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Health Information Technology Utilization in Patient Safety Promotion by Health Care Workers, Mama Lucy Kibaki Hospital, Nairobi City County, Kenya

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Authors:
Esther Kathini[1], Dr. Andre Yitambe[2], Dr. George Ochieng Otieno[3]

[1] Ministry of Health Headquarters Nairobi P.O Box 2227-00100 Nairobi Kenya

[2] Department of Health Management and Informatics, School of Public Health Kenyatta University

Correspondence: Esther Kathini, Ministry of Health, Nairobi

Email:andykathini@gmail.com

ABSTRACT

Patient safety remains despite interventions through regulatory measures and policy changes. Seven (7%) percent of all hospitalizations in Kenya report some form of negligence, privacy or confidentiality concerns. This study sought to establish the role of Health Information Technology (HIT) in promoting Patient safety at Mama Lucy Kibaki Hospital, Nairobi County Kenya. Specifically, it determined the role of HIT in promoting Patient Safety, and described organizational, technological and individual factors influencing HIT's role in promoting patient safety. The study was conducted in the framework of a descriptive cross-sectional design. The sample size used was 147 consisting of both medical and paramedical staff respondents derived using Fisher's sample size calculation formula. Sampling was done both purposively to select only staff respondents, and then proportionate random sampling was used to obtain the number required by the sample size. Questionnaires and Key informant guides were used for data collection. Pretesting for validity and reliability of tools was done at Mbagathi Sub County Hospital. Cronbach's alpha was used to calculate the reliability of the data collection tools, with the test conducted on 32 items for the questionnaire and 8 items for the Key informant guide. The reliability results produced alphas of 0.80 and 0.84 respectively, compared to an alpha of 0.7 which was the lower bound for acceptable reliability. Data entry, cleaning, aggregation and analysis were done using STATA 12 software. The study found out that 1) Most respondents 66 (56%) felt that HIT played a key role in promoting patient safety. EMR, CPOE and DSS were found to be important HIT useful for ensuring patient safety at the hospital. Following binary logistic regression, the study found sufficient evidence to suggest associations between effective patient safety promotion through HIT and the following variables similarity of access passwords (OR=1.2 [95% CI 1.075-1.600]); periodic trainings on HIT (OR =2 [95% CI 1.456-2.027]); involvement of HIT users (OR=1.5 [95% CI 1.180-1.654]); auto logout of users (OR=0.2 [95% CI 0.052-0.801]), knowledge and use of EMR (OR=0.4 [95% CI 0.195-0.877]); notification on patients' identification number (OR=3.6 [CI 0.072-0.572]) similarity and presence of backups to the systems (OR=0.2 [95% CI 1.306-9.916]). The study also observed that doctors were more likely to perceive the utility of HIT in promoting patient safety compared to pharmacists (OR= 0.56 [95% CI 0.131-2.135]). Based on the findings, conclusions were drawn, and there from the study recommends involvement of users during system implementation for greater ownership and effectiveness of usage of the technologies; training on the various technologies to improve utilization; as well as implementation of backup of the systems as this was observed as a perceived patient information security measure.

Key words: Health Information Technology, Patient Safety, Clinical decision support, computerized physician order entry, Decision Support Systems, Electronic health records, Electronic Medical Records.

1.0 INTRODUCTION

1.1 Background to the study

Introduction of Information Technology (IT) in the health sector all across the globe is not new to the ears of many. As long ago as the 1960s, health IT in the form of Electronic Health Records (EHRs) has been lauded as possessing the potential to revolutionize the functioning of the health systems. This potential of health IT is in ways

such as improvement of quality, safety and efficiency of healthcare delivery as a whole (Nieva & Sorra, 2003). When optimized, EHRs are capable of preventing avoidable medical errors. In actual sense, much has been spoken of EHRs as being able to transform the day-to-day operations of hospitals among other healthcare-oriented facilities so as to realize optimal results.

Most sectors of governments have been able to deploy IT systems in their work. The financial sectors have been exemplary in this. Presently, it is possible to access up-to-the-minute financial service account details and transactions over the internet. Blumenthal (2009) wrote that the introduction of "an hour of coding classes for primary school pupils" is making them become more machine like. He suggests that in the near future, this would escalate into a world where knowledge or possession of IT skills is mandatory. Health Information technology risk refers to any kind of perceived dangers that are resolvable through information technology in the health sector.

