2018

Effect of Electronic Medical Record Systems on the delivery of hospital services in Kenya: an operational efficiency perspective

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EFFECT OF ELECTRONIC MEDICAL RECORD SYSTEMS ON THE DELIVERY OF HOSPITAL SERVICES IN KENYA: AN OPERATIONAL EFFICIENCY PERSPECTIVE

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A Thesis Submitted in partial fulfillment of the requirements for the award of a Master's in Business Administration (MBA) Degree

Strathmore Business School

MAY, 2018

DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other university. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the thesis itself.

Kevin Marete

May 2018

Approval

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DEDICATION

This dissertation is dedicated to my family, which has been very supportive, full of encouragement and contributed to my personality. Nevertheless, I want to thank the Almighty God for the gift of life and sustaining me thus far.

ACKNOWLEDGMENTS

I would like to thank my supervisor Dr. Omwenga for the continuous support, motivation and vast knowledge of the subject matter during the writing of this dissertation. His insight and guidance helped me finalize my research work. I would also like to thank the Strathmore Business School community from the facilitators, support staff and classmates who made it an impactful and enjoyable experience.

ABSTRACT

Delivery of hospital services has been experiencing various challenges such as escalating costs of care delivery. Spending in healthcare is wasted due to operational inefficiency leading to poor healthcare outcomes. Health information technologies, such as Electronic Medical Records Systems (EMRS) are critical to transforming the healthcare industry. The purpose of this study was to analyze the effect of EMRS on the delivery of hospital services from an operational efficiency perspective. The study adopted a descriptive research design both in identifying factors that influence service delivery in hospitals and analyzing observed operational throughput, followed by both descriptive and correlational research design aiming to establish a relationship between EMRS and operational efficiency of service delivery in hospitals. The study gathered primary data by administering questionnaires to a sample size of 51 hospitals, 357 hospital workers which achieved a response rate of 85.71%. Findings revealed that factors that most influenced operational efficiency included; availability of ICT infrastructure (22.22%), lack of valued analytical skills among hospital staff (20.57%) and staff limited time to access information (18.37%). On the analysis of observed operational throughput, the most relevant measures were total patients served (27.24%), waiting times (22.65%), throughput times (21.08%) and costs saved (18.95%) and on the effects of EMRS on operational efficiency, the effects were; better decision support mechanism (11.83%), faster access of information (11.36%), reduction of waiting times (11.30%), improvement of commodity management (11.15%), faster lab results access (10.36%). Correlation analysis established a relationship where total patients served would lead to (2%) increase in operational efficiency, waiting time would increase operational efficiency by (3%), throughput time would decrease operational efficiency by (4.4%) and cost saved would increase operational efficiency by (5%). Through these findings the study recommends that hospital administrations should work towards building the capacity of the hospitals to improve on the use of EMRS through ICT infrastructure.

Key words: EMRS, Operational efficiency, hospitals, service delivery.

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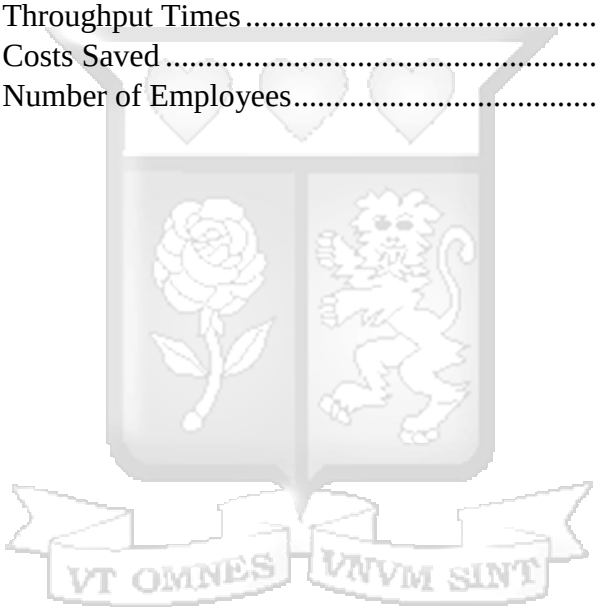

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ABBREVIATIONS/ACRONYMS

EMRS	Electronic Medical Record System
ER	Emergency Room
GP	General Practitioner
ICT	Information Communication Technology
TAM	Technology Acceptance Model
TOC	Theory of Constraints

DEFINITION OF TERMS

Electronic Medical Record System:

They are defined as a computerised system that collects, stores and displays health information (Bologva, Prokusheva, Krikunov, Zvartau, & Kovalchuk, 2016).

mHealth:

In full it is referred to as mobile health, which is a medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices (WHO, 2010).

Operational Efficiency:

The ability to deliver products and services cost effectively without sacrificing quality (C.-Y. Lee & Johnson, 2013).

Operational Throughput:

This is a measure used by hospitals to increase their service capacity by improving their ability to move patients through the treatment system (C.-Y. Lee & Johnson, 2013).

Service Delivery:

It defines the quality and availability of a service and describes how and when it is delivered to the intended persons in need of the service at hospitals (Akacho, 2014).

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Hospital services have been described to be all activities that relate to the wellbeing of the general populace of a given country (Steinwachs & Hughes, 2008). Some of the hospital services include diagnostic, preventive, palliative, rehabilitative, and therapeutic procedures that are provided in establishments operated by doctors of osteopathy, doctors of medicine as well as the care practitioners; separately identifiable for billing and accounting purposes (Fox, et al., 2010; Heredia-Ortiz, 2013; Suraratdecha & Okunade, 2006). The hospital services are critical for operation of the hospitals since they are the fundamental functions that warrant the presence of these institutions. Therefore, hospitals should develop a clear service delivery mechanism for them to achieve the expectation related to hospital services. Consistency in healthcare operations is very essential since it allows predictability of the outcomes of hospital services. In the western countries, the definition of roles related to hospital services has been undertaken to comprehensively describe the minimum support services, workforce, and any additional requirements that can be employed for the safe delivery of hospital services (Buigut, Ettarh, & Amendah, 2015). Where charters guide the hospitals on the delivery of these services, the definitions provide a language that is consistent to describe the services.

An all-inclusive approach towards service delivery has been the guiding framework for delivering the existing patients' care services in Kenya (Ministry of Health, 2014). It is based on the readiness of sufficient guidance for the standards of service, service inputs including equipment, infrastructure, and human resource, and collaboration of services among different care levels (Ministry of Health, 2014). The resulting hospital procedures are useful because they provide not only safeguards but also ensure that service delivery follows a characteristic consistency to allow for predictability (Steinwachs & Hughes, 2008). Among the fundamental components of these framework is the operational efficiency of the services offered in each hospital.

Kenya is a developing country, and thus the abundance of resource allocation towards accessible and efficient healthcare is far from optimum. Deficiency in resources has played a great role in the drive towards improved efficiency of delivering hospital services (Mayberry, Nicewander,

Qin, & Ballard, 2006). EMRS has been among the pioneering systems that were installed in hospitals for the primary aim of improving the effectiveness and efficiency of the delivering hospital services (William & Boren, 2008). This study sets out to establish a relationship between EMRS and operational efficiency of service delivery in Kenyan hospitals.

Obtaining sufficient resources that will enable hospitals to finance their health systems has been a great challenge, more so, in the developing countries (Heredia-Ortiz, 2013). The state of health in third world nations has been especially problematic in those instances where they have had insufficient funding for the provision of basic health services (Heredia-Ortiz, 2013). Therefore, policymakers, administrators, and clinicians alike throughout the globe have faced the pressure of finding efficient mechanisms of delivering the hospital services.

The ways of delivering these hospital services have undergone changes over the years in policy, and consequent resource allocation and utilization courtesy of the innovators' deep insights into ways of meeting the needs of their clients (Ramdas, Teisberg, & Tucker, 2012). Service delivery methods have been identified to fall into four dimensions that can be focused by all health institutions. Thus, the structure of the relationship between the hospital and patient, boundary of services offered, the location of delivery, and finally the task allocation (Ramdas, Teisberg, & Tucker, 2012). Most institutions have developed charters to serve as frameworks that will be the basis of all their service delivery procedures. Operational activities are one of the most vital components of a charter for the hospitals, thus, they have to be described comprehensively. The importance of hospital operational activities makes their efficiency a top priority (Peacock, Chan, Mangolini & Johansen, 2001).

The health sector has experienced rapid growth in hospital services, its support thereof, and applications for medical knowledge management comparatively looking at pre-versus-post the turn of the millennium (Pagliari, et al., 2005). The advancements have been greatly achieved by increasing the "fiscal space" for health. It does not necessarily mean that larger budgets have been allocated. Improvements in efficiency - operational efficiency - even in small dimensions often generate savings in costs that can be directed to the expansion of clinical services to the community (Heredia-Ortiz, 2013). Operational Efficiency in medical care is the ability of hospitals to deliver services to its patients in the most cost-effective way while seeing to it that the quality of its services and support to the patients is not compromised (Nokia Siemens

Networks, 2009). While measuring the operational efficiency of hospital services is critical for the delivery of these services, it remains a challenging process. Still, various studies have developed useful methods that categorize and outline vital data classifications and indicators that are essential in efficiency evaluation on resource input data sources and indicator calculations (Heredia-Ortiz, 2013; Suraratdecha & Okunade, 2006).

From the benefits that the pioneering health institutions in EMRS enjoyed at the turn of the millennium, governments were under pressure to ensure that many of the health institutions installed the EMRS quickly (Fox, et al., 2010). Yet while this happens even presently, researchers are cautious that technology might become a burden when not selected appropriately (Fox, et al., 2010). Technological integration has been one of the great challenges that have led to fragmentation and even slower process of service delivery in the developed countries (Samson, et al., 2007). These observations only emphasize the need for evaluation of the operational efficiency of hospital services delivery.

1.2 Problem Statement

Hospital service delivery has become an important political and social issue. According to Nzinga, Mbaabu, & English (2013), hospitals in Kenya face major challenges in provision of quality healthcare services especially in low income settings and are in need of better system strengthening. The obsolete work environments have hindered efficient delivery of hospital services (Bain, 2015). Several factors, such as an increasing aging population, increase in chronic diseases are leading to an increase in overall demand for hospital services. Scarce hospital resources and a shortage among health professionals has further complicated the issue (Amendah, 2015).

A report by the World Health Organization indicates that corruption and other forms of wastages and inefficiencies account for up to 40% of the total health expenditure by countries (WHO, 2010). A country having zero wastages can almost double the resources dedicated to improving healthcare without increasing their budget. Resource utilization and allocation, and errors due to failure of accessing patient information have been characteristic of the operational inefficiency in healthcare (Mayberry, Nicewander, Qin, & Ballard, 2006). The analysis of a report by the Institute of Medicine report states that the wastages in resources often result from unnecessary

services and administrative waste like duplicate documentation and inefficiently delivered services (Groves, Kayyali, Knott, & Kuiken, 2013).

Technology has been widely embraced in European health institutions as well as those in the United States to a greater extent over the recent years to address these inefficiencies such as long waiting and throughput times (Bain, 2015). In determining how EMRS affects operational efficiency in hospital service delivery, it will allow management to understand how the EMRS can be utilized to improve their hospital service delivery goals (Bologva et al., 2016). This study will aim at reviewing the factors that influence service delivery in Kenyan hospitals and also analyze the effects of EMRS on hospital service delivery in Kenya from an operational efficiency perspective.

1.3 Research Objectives

1.3.1 General Objective

The main objective of this study is to analyze the effect of Electronic Medical Record Systems on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals.

1.3.2 Specific Objectives

1. To determine the factors that influence operational efficiency in delivery of hospital services in Kenya.
2. To analyze the observed operational throughput on delivery of hospital services in Kenya.
3. To determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya.

1.4 Research Questions

1. What are the factors that influence operational efficiency in delivery of hospital services in Kenya?
2. What are the observed operational throughput on delivery of hospital services in Kenya?
3. What is the relationship between EMRS and operational efficiency in delivery of hospital services in Kenya?

1.5 Significance of the Study

This study will provide useful information to the scholarly world on the practical effects that have resulted from the use of EMRS for the delivery of hospital services in the Kenya. Nevertheless, there is the clear benefit of saving the resources that have been channeled to deliver the hospital services through preventing leaks and wastages. Additionally, a great benefit will arise from the relevance it will offer in positioning the practicality of EMRS and how it might sync with other new technologies when embraced in hospitals. For the health sector of any country or geographical region to integrate the 'supporting' technology with EMRS, an account of the performance and efficiency of the EMRS has to be evaluated to understand how the new technology fits or whether it will be redundant. In the case of the Kenyan Health Sector, this study will serve the role fully (Bain, 2015).

1.6 Scope of the Study

The scope of this study is Kenya. It dealt with the delivery of hospital services which was affected by EMRS. These services include inpatient, outpatient, laboratory, therapeutic and diagnostic and pharmacy services. The target population of this study was all the hospitals in Kenya.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter forms the literature review. A review of various literature is undertaken and discussed in this chapter in line with the study objectives. The chapter also discusses the factors that influence service delivery in hospitals, the observed operational throughput on hospital services delivery and the effects of EMRS on the operational efficiency in delivery of services in hospitals. The theoretical review and conceptual framework that inform the study and explain the influence of EMRS on operational efficiency in service delivery in hospitals is also outlined.

2.2 Theoretical Framework

The theoretical framework offers theories that expound on why the research problem under study, operational inefficiency in hospitals, exists. In order to measure and determine the statistical relationships between adoption of EMRS and the operational efficiency in service delivery in hospitals, this study will adopt three key theoretical frameworks.

2.2.1 Theory of Constraints

According to (Boyd & Gupta, 2004), the theory of constraints is a management philosophy that focuses on continuous improvement resulting in organizational performance. The main construct of this theory is throughput orientation stating that by increasing throughput orientation will lead to an increase in organizational performance. It further describes three components of throughput orientation as organizational mindset, performance measurement systems and decision making. These components have a major contribution to throughput through their influence on cost reduction strategies, growth strategies and customer satisfaction (Pacheco, 2014).

