal. Such reversals have been the lack of an efficient health care pricing, human resource constraints, infrastructural rigidities and a general political disinterest in honoring internationally agreed declarations. The most recent challenge has been the process of devolution where the constitution envisaged a three year transition period with key healthcare functions devolved at a time. However, functions of the health sector have been devolved as a block to county governments some of which had no installed institutional infrastructure to further the health agenda. Such exodus to better employments abroad poses acute resource constraints to the entire health sector.

Health financing has also faced challenges in the recent past with governments allocating leaner budgets to the sector every financial year. Health financing has not moved in tandem with obvious facts such as rising disease burden, population growth and increased lifestyle

complications. Donor funding has become stringent with laws regulating external sources of financing becoming more rigid. This has not only discouraged individual donors but also has become cumbersome for health institutions to solicit donations. User fees and out of pocket expenditures have arguably been blamed for denying poor population the affordability of health care services. As such, they have not won any public goodwill as sustainable sources of financing.

This study reviewed the Data Envelopment Analysis method with efficiency estimation theories explained. The input and output orientations of DEA were discussed where the former was assumed for this study following the fundamental tenets of health facilities.

Relevant literature was revisited in order to clearly show the gap

A simple random sample of 30 hospitals owned by FBOs was used for analysis of both technical and scale efficiencies in Kenya. Medical officers, nurses, number of beds and cots, and an aggregate of other workers were assumed to be key components of vital input data while the number of outpatients and inpatients recorded in a year depicted the output set.

Data from the Ministry of health and from individual hospital's records department were collected, organized and analysed to obtain the results.

The findings from an input oriented DEA revealed that 36.67 percent of the hospitals were variable returns to scale technical efficient while the rest bore varied efficiency scores. At least 13.3 percent of the hospitals had less than 50 percent efficiency scores. The rest had efficiency scores varying between 0.5 and 1.

The scale efficiency of the hospitals involved was that only six had scale efficiencies of 100 percent while the rest depicted varied inefficiency results. Other key findings were the output and input slacks that basically gave the quantity misallocations of both inputs and outputs.

Peer counts we discussed in details in an aim to show which hospital was most preferred in the optimization process. The study further gives the researcher's observation on the possible causes of inefficiency.

5.3. CONCLUSIONS.

This study concludes that there exists a myriad of challenges in the Kenyan health sector that continually pose threats to the achievement of universal health coverage. The MDGs further envision efficient, affordable and accessible health care services although inefficiencies in the hospitals owned by FBOs and the sector as a whole present hardships in attaining the goals. Other goals include the Abuja declaration of 2001 that Kenya has never attained 13 years on. It is therefore fundamental for Kenya to find avenues to avail to her population, an efficient health care system. Such avenues would be to first and foremost estimate the efficiency levels of all levels of health facilities.

Efficiency is one of the components of a vibrant health sector that cannot be overlooked. In its conclusion, this study has found out that there exists inefficiencies in the hospitals owned by faith based organizations and that resources have been poorly allocated hence causing increased operational costs. Such costs in the advent of serious financial constraints are not only misplaced but also pose threats to the realization of universal health coverage goals.

5.4. POLICY IMPLICATIONS.

FBO hospitals have been revealed to have inefficiencies in their operation. This is depicted by the amounts of inputs that they employ. Majority of the inputs are not fully utilized hence their output is always understated. As a policy recommendation, all FBO hospitals must find avenues to make optimal use of all available inputs by probably increasing monitoring and evaluation practices and subjecting medical officers, nurses and other workers to performance

contracting. This will compel all human resource to be gainfully utilized for the betterment of the hospitals.

Since DEA presents results suggesting reduction of the use of inputs especially when the input oriented DEA is employed, FBO hospitals should transfer excess medical officers, nurses and other hospital workers to facilities with shortages in this manpower so as to increase their service delivery and ultimately their efficiency. This is possible since every hospital is under a certain umbrella body that would facilitate such transfers easily. This would solve the national wide healthcare personnel disparities in distribution and employment to areas with high demand for healthcare.

FBO hospitals should also make decisions that will govern the use of excess beds and cots. Such decisions may circumvent transferring the excess beds to efficient FBO hospitals and thus making the inefficient ones more efficient by shedding excess inputs. Further, the umbrella bodies for the FBO hospitals can enter into contracts with each other in using excess beds and cots at a fee. This will further the needs for service delivery and increase patient confidence in all the FBO hospitals. As a further recommendation, hospitals with excess beds and cots than required should sell them out and recoup the money that can be used in other projects.

In as much as hospital management may not influence the choice of health facility that an individual patient prefers to attend, the output slacks suggest that they can still expand their outputs even without changing the current inputs. Hospitals should therefore increase innovations in service delivery in that they can reach more than already met demands. In so doing, they can probably increase medical camps where the hospital personnel visit remote and far places to meet people and sensitize them on the need for seeking healthcare and how expert advice on health issues is important.

Such demand can be termed as induced demand and therefore gives individual hospitals the ability to utilize the inputs optimally as they meet the increased demand.

5.5. AREAS FOR FURTHER RESEARCH.

Technical and scale efficiency are partial measurements of total economic efficiency. This study proposes other measures of efficiency on health facilities in Kenya. Secondly, it would be informative for other researches to endeavor in using the Stochastic Frontier Analysis method to estimate efficiency and draw comparisons with the results of this study. Thirdly, the extension of this study to include the determinants of efficiency would be a preferable research area. Fourthly, since primary and peripheral health care facilities owned by FBOs are many in number and as such serve a large group of health care demand especially in remote areas; further research would take into consideration the estimation of their efficiency. Lastly, where cost data is readily available for the health sector, further researches would revolve around cost, allocative and profit efficiencies of health facilities in Kenya.

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