Countries in the developed world are working relatively well in implementing the latest IT developments in the health sector. For instance, over a decade ago, the United States (US) implemented the use of the National Grid System that networked health service delivery points all across the nation. The effect was that there was an incredible rise in the speed of delivery of care and patient satisfaction, based on subsequent surveys that aimed at determining efficiency of those services (Ballard, 2003). Clinical decision Support (CDS) and Computerized Physician Order Entry (CPOE) have also been employed in various capacities. In the developing world, incorporation of IT systems in the health sector has been a huge struggle, which sometimes is attributed to corruption, selfish or conflicting interests among the policy makers and drivers, among other factors. Privacy, Confidentiality and Security are the hugest concerns posed by patients and clinicians alike. The constant need for backup of whatever is stored in information systems is also due to data loss risk. Big Data analytics, Business intelligence and Cloud Computing are also technological resources that could be explored in health IT in relation to patient safety (Dommering, 2012).

A study conducted in US hospitals showed that processing drugs via HIT decreased the likelihood of drug error by 48% or approximate 17.4 million medication errors were averted in one year (Sittig, 1994).

Mama Lucy Kibaki Hospital (MLKH) is a level four Hospital in Nairobi County; its location pre-exposes it to patient safety concerns due to great demands. MLKH is reported as having the most cases (3/100) in 2015 due to negligence in Nairobi County (Nyamasege, 2015). This points the need to do the study in MLKH to understand how HIT would work in the context of patient safety.

1.2 Problem Statement

Over the years, Kenya's health sector has improved the quality of care whilst minimizing patient safety concerns in its hospitals. However, key areas relating to patient safety continue to experience dissatisfaction from patients (WHO, 2014). Concerns have risen in the form of Information Privacy, Confidentiality and Security, Diagnostic and Prescription Errors, Delay in Care delivery, and Medication errors or Negligence – which were reported at a high of 2 in every 100 patients experiencing negligence errors– accounting for over half of the patient safety concerns (WHO, 2014). The patient safety concerns are more pronounced in the public health facilities. Owing to the long waiting times and lack of assurance of their safety, patients, more and more resort to home-based care or private facilities. Majority of Kenyans often cannot afford the costs of care in private health facilities, which implies they experience delay in care provision or fail to access the care altogether, further compounding their plight (Nyamasege, 2015). The consequences of these safety concerns range from unnecessarily longer periods of illness, to more complicated situations such as paralysis from advanced sicknesses, or even occasionally catastrophic, causing death (Nyamasege, 2015). The frustration also arises when whilst it is well documented the potential of IT in narrowing health gaps and improving patient safety, the health sector in Kenya has been one of the slowest in tapping onto the promise of health IT and maximizing its potential. As a result, patient safety concerns in Kenya, most of which have already been mentioned, continue to grow (Barnet *et al.,* 2016).

1.3 Study Justification

Nairobi City County was selected purposively for the study. The rationale for this study was based on several existing conditions: First, Healthcare has no doubt made giant strides in patient safety in recent years. Hospital-acquired condition rates dropped by 17 percent from 2010 to 2014, leading to 87,000 fewer patient deaths in hospitals. However, there are hundreds of millions who still die all over the world due to patient safety issues hence the need for continual improvement in the journey toward zero patient harm. Secondly, Health Information Technology, more particularly Electronic Medical Records (EMR) and Computerized Physician Order Entry (CPOE) have provided an avenue for improvement of the patient safety picture(Barnet *et al.,* 2016).In health care, where coordination of information, decisions, and actions

involving several professionals and departments must occur flawlessly in real time, thus health IT systems are seen as having the ability to slash the odds of occurrence of misinterpretation and negligence cases by half. Mama Lucy Kibaki Hisoital (MLKH) was reported as having the most (3/100) cases in 2015 due to negligence in Nairobi (MOH, 2016). MLKH is also the only public hospital in Nairobi with full computerized patient system. Mama Lucy Kibaki Hospital's location on the Eastern side of Nairobi City County, made it a candidate for a number of concerns from patients regarding their safety as it serves as the first point of contact for patients for most residents in that region. MLKH is the only level 4 government hospital using Health Information Technology in all points of service. The focus of this study was to investigate the use Health Information Technology in patient safety promotion (Barnet, Green & Punke, 2016).

1.4 Research Questions

1) What is the utilization of HIT in promoting Patient Safety at MLKH?
2) Which organizational factors influence the utilization of HIT in promotion of patient safety at MLKH
3) Which technological factors influence utilization of HIT in promotion of patient safety at MLKH
4) Which individual system components influence utilization of HIT in promotion of patient safety at MLKH

1.5 Objectives

1.5.1Broad Objective

To assess the utilization of HIT in promoting patient safety by health care workers at Mama Lucy Kibaki Hospital, Nairobi City County, Kenya

1.5.2 Specific Objectives

i. To identify technological factors influencing utilization of HIT in promotion of patient safety at MLKH
ii. To determine HIT organizational factors influencing utilization of HIT in promotion of patient safety at MLKH
iii. To describe individual system components influencing utilization of HIT in promotion of patient safety at MLKH

1.6 Significance of the Study

The study results are beneficial to the researcher as they add to the knowledge gained in class rooms. The study is also helpful to upcoming researchers in the Health IT field. The interventions recommended by this study increase awareness on risk management. Finally, information from the study would enable Ministry of Health (MOH) to be decisive when acting on the gaps identified in Health IT risks management.