Sadat (2009) notes that hospitals are riddled with problems that other companies and sectors do not face. Different from other for profit organizations, hospital earnings per patient is a constant and a reducing amount. Hospitals claims are paid by insurance companies based on a contracted sums disregarding associated costs of care provided. It is thus important for these hospitals to push down operational costs and increase patient capacity and service to support their dwindling revenues. This is where the Theory of Constraints (TOC) is adaptable in the healthcare industry to advice in cost management, improvement of operational efficiency and to increase patient satisfaction (Sadat, 2009).

(Kershaw, 2000) provides an analysis of how TOC can be applied in the healthcare sector by translating the key concepts used in this theory to the healthcare context. First would be, Throughput which can be modified to mean the rate of claims paid minus drug costs and medical commodities for the total patients seen and treated." Secondly, output unit which is can be perceived to be a human being or patient. Thirdly, external constraint from a hospital angle is the availability of drugs and other medical commodities being limited. Lastly, internal constraint in the hospital industry can be patient need of care exceeds the capacity of hospital service provider. From a translation of the key TOC concepts to a healthcare context, now the application of the TOC model can be applied in a hospital setting in order to reap the intended benefits. The model entails the following steps: identify the constraints, let the constraints set the pace, focus improvement efforts on constraints and finally start over. It therefore seems like a process of continuous improvement until a desirable optimum cycle is achieved.

Corporates can apply the Theory of Constraints to improve their operational processes which can lead to a reduction in operational costs. Theory of Constraints must be carefully utilized and special attention must be paid to crucial elements involved such as morale of workers, satisfaction of patient and the structure of business procedures. If properly implemented, TOC can lead to profitability. It is therefore the reason why this theory is a basis for which the study is based on and how it can be leveraged to understand how EMRS can be used to improve operational efficiency in hospital service delivery (Gupta & Boyd, 2008).

2.2.2 Queuing Theory

Queuing theory is considered a mathematical study of waiting in lines. It is a branch of operations research from which the results often are used when making decisions about resources required by businesses to provide services. At a granular level, queuing theory involves arrivals of customers and service requirements of the business. Customer arrivals may fluctuate over the operating hours of a business which may lead to variation to strain on available resources to handle the customers (Sztrik, 2010).

Ameh, Sabo, and Oyefabi (2013) posits that the application of queuing theory in the healthcare sector can be in the analysis of waiting lines in hospitals. Most hospitals have excess capacity to accommodate unforeseen variations hence queuing analysis can be used as a short-term measure or for resource planning. Other applications can include outpatient clinics, pharmacy, inventory

control, infrastructure planning for disaster management and public health. The necessity of application of queuing theory in healthcare is of great importance due to the wellbeing and life of patients concerned. The duration a patient spends waiting to be attended to by a doctor is critical to the patient as well as to the image of the hospital to the public.

A study by (Bahadori, Mohammadnejhad, Ravangard, & Teymourzadeh, 2014) showed that the application of queuing theory in an outpatient pharmacy hospital was able to reduce patient waiting times and patients waiting in a queue to be served at the counter by multitasking persons and reallocating personnel at the time-consuming stage. This shows that the theory can be used to advise management on when and how their resources can be better utilized.

Our study focuses on operational efficiency in service delivery in hospitals and how EMRS can be used to improve hospital services. Therefore, this theory can be used as the basis from which service delivery in our context will be simulated and modelled upon. Through understanding arrival times, waiting times, service times and throughput times we will be able to analyze the operational efficiency of service delivery in hospitals and how it can it is affected (Taha, 2007).

2.2.3 The Unified Theory of Acceptance and Use of Technology

Williams, Rana, & Dwivedi (2013) states that the theory was developed through the analysis of eight dominant theories and models, namely: Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behaviour (TPB), a combined TBP/TAM, the Model of PC Utilization, Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT). These contributing theories and models have all been widely and successfully utilized by a large number of previous studies of technology or innovation adoption and diffusion within a range of disciplines including information systems, marketing, social psychology, and management.

The significance of this theory to this study is its underlying proposition that an individual may use or not adopt ICT despite its availability in the organization. According to this theory, it would make no difference if the healthcare providers adopted EMRS in clinical service delivery for it does not guarantee that individual service providers will use this technology. The model argues that there is need to consider other factors despite the availability of the technology. The theory espouses the belief that adoption does not occur in isolation rather than in a social

dynamic system. Thus, adoption and utilization of EMRS in clinical service delivery will depend on the existing social system (Schwarz & Chin, 2007).

2.3 Empirical Literature

2.3.1 Factors influencing Operational Efficiency of Service Delivery in Hospitals

Hospitals are organizations that are charged with the responsibility of managing the care of the populace. They provide services that are essential for the sustainability of humanity and without them there cannot be progress. The human body is prone to a number of weaknesses and it is the responsibility of hospitals and their professionals to provide assistance when the human body is in need of assistance. They however face many challenges such as evidence-based healthcare, which is the right interventions to the right people at the right time in normal settings. WHO (2010) reported that a leading factor to poor quality care was inadequate knowledge and skills which were compounded by broader system failures and low staff numbers. More recently the focus has shifted to the health worker capacity, their motivation and organizational aspects that influence worker performance. A study by (Akacho, 2014) conducted in low-income African Settings showed that the key indicators identified for service delivery were inpatient bed capacity, total staff, nature of care such as inpatient, outpatient and service types such as adult surgical, pediatric wards. Over time, recognition to leadership, supervision, information dissemination and communication are major moderators for quality and effectiveness of healthcare service delivery. From the outlook of service delivery, the factors that influence service delivery must be observed from the perspective of the service provider and the service receiver(patient) both of which influence the service delivery in hospitals (Capkun, Messner, & Rissbacher, 2012).

From the patient perspective, Socio-demographic factors were identified as an influence to the issues affecting hospital service delivery. A factor identified was the language barrier whereby the doctor or clinician spoke a different language from the patient hence it became difficult to serve the patient. The financial status of the patient may affect the quality of hospital services. At times patients cannot afford the treatment and decide to forgo the treatment. The treatment will not be effective as the patient will not follow the doctor’s orders due to financial problems leading to increased illness burden. The types of illnesses being treated can cause personal job stress to the hospital care providers. When mortality rate is high it causes anxiety and stress

among staff which leads to inefficiency. Health provider's attitude to the patients and communication may influence the service delivery. In public hospitals, the demand for service is quite high hence providers are unmotivated in improving their communication ability (Capkun et al., 2012).

From the Provider perspective, they should have knowledge and skill competency. The provider should be able to deliver services because they are capable and understand what is required of them. Provider should have motivation and satisfaction. This would come in the form of good pay, a conducive working environment, managerial leadership, organizational policies, recognition, job security, job identity, and chances for promotion. Employees tend to leave hospitals since they are not provided with job satisfaction of learning new skills or having the tools necessary to perform their jobs. (Izzat Mohd. Nasurdin, T. Ramayah et al., 2014). Another factor is the availability of resources and facilities such as equipment, supplies, drugs, protective materials these will ensure better service delivery as they can focus on the tasks at hand than on the equipment. Finally, leadership and management is a vital factor because they provide for the direction and wisdom which is required to run the hospitals (Mosadeghrad, 2014).

2.3.2 Observed Operational Throughput of Hospital Services Delivery

In a public health system, one of the problems is the size of the waiting list for admission to hospital, this is further aggravated by the cost of increasing physical infrastructure, this has however forced hospitals to look at other cost saving measures. Rather than increase physical capacity to meet increased patient numbers hospital are looking at decreasing the time and costs of moving patients through the treatment flow "throughput". According to (Thompson et al., 1996) throughput is the rate at which admissions are converted to discharges.

The health care industry is service oriented. As such, the waiting time patient experience prior to receiving treatment is a fundamental factor that directly influences a patient's satisfaction (Thompson et al., 1996). This has been done through information tracking systems which provide notification of important patient's information enabling caregivers to deliver more efficiently thus reducing patient flow time and increasing number of patients seen. Accordingly, the process of admission, hospitalization, and discharge resembles a "bell-shaped curve." To achieve effective throughput, hospitals must expedite patient care and also maintain careful oversight throughout a patient's entire hospital stay.

Radical thinking about the design of industrial processes over the last century has greatly improved the quality and efficiency of manufacturing and services. Similar methods to deliver higher quality health care at lower cost would be extremely valuable. In health care, the concepts of throughput, lean and six-sigma need to be incorporated (Young et al., 2004).

As providers face growing inpatient capacity utilization challenges and Return on Asset (ROA) pressures, optimizing inpatient throughput—cycling patients through a hospital's fixed resources (beds, procedure rooms, imaging) more effectively and efficiently—is an essential operations management strategy.

Hospitals are experiencing financial and operational problems. Margins are dwindling and bed capacity is at a premium. The need for more bed capacity is on the rise but adding new physical capacity is often out of the question. Rather than increasing physical capacity to meet growing patient numbers, hospitals can increase their service delivery capacity by improving their ability to move patients through the treatment system, a measure known as "throughput." Throughput refers to hospital processes that impact patient flow. This includes triage, staffing, availability of specialty and diagnostic services, surgical scheduling and information technology resources. Disruptions in any one of these, and other areas, can create a backlog within the hospital resulting in long wait times and increase the likelihood of patients leaving before being seen by a doctor or other healthcare provider.

A decrease of available inpatient beds along with an overall increase in emergency department visits has caused overcrowding. For hospitals, whose inpatient systems are not equipped to handle the volume or pace of new admissions, the level of care and patient experience can easily deteriorate when patients are held in the emergency department (C.-Y. Lee & Johnson, 2013).

Many factors are involved as hospitals seek to increase patient throughput from point-of-entry to inpatient, and even through the discharge process and transitions to home (Cowing, Davino-Ramaya, Ramaya and Szmerekovsky, 2009). Their approach is designed to deeply understand the unique dynamics of each organization and apply proven best practices to address specific challenge. By combining a flexible mindset with hands-on experience, a range of factors that can help collaborate with a hospital team to jointly arrive at an action plan for improvement. The approach includes; in-depth assessments of both emergency department and inpatient processes and procedures, direct observation of patient experience and work flow, data analysis of

performance metrics and review of reporting tools, interviews and insights from staff, management, and physicians (Leu, Lee, & Huang, 2016).

The involvement of physicians and staff is key to the development and ownership of the new processes. Also work teams are formed to address process redesign. The work team members represent all of the key stakeholders who are part of the new processes. Common outcomes result in: Increased access to available beds**,** streamlined bed control process**,** Creation of a "pull" culture**,** Refocused resources**,** Improved discharge process. These system changes can result in additional bed capacity, streamlined processes, and improved patient satisfaction (Basarkar & Saxena, 2016).

2.3.3 Effect of EMRS on Operational Efficiency of Hospital Service Delivery

Electronic Medical Record Systems (EMRS) are defined as a computerised system that collects, stores and displays health information. Using of EMRS is a quality improvement program in the medical science field as it seeks to replace the traditional paper-based technique (Najaftorkaman & Ghapanchi, 2014).

The potential benefits of EMRS adoption, such as improvement in the care process and the overall resident experience, are well documented. EMRS implementation, however, can also have a huge impact on operational efficiencies, creating opportunities for your community to improve a number of cumbersome administrative processes to drive bottom line improvement. Additionally, electronic access to health information opens up your organization to improvements that can affect both turnaround times as well as cost of care delivery (Drazen & Rhoads, 2011). According to (Institute of Medicine & Committee on Quality of Health Care in America, 2001), the a major effect of health EMRS on patient safety and the overall quality of the care delivered is its role in increasing compliance with guideline- or protocol-based care particularly in the management of chronic diseases such as asthma, diabetes or heart failure

According to Chaudhry et al. (2006), EMRS can lead to improved clinical decision support by a factor of 24% which leads to influencing prescribing behaviour and cost savings to hospitals by recommending to clinicians' alternative treatment methods that can be as effective and cheaper. This ensures that costly treatment measures are only utilized in cases in which they offer better outcomes than the cheaper methods. (Bologva et al., 2016).

EMRS usage has led to the reduced hospital operation costs through improvement of process flow in hospitals therefore faster clinical service turnaround, reduction of time spent on data entry and reduction in multiple handling of patient documents. Productivity of staff can become more positive through reducing some of the work involved in collecting patient information and getting it to the relevant users who need it. EMRS effects for the clinician can vary greatly and depending on individual skill-level, type of decision-support tool used and technology adopted (A. Garg et al., 2005).

A care and treatment gap is created when improved access to care is implemented using a fragmented approach towards healthcare delivery. This is brought about by putting merging inequities in access to care that reflect geographic, socioeconomic, and cultural disparities (Dale Compton, Ganjiang, Reid, & Grossman, 2005). Usage of EMRS can help to close this gap by offering cost-effective quality healthcare delivery to remote or neglected populations. According to Cleven, Mettler, Rohner, & Winter (2016) , telemedicine can be used in various situations to address challenges such as workforce shortage and the often-uneven distribution of doctors, and more so specialists, between rural and urban areas.

2.4 Research Gaps

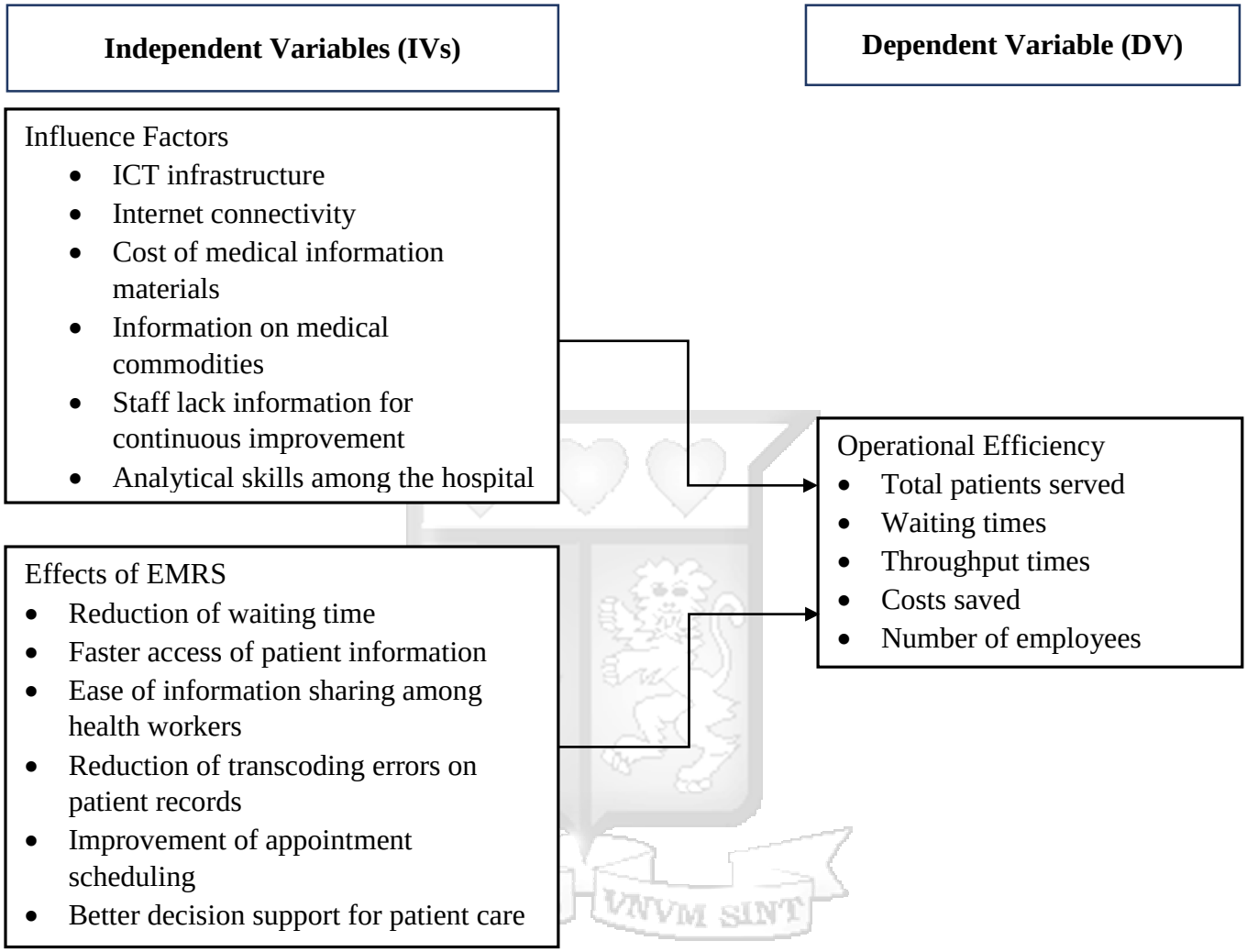
Research gaps encountered in this study include relevant literature that could inform on operational efficiency theories in hospitals are very limited as due to its application mainly in production/manufacturing industries as opposed to service industry.

Most studies relating to electronic medical systems explain importance and impact on service quality but do not show a co-relation to how this quality is affecting the efficiency in health provider services and costs.

Finding literature on operational efficiency in the healthcare sector proved challenging as the metrics used would be more from the consumer (patient) perspective than from the health provider. There are limited studies that have been conducted in the Kenyan context with regards to Service quality in the health sector therefore posed a challenge in understanding the local context of health service quality in Kenya.

2.5 Conceptual Framework

Figure 2.1 Conceptual Framework



CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Saunders et. al (2016) explained research methodology as the theory of how scientific research should be undertaken. This chapter discusses the research design, population and sampling, data collection, and data analysis. Furthermore, research quality and ethical considerations are discussed.

3.2 Research Design

Research design is defined as an overall plan used to answer a research question (Saunders et. al, 2016). The research is a correlational study. This approach is useful in explaining the existing relationships between variables (Cooper & Schindler, 2008). The research design is descriptive in nature finding out who, what, when, how or how much for all the objectives. The study employed ex post facto research design which presumes a cause-effect relationship and is preferred in situations where it is not possible to manipulate variables (Vogt, Gardner and Haeffele, 2012). It also employed the use of quantitative methods. Using the quantitative approach allowed measuring and analysis of respondent data. The respondent data allows us to understand the relationships between the variables being measured such as service delivery and operational efficiency. A benefit of using this method is that it required minimum researcher involvement therefore reducing bias and improving generalization of research findings based on convenient samples of sufficient size (Nguti, 2014). The study is cross-sectional which answered the research questions at a particular point in time. The unit of analysis for this research will be the employees in hospitals in Kenya.

3.3 Population and Sampling

According to Mugenda & Mugenda (2003) a population is an entire group of individuals, events or objects with some common observable characteristics. The population in the study is the employees within hospitals in Kenya. Ministry of Health (2014) states that there are 507 hospitals in Kenya. These hospitals are categorized as Level 6 - Tertiary hospitals, Level 5 - Secondary hospitals, Level 4 - Primary hospitals and Other hospitals. According to Mugenda & Mugenda (2003), 10% of the population is considered an adequate sample size for descriptive

study. Therefore, to acquire an appropriate sample size, I used the stratified random sampling technique.

According to Cochran (2007), Stratified sampling entails first dividing the population into none overlapping subpopulations called strata that together comprise the entire population and then drawing an independent sample from each stratum. If the sample in each stratum is a simple random sample, the whole procedure is described as stratified random sampling. Stratification is used to increase the precision of population estimates. Stratified random sampling technique was based on categories of hospital classification of Level 6, Level 5, Level 4 and Others. The population was divided into relatively homogeneous groups called strata. Each stratum was selected randomly. Elements from each stratum were then combined to form the overall sample. This technique gave all the subjects an equal chance and also reduced bias and errors. The sample size included various personnel of different positions due to the nature of the data required. The positions included Doctor, Nurse, Clinical Officer, Lab Technician, Data Analyst, Pharmacist/PharmTech and Management.

Table 3.1 Target Population

Hospital Classification	No. of Hospitals	No. of Hospital Sample Size (10%)	Sample Size of Respondents
Level 6 - Tertiary	3	1	7
Level 5 - Secondary	9	1	7
Level 4 - Primary	264	26	182
Other Hospitals	231	23	161
Total	**507**	**51**	**357**

3.4 Data Collection

The study used both primary and secondary data sources. Gathering data from respondents using closed-ended questionnaires aligned to address our research questions served as the primary source of data. The hospital administration was approached at hospitals for permission to conduct the study. After permission was given, the questionnaires were physically administered by the researcher to the respondents and collected there and then. This was done to encourage completion and improve the overall response rate.

The documents used included an introduction letter (Appendix A), a consent letter (Appendix B) and the questionnaire (Appendix C).

3.5 Data Analysis

The filled questionnaires were checked for completeness, and then coded and the data analyzed. Objective one that sought to determine the factors that influence service delivery in hospitals in Kenya was analyzed using descriptive statistics (particularly the mean and standard deviation) to determine the key factors for influencing service delivery in hospitals. Objective two aimed to analyze observed operational throughput of service delivery in hospitals in Kenya. Similarly, descriptive statistics was used for analysis from which measures of central tendency helped determine the key measures of observed operational throughput. Finally, objective three which sought to analyze the effect of EMRS on service delivery in hospitals was analyzed using regression analysis from which a coefficient of determination told about variance in service delivery in hospitals that can be attributed to use of EMRS.

Regression Equation

$Y = \alpha + \beta iXi + error$ Where I = 1, 2 ……., n

Y = Operational efficiency, $X1$= Total patients served, $X2$= Waiting Time, $X3$=Throughput Time, $X4$= Costs saved, $X5$= Number of employees

$$Y = \alpha + \sum_{i=1}^{n} \beta iXi + error$$

$$Y = \alpha + \beta 1\,(Total\ patients\ served) + \beta 2(Waiting\ times) + \beta 3(Throughput\ times) + \beta 4(Costs\ saved) + \beta 5(Number\ of\ employees)$$

In general, data was analyzed using descriptive statistics such as mean, standard deviation, frequency distribution and percentages. The relationship between dependent variables and

service delivery in hospitals and mean differences was established using parametric analytical techniques and statistics. These included correlation coefficient, F-statistic and coefficients of determination.

3.6 Research Quality

Research quality was measured through reliability and validity of the study.

3.6.1 Reliability

The reliability of the study was enhanced through conducting a pilot study on a smaller population of hospitals conveniently selected in Nairobi. The pilot sample was representative of the target population. This process was expected to refine the questionnaire so as to reduce response error rate by respondents. Reliability of a research instrument concerns the extent to which the instrument yields the same results on repeated trials. The researcher tested for reliability of the questionnaire using internal consistency method which yielded an internal consistency reliability estimate reported by Cronbach's alpha. A threshold alpha of 0.7 was used to demonstrate reliability of the questionnaire.

3.6.2 Validity of the Study

Validity of a study can be divided into two; namely internal and external. Internal validity is explained as the study being able to achieve what it set out to achieve while external validity is defined as the degree to which the results of a study can be generalized to other people, situations and times (Saunders et. al, 2016).

Using a well-designed and tested questionnaire helped improve on the validity of the study. It allowed respondents to only give relevant information as required by the study. The questionnaire covered all aspects of the research questions in order to yield consistent results.

3.7 Ethical Considerations

To maintain research quality, ethical concerns must be addressed. The respondents were informed before-hand that their participation will be voluntary and anonymous. They were also notified of their right to withdraw from the study at any point. The researcher received informed consent from all respondents and further explained to them that the data to be collected will be used for the purpose of education and research only. Finally, assurance was given to the respondents that the information collected was confidential and therefore there should be no risk in their participation.

CHAPTER FOUR: PRESENTATION OF FINDINGS

4.1 Introduction

The study sought to understand the effect of EMRS on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals. The objectives of the study were to determine the factors that influence operational efficiency in delivery of hospital services in Kenya, to analyze the observed operational throughput on delivery of hospital services in Kenya and to determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya. The collected data was coded and keyed into Statistical Package for Social Sciences (SPSS Version 22). Statistical tests were carried out to qualify the data for internal consistency and validity. Quantitative data was analyzed and presented in terms of frequencies and percentages. The chapter begins by providing the organization profile characteristics followed by a report of other findings with respect to the specific study objectives.

4.2 Response Rate

Out of the 357 questionnaires sent to the respondents, only 306 were responded to which represented a response rate of 85.71%. According to Mugenda and Mugenda (2003), a response rate of 50% was acceptable for analysis and reporting 50%; 60% is good; 70% and above is excellent. Based on this, the response rate was considered excellent. The respondents were represented in the following categories: Doctors, Nurses, Pharmacists/PharmTech, Data Analyst, Clinical Officer, Lab Technician and Management. Piloting the questionnaire ensured revision of the questionnaire thus helping in boosting the completeness of responses by the respondents to the questionnaires.

4.3 Organization Profile Information

The study sought to know the various levels of hospitals, different job cadres that interact with EMRS and also the respondent level of job experience. This was important since it determines the scope of operation of the hospitals and influence on operational efficiency.

Table 4.1 below shows that out of the 306 respondents, 6 (2.0%) were from Level 6 Hospitals, 6 (2.0%) from Level 5 hospitals, 156 (51.0%) were from Level 4 hospitals and 138 (45.1%) were from Other Hospitals. This was representational of how hospitals in Kenya are distributed

coinciding with the report by Ministry of Health (2014) on distribution of hospitals in the identified categories.

Table 4.1 Hospital Classification Frequency Table

Hospital Classification		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Level 6	6	2.0	2.0	2.0
	Level 5	6	2.0	2.0	3.9
	Level 4	156	51.0	51.0	54.9
	Other(Specify)	138	45.1	45.1	100.0
	Total	306	100.0	100.0	

Table 4.2 shows how the study was targeting specific job roles hence the proportion of distribution amongst the respondents was distributed amongst the following cadres with 16.3% proportions for Doctors, 16.7% for Nurses, Clinical Officers and Lab Technicians while Data Analysts had 15.7% and Pharmacists/PharmTechs having the highest with 17.3%. There were outliers in the other segment which was a cadre not in the options which accounted for 0.7%.

Table 4.2 Job Role Frequency Table

Job Roles		Frequency	Valid Percent
Valid	Doctor	50	16.3
	Nurse	51	16.7
	Clinical Officer	51	16.7
	Lab Technician	51	16.7
	Data Analyst	48	15.7
	Pharmacist/PharmTech	53	17.3
	Other (specify)	2	.7
	Total	306	100.0

Table 4.3 shows how the respondents were requested to share their years of experience in health industry. This information aided in evaluating their understanding of EMRS and the attitude towards EMRS in relation to work experience thus increasing their viability as respondents. Of the 306 respondents, 25 (8.2%) had less than one year of experience, 125 (40.8%) had one to five years of experience, 131 (42.8%) had five to ten years of experience and 25 (8.2%) had more than 10 years of experience.

Table 4.3 Work Experience Frequency Table

Years of Work Experience		Frequency	Valid Percent
Valid	Less than 1	25	8.2
	1-5	125	40.8
	5-10	131	42.8
	Over 10	25	8.2
	Total	306	100.0

From table 4.3 it can be deduced that majority of the respondents who are working in different cadres in hospitals have work experience clustered between 1 to 10 years which combines the experience band of 1-5 (40.8%) and 5-10 (42.8%) which gives a percentage total of 83.6%. Therefore, it can be deduced that a majority of the respondents are comprised of a young workforce.

4.4 Analysis of factors influencing operational efficiency in hospital service delivery

The study sought to determine the factors that influence operational efficiency in hospital service delivery. Through the use of descriptive statistics, the quantitative data was analyzed and presented using mean, standard error, frequency tables and percentages. This was important since it helps answer the first research question of, what are the factors that influence operational efficiency in delivery of hospital services in Kenya.

Table 4.4 below shows that the respondents selected the factor of, availability of ICT infrastructure to have the most important influence on operational efficiency in hospital service delivery with a proportion of 22.22%. The respondents also selected other factors that seemed to have an influence on operational efficiency in hospital service delivery, these were lack of valued analytical skills among the hospital staff (20.57%) and staff have limited time to access information for continuous improvement (18.37%). The proportions were calculated as a percentage of the total selections. These findings compliment the study by Akacho (2014) on the factors influencing provision of health care service delivery.