1.7 Study Limitations and Delimitations

1.7.1 Limitations

To obtain sensitive information, persuasion and written consents were used where necessary for confidentiality purposes. The study was also limited by the inadequate local literature. Thorough exploration of the available local literature was done to counter this challenge.

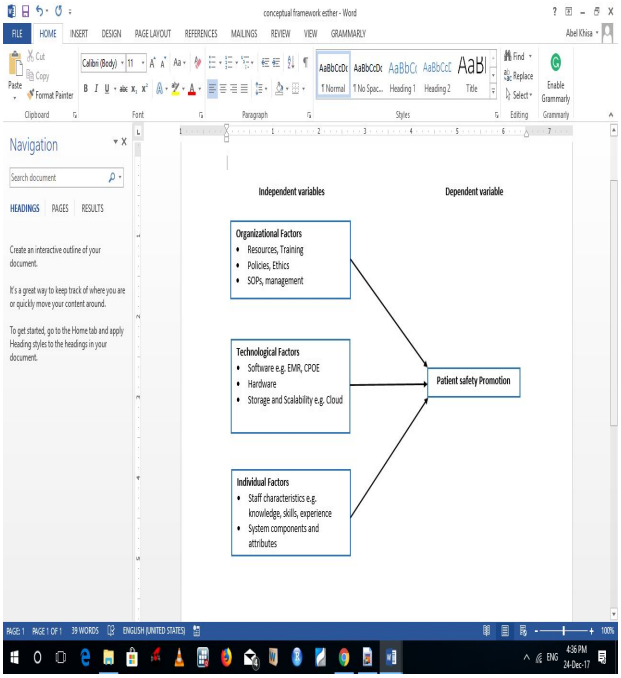
1.7.2 Delimitations

The major delimitation was the use of medical staff only, excluding the patients. To overcome this, the participants were asked to provide responses and suggestions that would not only be beneficial to them but also to their clients.

1.8 Conceptual Framework

The Independent Variables were Role of Health IT – consisting of elements such as Decision support, prescription assistance, appointment monitoring, speed of execution; Individual factors – consisting of variables such as Age, Experience, Attitudes or operational skills; Organizational factors – consisting of elements such as Policies, resources, Standards of Operating Procedures, Training, Ethics, and Management Types; Technological factors which included the software characteristics that define the various Health IT, the hardware components as well as the Cloud computing capabilities. The dependent Variable was Patient Safety Promotion. Patient safety was measured by assessing various metrics for patient safety such as timeliness of services and accuracy of patient information.

Conceptual Framework



Source: Adopted and Modified from Battles *et al*. (2006)

Figure1.1: Conceptual Framework

2.0 LITERATURE REVIEW

2.1 Utilization of Health Information Technology

There are a number of technologies that are used in healthcare setups. The advances progress each day and get even more and more mind-blowing. Such technologies can be used in diagnosis of illnesses to improve the accuracy of diagnosis, as well as for measuring precision during drug administration or prescription. With assistive technologies, the quality of healthcare provided also improves. Computerized Physician Order Entry (CPOE), Decision Support systems (DSS) and Electronic Medical Records (EMRs) are the most common forms of health IT and contribute to a safer patient population. EMRs in particular improve adherence in clinic attendance as well as speed of execution of tasks such as registration of patients. With Health IT, protection of patient information is taken to another level as it is possible to use applications such as Bit Locker to secure extra-sensitive information (Barnet, Green & Punke, 2016).

Identifying and mitigating health IT safety risks is a relatively new undertaking for most health care organizations, especially given that the purpose of introduction of IT is usually to minimize non-automated risks. The solution of elimination of man-made errors could be ensured by the health information technology such as decision inconsistency which is common to man. This awareness has led to the introduction of health IT safety improvement initiatives which could be expected to face many of the challenges that accompany introduction of any change to clinical practice (Podean & Benta, 2012).

In ambulatory settings, one individual may be responsible for several of these tasks, thus making it easy to identify and mitigate any challenges that may arise (McKinley, 2011). Hospitals and suggestions given the multidisciplinary nature of the work setting (Poon *et al*., 2010). However, these settings may counter this barrier through collaboration between the medics and paramedics, and health IT developers to reduce health IT–related safety risks (Stevens & Milne, 2004).