Table 4.4 Factors influencing operational efficiency in hospital service delivery

Factors influencing operational efficiency	**Total**	**% of Total**
Availability of Information Communication Technology (ICT) infrastructure	242	22.22%
Lack of valued analytical skills among the hospital staff	224	20.57%
Staff have limited time to access information for continuous improvement	200	18.37%
Inadequate information on medical commodities available	161	14.78%
High subscription cost of medical information materials	141	12.95%
Non-existent or unreliable internet connectivity	121	11.11%
Valid N (list-wise)	1089	100.0%

Table 4.5 shows how respondents were asked to rate on a scale of 1 – 5 (with 5 being the highest and 1 being the lowest), the factors influencing operational efficiency in hospital service delivery. Availability of Information Communication Technology (ICT) infrastructure was rated with a mean of 3.350, Lack of valued analytical skills among the hospital staff with a mean of 3.114, Staff have limited time to access information for continuous improvement with a mean of 2.797, Inadequate information on medical commodities available with a mean of 2.121, High subscription cost of medical information materials with a mean of 1.765 and finally Non-existent

or unreliable internet connectivity with a mean of 1.725. The average mean and standard error of the ratings were as follows (Average Mean = 2.1268) (Average Standard Error = 0.1017). This clearly indicates that Availability of Information Communication Technology (ICT) infrastructure, Lack of valued analytical skills among the hospital staff, Staff have limited time to access information for continuous improvement had the most influencing factors in that order as they were far above the average.

Table 4.5 Ranking of factors that influence operational efficiency in hospital service delivery

Factors influencing operational efficiency	**N**	**Mean**	
	Statistic	**Statistic**	**Std. Error**
Availability of Information Communication Technology (ICT) infrastructure	306	3.350	.1140
Lack of valued analytical skills among the hospital staff	306	3.114	.1195
Staff have limited time to access information for continuous improvement	306	2.797	.1214
Inadequate information on medical commodities available	306	2.121	.1250
Non-existent or unreliable internet connectivity	306	1.765	.1256
High subscription cost of medical information materials	306	1.725	.1200
Average		2.4787	0.1209

Table 4.6 below shows that the respondents sought to discern the methods of identifying the factors that influence operational efficiency in hospital service delivery. Use of performance reviews was the most important with 232 (29.71%) respondents selecting it. The other methods that were used that but less important included use of customer feedback with 220 (28.17%) and Industry benchmarks with 215 (27.53%). The findings observed collaborate the study by

Capkun, Messner, & Rissbacher (2012) on methods used to identify factors that influence operational efficiency.

Table 4.6 Method to identify the factor that influence operational efficiency in hospital service delivery

Methods of identifying factors influencing operational efficiency	Total	% of Total
Performance reviews	232	29.71%
Customer feedback	220	28.17%
Industry benchmarks	215	27.53%
Service Charters	107	13.70%
No method used	5	0.64%
Other (specify)	2	0.26%
Valid N (list-wise)	781	100%

Table 4.7 shows how the respondents rated the methods of identifying factors that influence operational efficiency in hospital service delivery on a scale of 1 -5 (with 5 being the most successful and 1 being the least successful). Performance reviews was rated with a mean of 3.222, Customer feedback with a mean of 3.049, Industry benchmarks with a mean of 3.042 The average mean and standard error of the ratings were as follows (Average Mean = 1.5572) (Average Standard Error = 0.0885). This clearly indicates that Performance reviews, Customer feedback, Industry benchmarks were the most successful methods of identifying factors that influence operational efficiency in hospital service delivery as they were far above the average.

Table 4.7 Ranking of the success rate of the identification method

Methods of identifying factors influencing operational efficiency	N	Mean	
	Statistic	Statistic	Std. Error
Performance reviews	306	3.222	.1105
Customer feedback	306	3.049	.1167
Industry benchmarks	306	3.042	.1195
Service Charters	306	1.542	.1225
No method used	306	.114	.0400
Other (specify)	306	.039	.0216
Average		1.5572	0.0885

4.5 Analysis of observed operational throughput on delivery of hospital services in Kenya.

The study sought to identify how hospitals measured observed operational throughput of delivery of hospital services in Kenya. Through the use of descriptive statistics, the quantitative data was analyzed and presented using mean, standard error, frequency tables and percentages. This was important since it helps answer the second research question of, what are the observed operational throughput on delivery of hospital services in Kenya.

Table 4.8 shows how the respondents ranked the methods of identifying observed operational throughput in delivery of hospital services in Kenya. Total patients served was the highest with 243 (27.24%), followed by waiting times with 202 (22.65%), then throughput times with 188 (21.08%) and costs saved with 169 (18.95%). The findings listed seem to correspond with the study conducted by Basarkar & Saxena (2016) in which they highlighted the measures of observed operational throughput.

Table 4.8 Measures of observed operational throughput

Measures of observed operational throughput	**Total**	**% of Total**
Total patients served	243	27.24%
Waiting times	202	22.65%
Throughput times	188	21.08%
Costs saved	169	18.95%
Number of employees	87	9.75%
Other (specify)	3	0.34%
Valid N (listwise)	**892**	**100%**

Table 4.9 shows how respondents rated on a scale of 1 – 5 (with 5 being the highest and 1 being the lowest) the rate the measures of observed operational throughput. Total patients served use was rated with a mean of 3.0948, waiting times with a mean of 2.6895, throughput times with a mean of 2.4412. Costs saved with a mean of 2.7190. The average mean and standard error of the ratings were as follows (Average Mean = 2.152) (Average Standard Error = 0.0616). This clearly indicates that Total patients served, waiting times, throughput times, costs saved were the most successful measures of observed operational throughput as they were above the average.

Table 4.9 Rating of measures of observed operational throughput

Measures of observed operational throughput	N	Mean	
	Statistic	Statistic	Std. Error
Total patients served	306	3.0948	.07262
Waiting times	306	2.6895	.07825
Throughput times	306	2.4412	.08173
Costs saved	306	2.7190	.07936
Number of employees	306	1.9641	.05424
Other specified	306	.0033	.00327
Average	306	2.152	0.0616

Table 4.10 shows the ranking of functional use of EMRS in the various departments of the facility. Patient Registration was ranked highest with 292(27.26%), followed by Pharmacy with 287 (26.80%), then Billing/Accounts with 206 (19.23%), and then Lab with 182 (16.99%). The findings above coincide with the study of Lee & Johnson (2013) that showed the various functional uses of EMRS.

Table 4.10 Functional Use of EMRS

Functional Use of EMRS	**Total**	**% of Total**
Patient Registration	292	27.26%
Pharmacy	287	26.80%
Billing/Accounts	206	19.23%
Lab	182	16.99%
Triage	62	5.79%
Consultation	41	3.83%
Other (specify)	1	0.09%
Valid N (listwise)	**1071**	**100%**

Table 4.11 shows how respondents were asked to rate on a scale of 1 – 5 (with 5 being the highest and 1 being the lowest) the functional use of EMRS affecting hospital operations. Patient Registration had a mean of 4.327, followed by Pharmacy with a mean of 4.278, then Billing/Accounts with a mean of 2.859 and then Lab with a mean of 2.346. The average mean and standard error of the ratings were as follows (Average Mean = 2.1676) (Average Standard Error = 0.0810). This clearly indicates that Patient Registration, Pharmacy, Billing/Accounts and Lab were the most functional uses of EMRS affecting hospital operations as they were far above the average.

Table 4.11 Rating of the Functional Use of EMRS affecting hospital operations

Functional Use of EMRS affecting hospital operations	N	Mean	
	Statistic	Statistic	Std. Error
Patient Registration	306	4.327	.0651
Pharmacy	306	4.278	.0706
Billing/Accounts	306	2.859	.1207
Lab	306	2.346	.1211
Triage	306	.843	.0978
Consultation	306	.500	.0753
Other (specify)	306	.020	.0167
Average		2.1676	0.0810

4.6 Analysis of effect of EMRS on operational efficiency in delivery of hospital services

The study sought to determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya. Through the use of descriptive statistics, correlation, ANOVA and regression analysis, the quantitative data was tested for normality then analyzed. This was important since it helps answer the third research question of, what is the relationship between EMRS and operational efficiency in delivery of hospital services in Kenya.

Table 4.12 shows how the effects of operational efficiency were ranked. These effects being an outcome of operational efficiency in hospital services delivery. Better decision support mechanism for patient management had 225 (11.83%), followed by faster access of patient information with 216 (11.36%), then reduction of waiting time for clients with 215 (11.30%) and then improvement of commodity management with 212 (11.15%). From the findings listed above there are similarities with the studies of both Bain (2015) and Goldzweig, Towfigh, Maglione, & Shekelle (2009) who highlighted the various benefits or outcomes of using EMRS in hospital service delivery.

Table 4.12 Effects of EMRS on operational efficiency in hospital service delivery

Effect of EMRS on operational efficiency in delivery of hospital services	**Total**	**% of Total**
Better decision support mechanism for patient management	225	11.83%
Faster access of patient information	216	11.36%
Reduction of waiting time for clients	215	11.30%
Improvement of commodity management	212	11.15%
Faster lab results viewing for clinicians	197	10.36%
Reduction of record keeping stationery and personnel	193	10.15%
Improvement of prescription management	189	9.94%
Ease of information sharing among health workers	181	9.52%
Reduction of transcoding errors on patient records	157	8.25%
Improvement of appointment scheduling	107	5.63%
Other (specify)	10	0.53%
Valid N (listwise)	**1902**	**100%**

Table 4.13 shows how respondents were asked to rate on a scale of 1 – 5 (with 5 being the highest and 1 being the lowest) the effects of EMRS as an outcome of operational efficiency in delivery of hospital services. Better decision support mechanism for patient management had mean of 3.343, followed by faster access of patient information with mean of 3.196, then reduction of waiting time for clients with mean of 3.036 and then improvement of commodity management with mean of 2.990. The average mean and standard error of the ratings were as follows (Average Mean = 2.6795) (Average Standard Error = 0.1239). This clearly indicates that Better decision support mechanism for patient management, Faster access of patient information, Reduction of waiting time for clients and Improvement of commodity management were the most rated effects of operational efficiency in hospital service delivery as they were far above the average.

Table 4.13 Rating of effects of EMRS on operational efficiency in delivery of hospital services

	N	Mean	
	Statistic	Statistic	Std. Error
Better decision support mechanism for patient management	306	3.343	.1198
Faster access of patient information	306	3.196	.1257
Reduction of waiting time for clients	306	3.036	.1200
Improvement of commodity management	306	2.990	.1205
Faster lab results viewing for clinicians	306	2.742	.1255
Improvement of prescription management	306	2.634	.1287
Reduction of record keeping stationery and personnel	306	2.618	.1209
Ease of information sharing among health workers	306	2.533	.1286
Reduction of transcoding errors on patient records	306	2.157	.1245
Improvement of appointment scheduling	306	1.546	.1250
Average		2.6795	0.1239

Table 4.14 shows the measures of operational efficiency in hospital service delivery with lack of adequate management of hospital resources being the highest with 227 (22.08%) was the leading indication of hospital service inefficiency, it was strongly followed by Existence of errors in the patient management process 224 (21.79%) then Slow patient throughput and flow 222 (21.60%) and Lack of technology adoption in service delivery at 218 (21.21%). Mosadeghrad (2014) had similar findings of the indicators of operational inefficiency in hospital service delivery.

Table 4.14 Measures of operational efficiency in hospital service delivery

Measures of Operation Efficiency	**Total**	**% of Total**
Adequate management of hospital resources	227	22.08%
Reduction of errors in the patient management process	224	21.79%
Fast patient throughput and flow	222	21.60%
Technology adoption in service delivery	218	21.21%
Reduced labor costs	136	13.23%
Other (specify)	1	0.10%
Valid N (list-wise)	1028	100%

Table 4.15 shows how respondents were asked to rate on a scale of 1 – 5 (with 5 being the highest and 1 being the lowest) the measures of operational efficiency in delivery of hospital services. Adequate management of hospital resources had mean of 4.327, followed by reduction of errors in the patient management process with mean of 3.196, then reduction of waiting time for clients with mean of 4.278 then fast patient throughput and flow with mean of 2.859 and technology adoption in service delivery had a mean of 2.346. The average mean and standard error of the ratings were as follows (Average Mean = 2.1676) (Average Standard Error = 0.0810). This clearly indicates that Better decision support mechanism for patient management, Adequate management of hospital resources, Reduction of errors in the patient management process, Fast patient throughput & flow and Technology adoption in service delivery were the most rated measures of operational efficiency in hospital service delivery as they were far above the average.

Table 4.15 Rating of measures of operational efficiency in hospital service delivery

Measures of Operation Efficiency	N	Mean	
	Statistic	Statistic	Std. Error
Adequate management of hospital resources	306	4.327	.0651
Reduction of errors in the patient management process	306	4.278	.0706
Fast patient throughput and flow	306	2.859	.1207
Technology adoption in service delivery	306	2.346	.1211
Reduced labor costs	306	.843	.0978
Other (specify)	306	.520	.092
Average		2.1676	0.0810

Table 4.16 shows how the respondents indicated the corrective action taken when there is lack of operational efficiency in hospital delivery, 158 (33.47%) indicated a staffing review was performed followed by advocacy for use of technology such as EMRS and Digital Medical Equipment at (31.36%).

Table 4.16 Action taken when lack of operational efficiency in hospital service delivery

Action taken for lack of operational efficiency in hospital service delivery	Total	% of Total
Staffing level review	158	33.47%
Advocacy for use of technology such as EMRS and Digital Medical Equipment	148	31.36%
Recommendation for employee training	116	24.58%
Service Charter review	50	10.59%
Valid N (listwise)	472	100%

4.6.1 Tests for Normality

Table 4.17 shows weighting scale for measures of operational efficiency based the proportions established in Table 4.14, by the respondent's selection of measures they considered important for operational efficiency. Using this weighting scale of 1-6 (with 6 being the highest and 1 the lowest), the operation efficiency level was established by multiplying the weighting scale value with the rating chosen by the respondent, which gave an aggregate which was divided by the total weighting to give a proportion of perceived operational efficiency level of each respondent.

Table 4.17 Weighting of measures of operational efficiency in hospital service delivery

Measures of operation efficiency	**Weighting Rate**
Adequate management of hospital resources	6
Reduction of errors in the patient management process	5
Fast patient throughput and flow	4
Technology adoption in service delivery	3
Reduced labor costs	2
Other (specify)	1
Total	**21**

Table 4.18 shows weighting scale for measures of observed operational throughput based the proportions established in Table 4.8, by the respondent's selection of measures they considered important for observed operational throughput. Using this weighting scale of 1-6 (with 6 being the highest and 1 the lowest), the measures of observed operational throughput were established by multiplying the weighting scale value with the rating chosen by the respondent, which gave an aggregate which was divided by the total weighting to give a proportion of perceived rating of the specific measure of observed operational throughput.

Table 4.18 Weighting of measures of observed operational throughput using EMRS

Measures of observed operational throughput	Total
Total patients served	6
Waiting times	5
Throughput times	4
Costs saved	3
Number of employees	2
Other (specify)	1
Total	**21**

Figure 4.1 shows the observation on QQ-plot of the expected normal value and the observed value of operational efficiency is that most of the points fall on the 45-degree reference line. This shows that the data sample is form a normally distributed population.

Figure 4.1 QQ-Plot of Measures Operational Efficiency Level

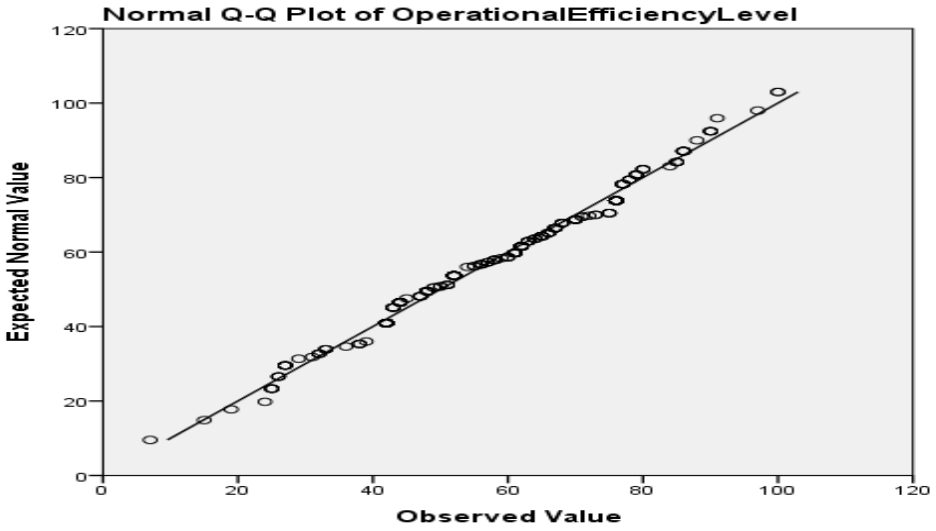


Figure 4.2 shows the observation on QQ-plot of the expected normal value and the observed value of total patients served. Most of the points fall on the reference line. This shows that the date sample is form a normally distributed population.

Figure 4.2 QQ-Plot of Total Patients Served

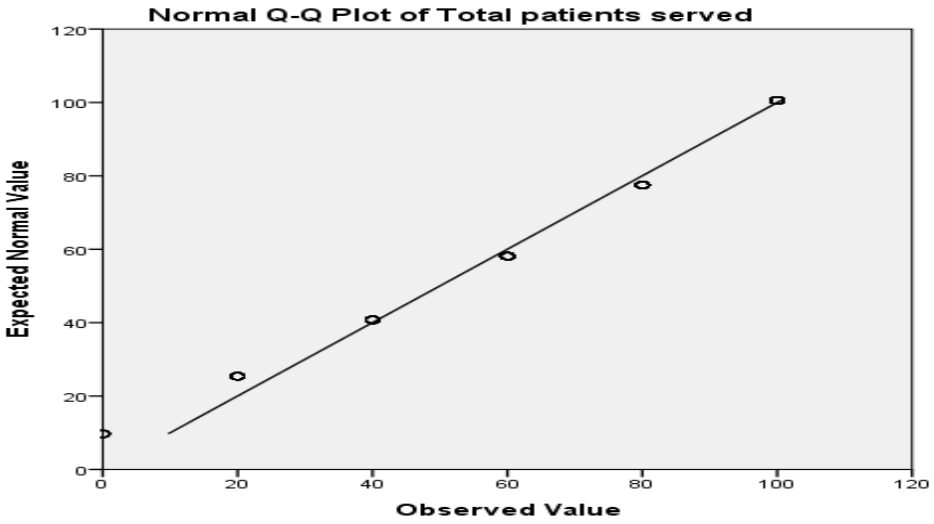


Figure 4.3 shows the observation on QQ-plot of the expected normal value and the observed value of waiting times. Most of the points fall on the reference line. This shows that the data sample is from a normally distributed population.

Figure 4.3 QQ-Plot of Waiting Times

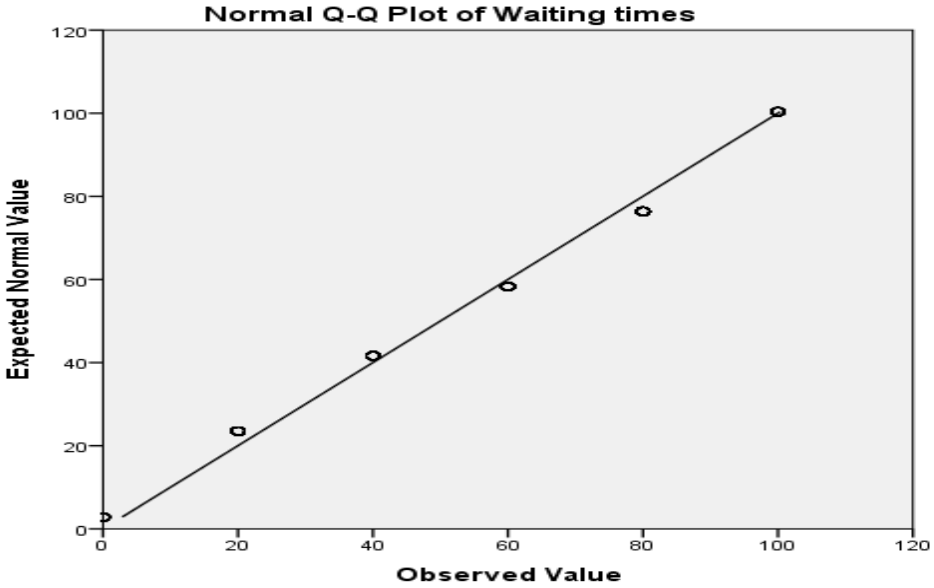


Figure 4.4 shows the observation on QQ-plot of the expected normal value and the observed value of throughput times. Most of the points fall on the reference line. This shows that the data sample is from a normally distributed population.

Figure 4.4 QQ-Plot of Throughput Times

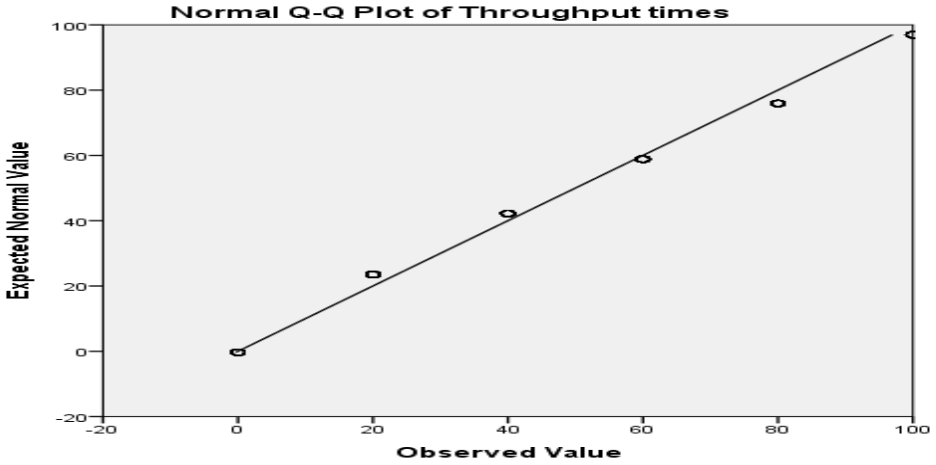


Figure 4.5 shows the observation on QQ-plot of the expected normal value and the observed value of costs saved. Most of the points fall on the reference line. This shows that the data sample is from a normally distributed population.

Figure 4.5 QQ-Plot of Costs Saved

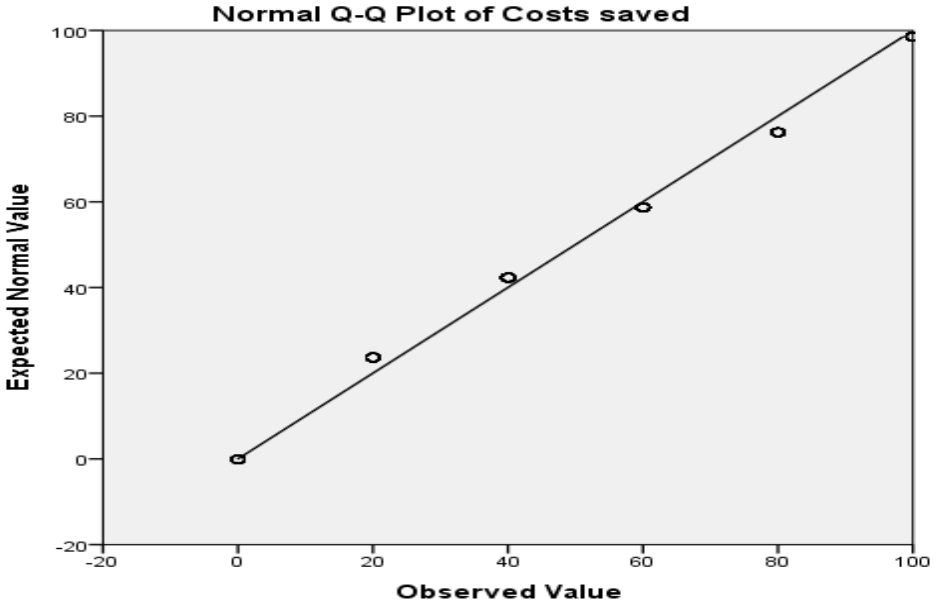


Figure 4.6 shows the observation on QQ-plot of the expected normal value and the observed value of costs saved. Most of the points fall on the reference line. This shows that the data sample is from a normally distributed population.

Figure 4.6 QQ-Plot of Number of Employees

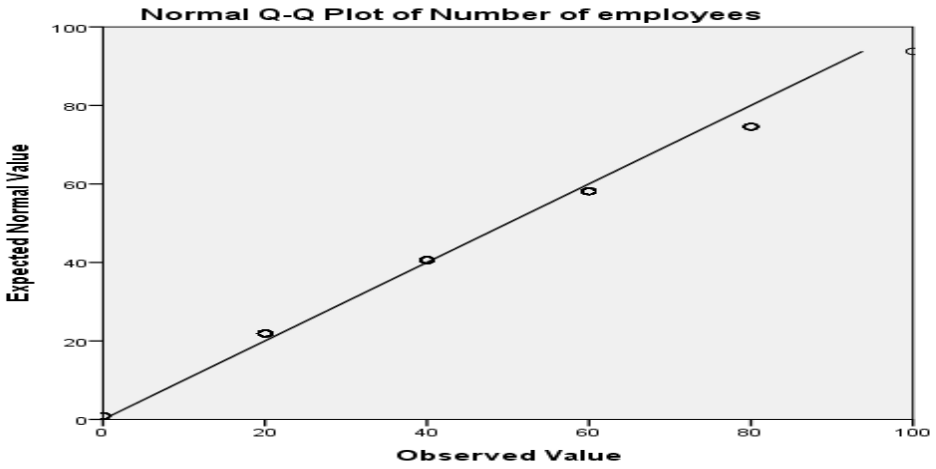


Figure 4.7 shows the observation on QQ-plot of the expected normal value and the observed value of other measures specified. No points fall on the reference line. This shows that the data sample is not from a normally distributed population.

Figure 4.7 QQ-Plot of Other measures specified

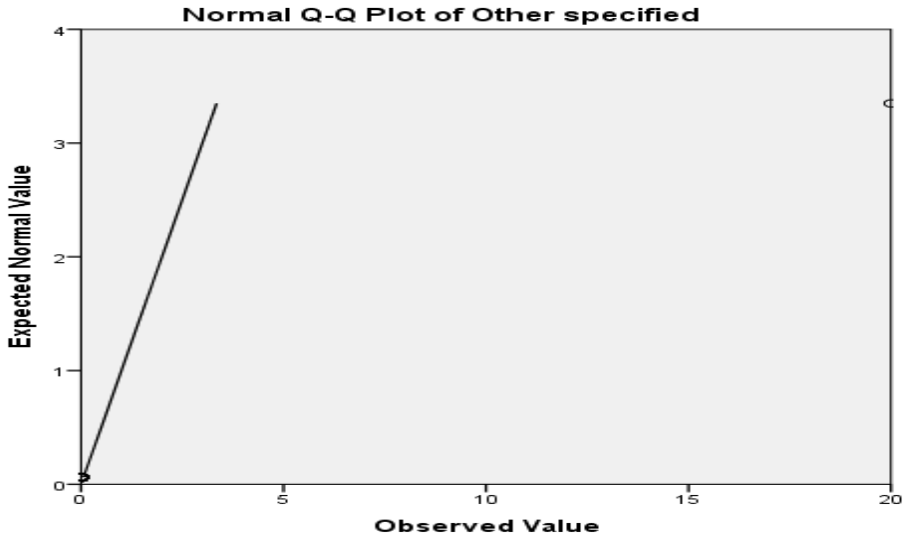


Figure 4.8 shows an observation of normally distributed operational efficiency level data that forms a bell-shaped curve. This shows that the data sample is from a normally distributed population.

Figure 4.8 Histogram of Operational Efficiency

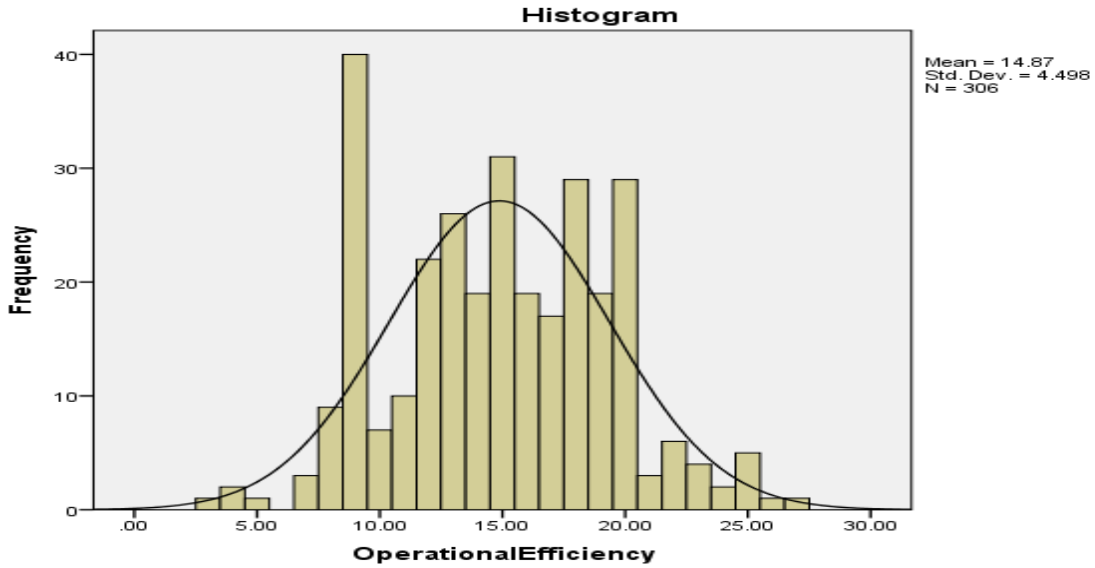


Figure 4.9 show an observation of normally distributed total patients served data that forms a bell-shaped curve. This shows that the date sample is from a normally distributed population.

Figure 4.9 Histogram of Total Patients Served

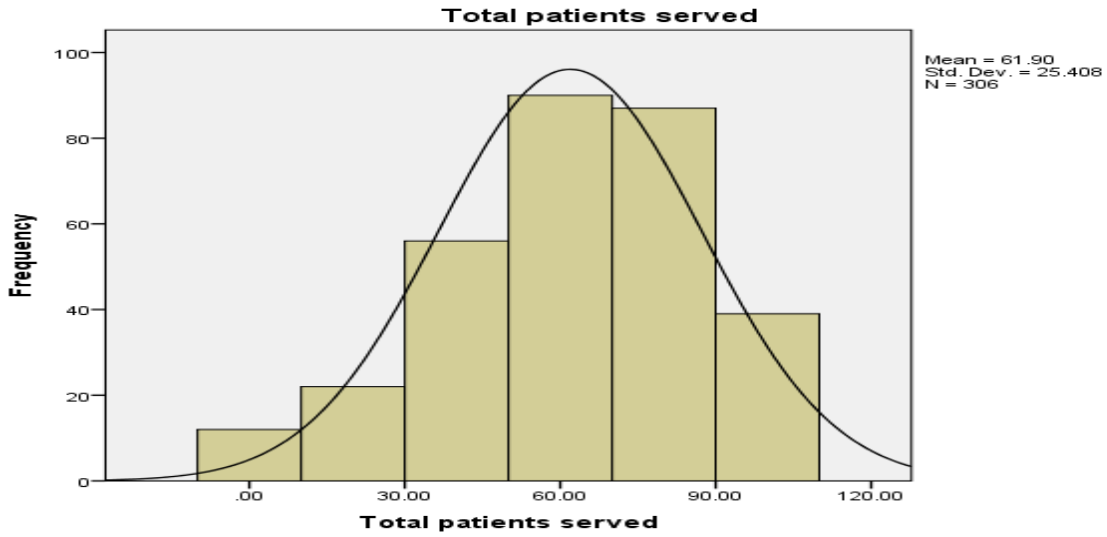


Figure 4.10 show an observation of normally distributed waiting times data that forms a bell-shaped curve. This shows that the data sample is from a normally distributed population.

Figure 4.10 Histogram of Waiting Times

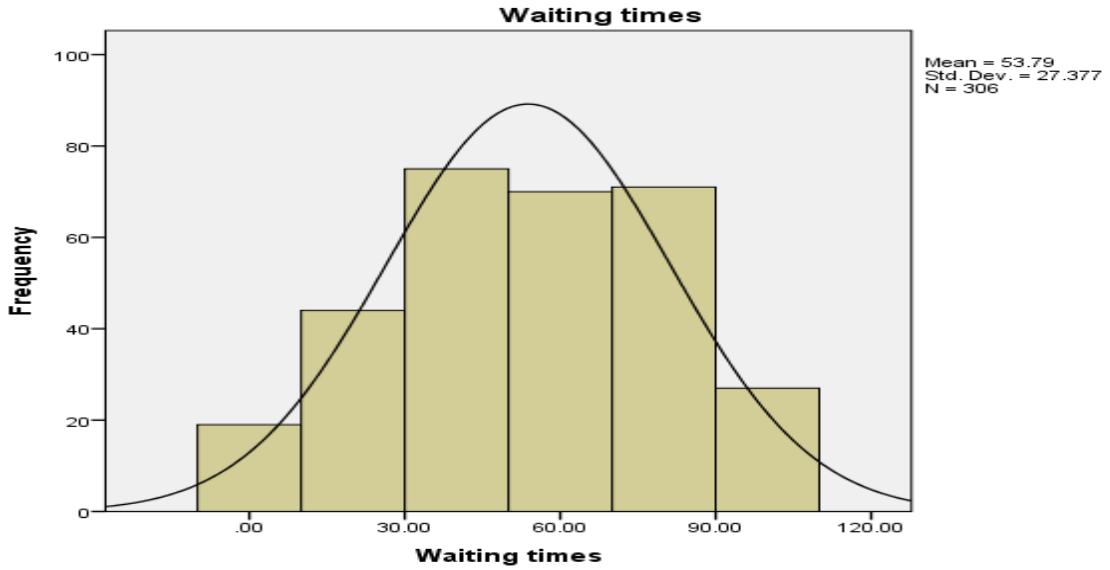


Figure 4.11 show an observation of normally distributed throughput times data that forms a bell-shaped curve. This shows that the date sample is from a normally distributed population.

Figure 4.11 Histogram of Throughput Times

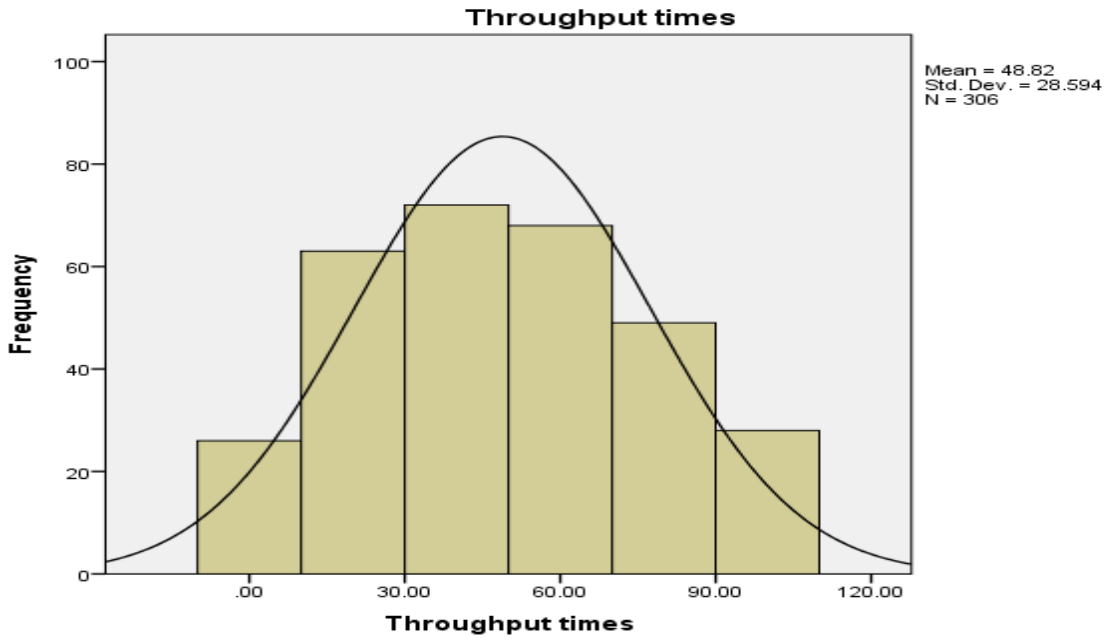


Figure 4.12 show an observation of normally distributed costs saved data that forms a bell-shaped curve. This shows that the date sample is from a normally distributed population.

Figure 4.12 Histogram of Costs Saved

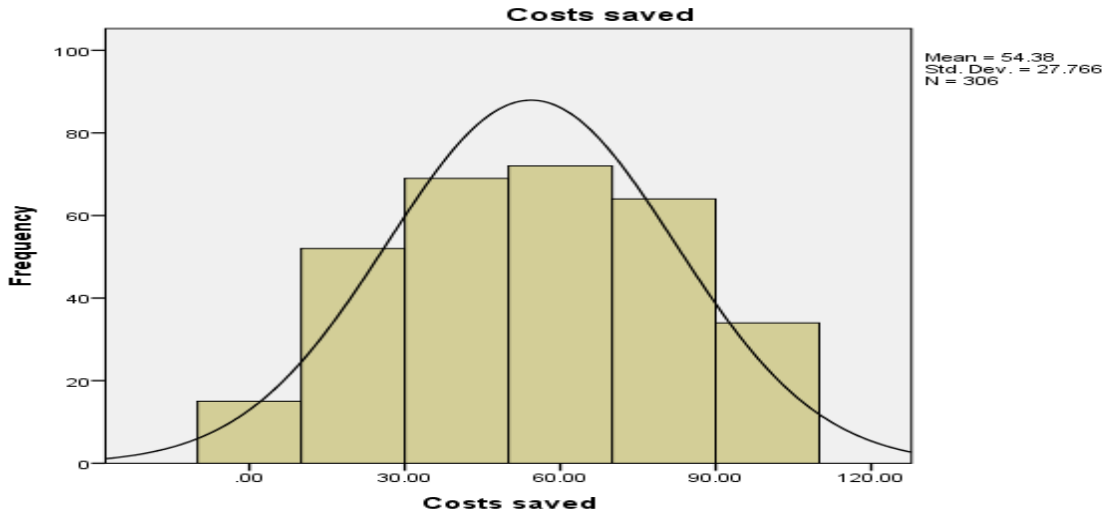


Figure 4.13 show an observation of normally distributed number of employees' data that forms a bell-shaped curve. This shows that the date sample is from a normally distributed population.

Figure 4.13 Histogram of Number of Employees

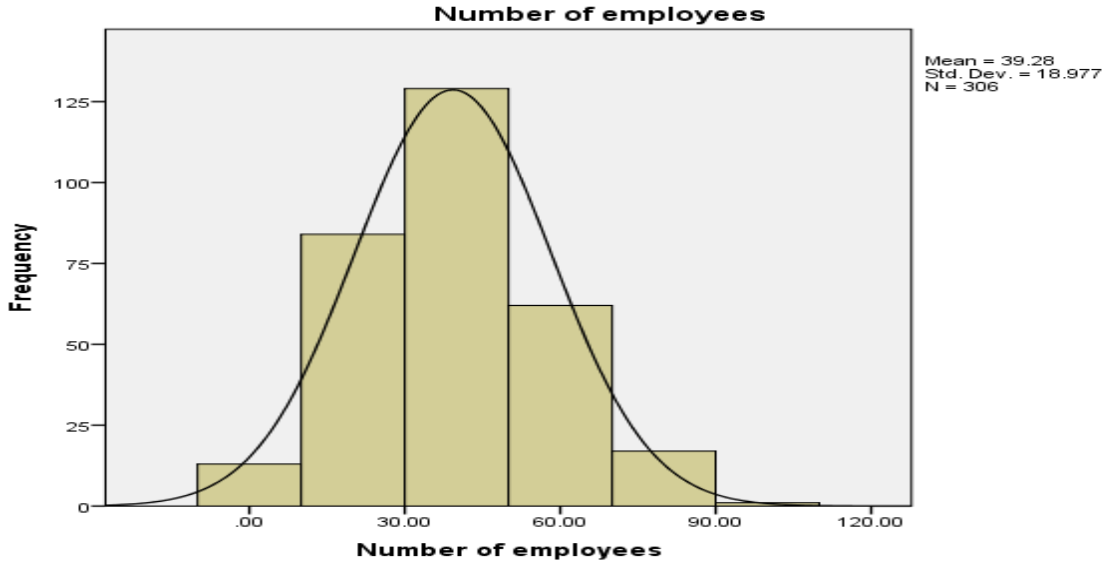


Table 4.19 shows an existing a relationship between Operational Efficiency and measures of operational throughput using EMRS which is displayed by the correlation analysis.

Table 4.19 Correlations

Correlations							
		Total patients served	Waiting times	Throughput times	Costs saved	Number of employees	Operational Efficiency
Total patients served	Pearson Correlation	1	.026	-.021	.010	.120*	.038
	Sig. (2-tailed)		.645	.711	.868	.036	.513
	N	306	306	306	306	306	306
Waiting times	Pearson Correlation	.026	1	-.010	.026	.034	.053
	Sig. (2-tailed)	.645		.859	.646	.550	.356
	N	306	306	306	306	306	306
Throughput times	Pearson Correlation	-.021	-.010	1	-.018	.026	-.077
	Sig. (2-tailed)	.711	.859		.750	.648	.178
	N	306	306	306	306	306	306
Costs saved	Pearson Correlation	.010	.026	-.018	1	.007	.078
	Sig. (2-tailed)	.868	.646	.750		.900	.176
	N	306	306	306	306	306	306
Number of employees	Pearson Correlation	.120*	.034	.026	.007	1	.039
	Sig. (2-tailed)	.036	.550	.648	.900		.502
	N	306	306	306	306	306	306
Operational Efficiency	Pearson Correlation	.038	.053	-.077	.078	.039	1
	Sig. (2-tailed)	.513	.356	.178	.176	.502	
	N	306	306	306	306	306	306
*. Correlation is significant at the 0.05 level (2-tailed).							

Table 4.20 Descriptive Statistics

	N	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total patients served	306	61.8954	1.45249	25.40819	645.576	-.478	.139	-.235	.278
Waiting times	306	53.7908	1.56506	27.37730	749.517	-.144	.139	-.793	.278
Throughput times	306	48.8235	1.63462	28.59419	817.628	.106	.139	-.874	.278
Costs saved	306	54.3791	1.58725	27.76553	770.925	-.064	.139	-.882	.278
Number of employees	306	39.2810	1.08486	18.97728	360.137	.257	.139	-.083	.278
Operational Efficiency	306	57.8758	.96215	16.83081	283.276	-.056	.139	-.379	.278
Valid N (listwise)	306								

The study sought to determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya. Through the use of descriptive statistics, correlation, ANOVA and regression analysis, the quantitative data was tested for normality then analyzed. This was important since it helps answer the third research question of, what is the relationship between EMRS and operational efficiency in delivery of hospital services in Kenya. Below is the derivation of the regression equation that will be used to answer the third research question.

$$Y = \alpha + \beta iXi + error$$

Where I = 1, 2 ……., n

Y = Operational efficiency

$X1$ = Total patients served

$X2$ = Waiting Time

$X3$ = Throughput Time

$X4$ = Costs saved

$X5$ = Number of employees

$$Y = \alpha + \sum_{i=1}^{n} \beta iXi + error$$

$$Y = \alpha + \beta 1\,(Total\ patients\ served) + \beta 2(Waiting\ times) + \beta 3(Throughput\ times) + \beta 4(Costs\ saved) + \beta 5(Number\ of\ employees)$$

Table 4.20 shows the regression analysis model showing that there exists a relationship between the predictors ((Constant), Number of employees, Costs saved, Throughput times, waiting times, Total patients served) and operational efficiency (R = 0.129) with 16.82% of the variance in the cases been explainable from the predictors (R Square = 0.017)

Table 4.21 Regression

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.129[a]	.017	.000	16.82904
a. Predictors: (Constant), Number of employees, Costs saved, Throughput times, Waiting times, Total patients served				

Table 4.22 indicates the statistical significance of the regression model that was run. Here, $p < 0.0005$, which is less than 0.05, and indicates that, overall, the regression model statistically significantly predicts the outcome variable (Operation Efficiency).

Table 4.22 ANOVA

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1434.293	5	286.859	1.013	.410[b]
	Residual	84964.988	300	283.217		
	Total	86399.281	305			
a. Dependent Variable: Operational Efficiency						
b. Predictors: (Constant), Number of employees, Costs saved, Throughput times, Waiting times, Total patients served						

Table 4.23 indicates the coefficients of the regression model that was run. These coefficients help in obtaining the operational efficiency as a factor that is applied to each measure of observed operational throughput.

Table 4.23 Coefficients

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	53.572	4.328		12.377	.000
	Total patients served	.020	.038	.030	.516	.607
	Waiting times	.030	.035	.048	.842	.401
	Throughput times	-.044	.034	-.076	-1.319	.188
	Costs saved	.045	.035	.074	1.297	.196
	Number of employees	.031	.051	.035	.602	.548
a. Dependent Variable: Operational Efficiency						

Given that:

Y = Operational efficiency

$X1$ = Total patients served

$X2$ = Waiting Time

$X3$ = Throughput Time

$X4$ = Costs saved

$X5$ = Number of employees

The regression equation will be; $\mathbf{Y = 53.572 + 0.02X_1 + 0.03X_2 - 0.044X_3 + 0.045X_4 + 0.031X_5}$

From the ANOVA, the significance of the predictor variables influencing operational efficiency in delivery of hospital services (dependence variable) was $p<0.0005$. The regression equation established was: $Y = 53.572 + 0.02X_1 + 0.03X_2 - 0.044X_3 + 0.045X_4 + 0.031X_5$; Given that Y = Operational efficiency, $\beta 1X1$= Total patients served, $\beta 2X2$= Waiting Time, $\beta 3X3$=Throughput Time, $\beta 4X4$= Costs saved, $\beta 5X5$= Number of employees. Their values were 0.02, 0.03, -0.044, 0.05 and 0.031 respectively as the un-standardized coefficients. These were the coefficients that the study would obtain when all variables were standardized in the regression. By standardizing the variables before running the regression, the study put all of the variables on the same scale, and compared the magnitude of the coefficients of the independent to determine which one had more effect on operational efficiency. The larger beta is associated with the larger t-value and lower p-value. The column of coefficient shows the predictor variables of constant, operational efficiency and observed operational throughput measures. The first variable constant of 53.572 represented the constant which predicted value of operational efficiency when all other variables affecting operational efficiency was constant at zero (0). From the above regression model, it was found that operational efficiency in hospitals would be at 53.572 when all measures of observed operational throughput were constant at Zero. Total patients served would lead to an increase in operational efficiency by factor of 0.02 with P value of 0.607, waiting time would increase operational efficiency by a factor of 0.03 with P value of 0.401, throughput time would decrease operational efficiency by a factor of 0.044 with P value of 0.188, cost saved would increase operational efficiency by a factor of 0.05 with P value of 0.196 and number of employees would increase operational efficiency by a factor of 0.031 with P value of 0.548.

This clearly indicates that there existed a positive relationship among total patients served, waiting times, costs saved, number of employees with operational efficiency. Whereas there exists a negative relationship between throughput times and operational efficiency in hospital service delivery.

4.7 Conclusion

This chapter presented the research finding, data representation and statistical data interpretation in form of tables and graphs. The findings were compared and contrasted with other studies in the literature review. The next chapter of this research presents the discussion, conclusion and the recommendation of the study.

CHAPTER FIVE: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The main purpose of this study was to understand the effect of EMRS on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals. This involved specifically; to determine the factors that influence operational efficiency in delivery of hospital services in Kenya, to analyze the observed operational throughput on delivery of hospital services in Kenya and to determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya. The findings obtained during the research formed the basis on which this chapter provides discussions, conclusions, recommendations and future areas of study in relation to the research objectives mentioned above and to what extent the findings agree with the literature review.

5.2 Discussion of the findings

5.2.1 Factors that influence operational efficiency in hospital service delivery

The purpose of this objective was to determine the factors that influence operational efficiency in hospital service delivery. From the findings we were able to identify the factors and to what extent they influenced operational efficiency through the use of descriptive statistics and mean. Therefore, these findings will help derive conclusions and provide recommendations with relation to the main study objective of effect of EMRS on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals.

a) Technology

The study sought after knowing the extent to which the availability of Information Communication Technology (ICT) infrastructure influenced the operational efficiency in hospital service delivery. It was noted that the availability of Information Communication Technology (ICT) infrastructure in hospitals had a major influence on operational efficiency of the hospital service delivery. 22.22% (242) of the respondents indicated that integration of ICT in the health system goes a long way in influencing the efficiency in hospital service delivery. In establishing to which extent availability of ICT affected operational efficiency, a rating on a scale of 1-5 (with 5 being the highest and 1 being the lowest) ICT infrastructure gave a mean of 3.350 which was above the average mean of 2.4787. This showed that it was very important.

This finding is also highlighted by Bain (2015) in which access to ICT infrastructure was an important factor that influenced operational efficiency through EMRS.

b) Employee Capacity

On whether lack of valued analytical skills among staffs influenced operational efficiency in hospital service delivery, 20.57% (224) of the respondents were in agreement. The extent to which lack of valued analytical skills by staff influenced operational efficiency in hospitals, on a scale of 1-5 (with 5 being the highest and 1 being the lowest) was a mean of 3.114 which was above the average mean of 2.4787 therefore indicated a high extent of influence. This corresponded with Argote and Ingram (2000) who stated that expert physicians, nurses, and subordinate staff are critical in producing high-quality services and effective quality improvement which will lead to hospital growth.

c) Limited time to access information for continuous improvement

The study sought after knowing the influence of limited access to information for the continuous improvement on operation efficiency in hospitals. 18.37% (200) of the respondents indicated that staffs had limited time to access information for continuous improvement. To establish the extent of influence a rating to a scale of 1-5 showed that limited time to access continuous improvement information had a mean of 2.797 which was above the average mean of 2.4787 therefore having a high extent in influence. According to Dobson, Tilson, Tilson, & Haas (2014) this was attributed by increased number of patients coupled by low staff numbers. Therefore, very low patient throughput. It was also noted that limited time to access the continuous improvement information was attributed by the lack of proper documentation which could consume lots of time to locate the information. This caused high number of errors in patient management process leading to poor operational efficiency in hospital service delivery. Centralization of information through the use of EMRS systems in the hospital can go a long way in easing the retrieval of patients' information and fast access of information with high privacy.

d) Inadequate information on medical commodities available

A large percentage of respondents 14.78% (161) indicated that inadequate information on medical commodities affected the effective operation of hospitals. While 12.95% (141) indicated that the available information was very costly to afford. This translated to lack of information on the current trend in medical industry therefore patients don't receive the most up to date care this

led to poor, inefficient operations. The extent to which they influenced operational efficiency in hospital service delivery was below the average mean hence indicating less influence.

5.2.2 Observed Operational Throughput on delivery of hospital services

The purpose of this objective was to analyze the observed operational throughput on delivery of hospital services in Kenya. From the findings we were able to identify the measures of observed operational throughput of hospital services through the use of descriptive statistics and mean. Therefore, these findings will help derive conclusions and provide recommendations with relation to the main study objective of effect of EMRS on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals.

a) Total Patients Served

From the study, 27.24% (243) of the respondents rated total patients served as a very crucial part as a measure of observed operational throughput in the integration and uptake of EMRS use in the hospital. In establishing the extent to which this measure was used in observed operational throughput, on rating on a scale from 1-5 (with 5 being the highest and 1 being the lowest) respondents gave a mean of 3.0948 which was above the average mean of 2.152 therefore indicating that total patients served is an important measure of observed operational throughput through use of EMRS. According to Nzinga et al (2013), EMRS are very efficient in data and patient information management. They increase the ability to serve as many patients as possible and hence increasing the observed operational throughput by allowing more patients to be served as it is easier and faster to attend to patients.

b) Waiting Times

The study sought to investigate waiting times as a measure of observed operational throughput through the usage of EMRS in the facilities. It was noted that 22.65% (202) of the respondents indicated that this measure through the use of EMRS would really have an impact on observed operational throughput as it would increase observed operational throughput as patients would not have to wait longer to be attended to.

To establish the extent of impact, on a scale of 1-5 (with 5 being the highest and 1 being the lowest), the respondents gave waiting times a mean of 2.6895 which was above the average mean of 2.152 which translated to how important it was as a measure of observed operational

throughput. According to Essoussi (2015), Waiting times would also act as a measure of observed operational throughput as they would go a long way in helping patients access treatment faster and hence serve more patients in the long run. This would increase observed operational throughput and hence operational efficiency.

c) Throughput Times

In this study, research was carried out to find out whether throughput times was a measure of observed operational throughput and hence increasing operational efficiency. 21.08% (188) of the respondents indicated that throughput times would go a long way in helping increase observed operational throughput. Throughput times on a scale of 1-5 (with 5 being the highest and 1 being the lowest) had a mean of 2.4412 which was above the average mean of 2.152 showing how important it was as a measure. This finding seems to coincide with the findings of Akacho (2014) in which throughput times was one of the most instrumental and crucial method of measuring hospital performance in any organization or industry therefore being essential to healthcare service delivery.

d) Costs Saved

18.95% (169) of the respondents, which rated on a scale of 1-5 (with 5 being the highest and 1 being the lowest) had a mean of 2.7190 which was above the average mean of 2.152 showing how important it was as a measure of observed operational throughput. Similarities can be drawn to the findings of the study by McNeal & Harmon (2006) where they conclude that in any system or industry, it is relevant when introducing any new system, costs savings as an important measure of impact or benefit from usage of a new procedure or technology. Other goals for such as improving quality and efficiency would be ineffective if costs savings was not complimentary to them.

e) Number of Employees

Employees in the past been the fuel of any business. The more employees a business has the more work can be done. Hence, when introducing an EMRS into the ecosystem of a hospital, the administrators should identify areas where an EMRS can bring benefits to health care, such as those that are under staffed and hence could benefit by leveraging on the efficiency that EMRS would create. 9.75% (87) of the respondents, which when rated on a scale of 1 – 5 attributed to an average mean of 1.9641which was below the average mean of 2.152. This clearly showed that not a huge number of the hospital workers considered number of employees as an important

measure of observed operational throughput. The extent to which it increased observed operational throughput in hospital service delivery was below the average mean hence indicating less importance.

5.2.3 Effect of EMRS on operational efficiency in delivery of hospital services

The purpose of this objective was to determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya. From the findings we were able to identify the effects of EMRS and what extent they improved operational efficiency in delivery of hospital services. This was achieved through the use of descriptive statistics and mean. The findings will help derive conclusions and provide recommendations with relation to the main study objective of effect of EMRS on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals.

a) Better decision support mechanism for patient management

From the study, the finding on this effect was that 11.83% (225) of the respondents, indicated that EMRS improved decision support mechanism for patient management. The extent to which the respondents thought it affected operational efficiency was at a mean of 3.343 which was above the average mean of 2.6795, when rated to a scale of 1-5 (with 5 being the highest and 1 being the lowest). According to Garg et al. (2005), EMRS is very crucial in providing a clinical decision support to the health workers as it provides data-driven analysis that allows them to provide informed decisions.

b) Faster access of patient information

According to the study findings, 11.36% (216) of the respondents indicated that the use of EMRS made it faster to access patient information. The extent to which the respondents thought it affected operational efficiency was at a mean of 3.196 which was above the average mean of 2.6795, when rated to a scale of 1-5 (with 5 being the highest and 1 being the lowest). This indicated a major impact on operational efficiency. They also indicate that EMRS provided a higher level of privacy as the information is restricted to authorized personnel. This finding establishes a similarity with Bologva et al (2016) in which faster access of patient information is established as compared to the use of hard-copy files.

c) Reduction of waiting time for clients

From the study, 11.30% (215) of the respondents stated that it was easier and faster to attend to patients. On a scale of 1-5, (with 5 being the highest and 1 being the lowest), this effect had a mean of 3.036 which was above the average mean of 2.6795. This finding would confirm the study by Sperandio, Gomes, Borges, Brito, & Almada-Lobo (2014), which concluded that the reduction of client waiting time would mean increased throughput and hence operational efficiency would be improved.

d) Improvement of commodity management

On this effect, the study found that 11.15% (212) of the respondents indicated that EMRS improved the management of commodities. The extent to which this effect affected operational efficiency was rated at a mean of 2.990 which was above the average mean of 2.6795 on a scale of 1-5 (with 5 being the highest and 1 being the lowest) thus indicating that EMRS had impact on operational efficiency. Studies such as Lee & Palaniappan (2014) establish that incidences of commodity pilferage exists due to ability of falsifying reports to hide the theft of commodities. Introduction of the EMRS not only helps to account for the commodities and also being able to control the flow of inventory in different locations. This makes it easier for zero error commodity management.

e) Faster lab results viewing for clinicians

The study shows that 10.36% (197) of the respondents indicated that the EMRS enabled fast viewing of the lab results by the clinicians. On a scale of 1-5 (with 5 being the highest and 1 being the lowest) this effect was rated at a mean of 2.742 which was above the average mean of 2.6795 thus indicating that it was an important effect on operational efficiency.

According to Goldzweig et al. (2009), using the EMRS, the lab staff are able to upload the results after performing the tests required and the health care worker can pull the results from the system without necessarily waiting of the hand-copy results. This enhances fast viewing of the results. This can lead to the reduction of turn-around time for patient treatment thus leading to improved operational efficiency.

f) Reduction of record keeping stationery and personnel

A number of the respondents, 10.15% (193), indicated that EMRS can really cause a reduction of the record keeping stationery and personnel, with a mean of 2.618 which was below the average mean of 2.6795 when ranked on a scale of 1-5 (with 5 being the highest and 1 being the lowest). The rating on extent of impact on operational efficiency was not as important as the other effects. EMRS are efficient in providing information as compared to manual registers and other hard-copy materials. Similarities can be seen in the study by Bologva et al. (2016) where conclusions are made on the substantial benefits of completeness and accuracy of data in EMRS.

g) Ease of information sharing among health workers

The study shows that 9.52% (181) of the respondents indicated that use of EMRS can ease in sharing of information among health workers. On a scale of 1-5 with 5 being the highest and 1 being the lowest) a mean rating of 2.533 which was below the average mean of 2.6795 shows that EMRS ease information sharing but not at an important level as the other effects. According to (Bhartiya, Mehrotra, & Girdhar, 2016), EMRS enhances the sharing of information from one office to another. The interlinking of the computers with the same EMRS enhances the viewing of the information simultaneously hence fast operational throughput. Shared information increases operation throughput and hence enhancing operational efficiency of hospital service delivery.

5.3 Conclusions

The study had the main objective of understanding the effect of EMRS on delivery of hospital services from an operational efficiency perspective in Kenyan hospitals. From the findings as discussed above with regards to first objective of identifying the factors that influence operational efficiency in delivery of hospital services in Kenya, the following factors had the highest influence on operational efficiency. They include availability of ICT infrastructure at 22.22% of respondents, lack of valued analytical skills among the hospital staff at 20.57% of respondents and staff have limited time to access information for continuous improvement at 18.37% of respondents. They in total represent a sum total of 61.16% which shows a majority of respondents rated these factors as most important in influencing operational efficiency.

On the second objective, to analyze observed operational throughput in delivery of hospital services in Kenya, the following measures had the most impact on observed operational

throughput, they include; total patients served use at 27.24% of respondents, waiting times at 22.65% of respondents, throughput times 21.08% of respondents and costs saved at 18.95% of respondents. They in total represent a sum total of 89.92% which shows a majority of respondents rated these measures as most relevant for observed operational throughput.

Finally, on the third objective which was to determine the effect of EMRS on operational efficiency in delivery of hospital services in Kenya. Based on the findings summarized above, it can be concluded that use of EMRS leads to improved hospital service delivery and increased operation efficiency. A number of effects were noted which led to operational efficiency, these include; better decision support mechanism for patient management at 11.83% of respondents, faster access of patient information at 11.36% of respondents, reduction of waiting time for clients at 11.30% of respondents, improvement of commodity management at 11.15% of respondents, faster lab results viewing for clinicians at 10.36% of respondents. They in total represent a sum total of 56% which shows a majority of respondents rated these effects as most relevant as an indicator of operational efficiency in hospital service delivery.

5.4 Recommendations

The following are the recommendations based on the findings of this study:

1. The hospital administrations should work towards building the capacity of the hospitals to improve on the use of technology through ICT infrastructure, adequate training of staff, providing incentives for continuous improvement and avail enough information on medical commodities and services.
2. The hospital administrations should work on enhancing and leading the use of the EMRS making sure that the health care workers are provided with management support, they should be trained on EMRS, they should have EMRS champions at hospitals to reinforce EMRS training and communicating on EMRS goals by spearheading paper-less initiatives and explaining benefits.
3. Hospital administrations and employees should invest time to understand the benefits of EMRS and how they can improve hospital processes and affect their bottom-line. The employees should embrace change of technology through EMRS and leverage the benefits of decision-support, integrity, accountability and efficiency.

5.5 Suggestions for further study

Further study should be carried out to;

1. To understand external factors such as environmental and political factors that influence operational efficiency in hospitals.
2. Understand the factors limiting the effect of EMRS on operational efficiency in hospitals.
3. Understand effect of EMRS from a consumer perspective and how it influences their cost of care and quality of treatment.

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APPENDICES

Appendix A: Sample Introduction Letter

Strathmore Business School

OUR REF:

(Date)

Dear Sir/Madam,
RE: INTRODUCTION LETTER

Thank you for participation in this study on the effect of electronic medical record systems on hospital service delivery in hospitals. Your participation would be greatly appreciated by you taking a few minutes of your time to answer the questionnaire. The purpose of this study is to understand the effects of electronic medical record systems on hospital service delivery from an operational efficiency perspective. The information you provide will assist us to draw conclusions on how these electronic medical record systems are affecting hospital's operational efficiency performance.

There is no personal risk involved as a result of your participation in this survey. The data collected from this survey will be used for education and research purposes only. The information will be kept strictly CONFIDENTIAL. Your participation is to be completely VOLUNTARY and ANONYOMOUS. Non-participation will not result in penalty or loss of any kind.

If you have any further questions about this study, please contact the principal researcher, Kevin Marete, Master's Student at the Strathmore Business School, Strathmore University (email: kevomarete@gmail.com). You may also contact the supervisor Prof. Vincent Omwenga (email: vomwenga@strathmore.edu)
Thank you very much for your time and cooperation.

Sincerely,
Kevin Marete

Research Student

Appendix B: Sample Consent Letter

Dear Respondent,

We invite you to participate in a research study entitled. EFFECT OF ELECTRONIC MEDICAL RECORD SYSTEMS ON THE DELIVERY OF HOSPITAL SERVICES IN KENYA: AN OPERATIONAL EFFICIENCY PERSPECTIVE.

I as Kevin Marete, am currently enrolled in the Masters in Business Administration program at Strathmore Business School in Nairobi, Kenya. As part of my coursework, I am required to write a dissertation which includes a research study. Your participation in this research study is completely VOLUNTARY. You may decline altogether, or leave blank any questions you don't wish to answer. There are NO KNOWN RISKS to participation beyond those encountered in everyday life. Your responses will remain CONFIDENTIAL and ANONYMOUS. No one other than the researcher will know your individual answers to this questionnaire.

If you agree to participate in this project, please answer the questions on the questionnaire as best you can. It should take approximately 15 minutes to complete. Please return the questionnaire to the researcher.

YOUR SIGNATURE ON THIS CONSENT FORM INDICATES THAT YOU HAVE DECIDED TO TAKE PART IN THIS RESEARCH STUDY AND THAT YOU HAVE READ AND UNDERSTAND THE INFORMATION GIVEN ABOVE.

Thank you for your assistance in this important endeavor.

Sincerely yours,

Kevin Marete

Appendix C: Sample Questionnaire

Effect of Electronic Medical Record Systems on the Delivery of Hospital Services in Kenya.

Dear Respondent

I am a Masters student at the Strathmore Business School, Strathmore University conducting a research entitled EFFECT OF ELECTRONIC MEDICAL RECORD SYSTEMS ON THE DELIVERY OF HOSPITAL SERVICES IN KENYA: AN OPERATIONAL EFFICIENCY PERSPECTIVE. You have been selected to form part of this study. I kindly request you to complete the questionnaire below. The information requested is needed for academic purposes only and will be treated in strict confidence.

Kind regards

SECTION A: ORGANIZATION PROFILE INFORMATION

1. What is the classification of your hospital?
   - ☐ Level 6
   - ☐ Level 5
   - ☐ Level 4
   - ☐ Other (specify) ……
2. What is your role in the hospital?
   - ☐ Doctor
   - ☐ Nurse
   - ☐ Clinical Officer
   - ☐ Lab Technician
   - ☐ Data Analyst
   - ☐ Pharmacist/PharmTech
   - ☐ Other (specify) ……
3. How many year(s) have you been working in the hospital?
   - ☐ Less than 1
   - ☐ 1-5
   - ☐ 5-10
   - ☐ Over 10

SECTION B: FACTORS INFLUENCING OPERATIONAL EFFICIENCY IN HOSPITAL SERVICE DELIVERY

4. Please select the factors that influence operational efficiency in hospital service delivery? *Select all that apply*
   - ☐ Availability of Information Communication Technology (ICT) infrastructure
   - ☐ Non-existent or unreliable internet connectivity
   - ☐ High subscription cost of medical information materials
   - ☐ Inadequate information on medical commodities available
   - ☐ Staff have limited time to access information for continuous improvement
   - ☐ Lack of valued analytical skills among the hospital staff

5. Based on factor(s) selected above, on a scale of 1 – 5 (with 5 being the highest and 1 being the lowest), rate the factors influencing operational efficiency in hospital service delivery. *Select one box only in each row*

	Influencing Factors	1	2	3	4	5
1.	Availability of Information Communication Technology (ICT) infrastructure					
2.	Non-existent or unreliable internet connectivity					
3.	High subscription cost of medical information materials					
4.	Inadequate information on medical commodities available					
5.	Staff have limited time to access information for continuous improvement					
6.	Lack of valued analytical skills among the hospital staff					

6. For your chosen method(s) in above, what is the success rate on a scale of 1 -5 (with 5 being the most successful and 1 being the least successful)?

   State the rate for method(s) used only

	Method of Identifying Factors	1	2	3	4	5
1.	Industry benchmarks					
2.	Service Charters					
3.	Performance reviews					
4.	Customer feedback					
5.	No method used					
6.	…… (*specified method*)					

7. What action is taken when there is lack of operational efficiency in hospital service delivery?

   Select one option only

   ☐ Staffing level review

   ☐ Service Charter review

   ☐ Recommendation for employee training

   ☐ Advocacy for use of technology such as EMRS and Digital Medical Equipment

SECTION C: OBSERVED OPERATIONAL THROUGHPUT OF HOSPITAL SERVICES DELIVERY

8. What approach(es) do you use to measure observed operational throughput in hospital service delivery? *Select all that apply*

   ☐ Total patients served

   ☐ Waiting times

   ☐ Throughput times

   ☐ Costs saved

   ☐ Number of employees

   ☐ Other (specify) ……

9. Could you indicate on how the method(s) identified above affected the measuring of observed operational throughput (with 5 being the most and 1 being the least)?
   State the rate for method(s) used only

	Approaches Used	1	2	3	4	5
1.	Total patients served					
2.	Waiting times					
3.	Throughput times					
4.	Costs saved					
5.	Number of employees					
6.	…… (*specified operation*)					

10. In what way(s) does your hospital use EMRS? *Select all that apply*
    - ☐ Patient Registration
    - ☐ Triage
    - ☐ Lab
    - ☐ Pharmacy
    - ☐ Consultation
    - ☐ Billing/Accounts
    - ☐ Other (specify) ……

11. Could you indicate on how the operation(s) identified above have affected the hospital operations (with 5 being the most affected and 1 being the least affected)?
    State the rate for operations(s) used only

	EMRS Operations	1	2	3	4	5
1.	Patient Registration					
2.	Triage					
3.	Lab					
4.	Pharmacy					
5.	Consultation					
6.	Billing/Accounts					
7.	…… (*specified operation*)					

SECTION D: EFFECTS OF EMRS ON OPERATIONAL EFFICIENCY IN DELIVERY OF HOSPITAL SERVICES

12. What effect(s) do you think are an outcome of using EMRS on operational efficiency in delivery of hospital services? *Select all that apply*
    - ☐ Reduction of waiting time for clients
    - ☐ Faster access of patient information
    - ☐ Improvement of commodity management
    - ☐ Ease of information sharing among health workers
    - ☐ Reduction of record keeping stationery and personnel
    - ☐ Reduction of transcoding errors on patient records
    - ☐ Improvement of appointment scheduling
    - ☐ Improvement of prescription management
    - ☐ Faster lab results viewing for clinicians
    - ☐ Better decision support mechanism for patient management
13. For your chosen effect(s) in above, what is the success rate on a scale of 1 -5 (with 5 being the most successful and 1 being the least successful)? *Rate effect(s) chosen only*

	Effects Observed	1	2	3	4	5
1.	Reduction of waiting time for clients					
2.	Faster access of patient information					
3.	Improvement of commodity management					
4.	Ease of information sharing among health workers					
5.	Reduction of record keeping stationery and personnel					
6.	Reduction of transcoding errors on patient records					
7.	Improvement of appointment scheduling					
8.	Improvement of prescription management					
9.	Faster lab results viewing for clinicians					
10.	Better decision support mechanism for patient management					

14. How do you determine whether the hospital service delivery has achieved operational efficiency? *Select all that apply*

- ☐ Fast patient throughput and flow
- ☐ Reduced labor costs
- ☐ Reduction of errors in the patient management process
- ☐ Adequate management of hospital resources
- ☐ Technology adoption in service delivery
- ☐ Other (specify) ……

15. For your chosen measures(s) in above, what is the success rate on a scale of 1 -5 (with 5 being the most successful and 1 being the least successful)? *Rate measures(s) chosen only*

Measures Used		1	2	3	4	5
1.	Fast patient throughput and flow					
2.	Reduced labor costs					
3.	Reduction of errors in the patient management process					
4.	Adequate management of hospital resources					
5.	Technology adoption in service delivery					
6.	…… (specified measure)					

16. What method(s) do you use to identify the factors that influence operational efficiency in hospital service delivery? *Select all that apply*

- ☐ Industry benchmarks
- ☐ Service Charters
- ☐ Performance reviews
- ☐ Customer feedback
- ☐ No method used
- ☐ Other (specify) ……