In such setups, the IT developers are usually the servers in as much as they are members of the organization, and everyone else a client. A good 'client-server' relationship may help identify, communicate and mitigate any arising challenges, although it is unclear how developers and their customers should work together to identify and mitigate such risks. These, amongst other clarity issues suggest a need to expand the knowledge base about how hospitals and ambulatory practices can approach the identification and mitigation of patient safety risks through IT. Assurance activities, Training or even Systems monitoring could as well be used as strategies to prevent foreseen risks, mitigate the risks that are identified and to neutralize the effect of challenges inherent in the staff (Koppel *et al*., 2005).

2.2 Organizational Factors influencing HIT utilization

There are a number of legal factors that have influenced the implementation of risk management units, especially in software-based risk management. They further propose that as a very much fundamental step in managing IT risks, governments and health institutions need to be aware of the legal and legislative requirements for them as the business owners (Adelman *et al*, 2013). On the other hand, privacy policies may differ greatly from one country to another or may even come in the form of institutional differences (Podean & Benta, 2012). The privacy laws are often affected by a number of factors, the most common of which is the organizational culture or the culture of a nation or region.

Lack of IT management policies and standards of operating procedures could as well be a safety risk factor given that the predefined procedures act as guidelines for operating or using the systems (Schneider *et al*., 2014). Health IT policies and procedures explain to staff and patients the importance of managing IT risks and may form part of the risk management and continuity plans as regards to enhancing the business aspect of the health facilities. Importance of these policies such as the security procedures and policies could go a long way to assisting

staff training on issues relating to or bordering, safe email use, setting out processes for common tasks, IT systems change management, IT incidents response among other crucial aspects of technology (Buntin, Jain& Blumenthal,2010). Finally, Blumenthal and Tavenner (2010) suggest that another risk factor could be in the form of an absence of an IT code of conduct. The code of conduct may otherwise be able to provide staff and customers with clear direction and definition of acceptable behaviors in relation to key IT issues, such as protection of privacy and ethical conduct. Other risks could come in the form of human threats such as physical burglary as well as natural risks such as radiations (Henriksen *et al*., 2005).

One of the most crucial determinants to the progress of a health IT introduction process is the top management support. The top management are often required to fit the health IT scenario in its policy structures. Often there arise situations where the requirements for the health IT initiative may be misunderstood, either by the users, clients in the form of patients as well as the top management as earlier discussed. Podeana & Benta (2012) indicated that since each health IT initiative involves transition from the old mode of operations to a new one, often there is need for proper change management. Poor change management often leads to one of the greatest risks in demeaning the effectiveness of the process. There is also a possible risk in the form of lack of necessary skills in implementing the systems, or a possible inadequate user involvement which then often may escalate a rejection of the system as the users would then not perceive ownership of the project. Buntin *et al.* (2010) suggests that before an introduction of any health IT initiative, there is often some form of expectation that the users have and sometimes this may be over the bar given that they might then end up demanding 100% performance and 0% frailties. Failure to manage these expectations may be catastrophic especially given that the users are the primary clients to the systems (Blumenthal &Tavenner, 2010).

2.3 Technological Factors influencing HIT utilization

With the emergence of Big Data, all sectors are slowly transitioning into a world of endless bounds through Cloud functionalities. Cloud services as well as maintenance of storage as the world is revolutionized may be helpful so as to ensure scalability. In the world of Big Data, skills for data management and hybrid systems are sure to come in handy both for information security purposes as well as for purposes of reducing errors through artificial intelligence services which makes decisions based on a person or system's historical records The globalization of the markets has led to innovations such as cloud resource management through services such as Software as a Service (SaaS) or Infrastructure as a Service (IaaS). These capabilities have enabled health institutions in the developed world to make strides in better management and accountability of all resources and improvement of patient's safety. Cloud based patient information management's efficiency is still not at 100% especially with fears emerging from viruses, spyware and malwares whose security is never guaranteed (Henriksen *et al.,* 2005).

Technological factors are the real game changers in the economies today, especially when the subject in question is Health IT. From simple applications for performing tasks such as preparation of clinics to more complex functionalities such as backups and storage and dynamic web content for health institutions, technology has revolutionized the health care sector. Applications such as Microsoft's Sway or Apple's App share have eased the pressure of delivering quality within short time frames (Lippert & Govindarajulu, 2015).

2.4 Individual system components

A system consists of several parts working together to achieve a common goal. The same applies to the health sector and healthcare settings at large. Individual human characteristics play a huge role in determining the weight of roles played by any factor towards reduction of patient safety concerns. Such characteristics include Attitudes, perceptions, Knowledge, Age, Education, experience. Black (2011) claimed that positive attitude releases energy into tasks thereby yielding a positive role in any activity. With increased knowledge and perception of health safety risks, it is possible to know how to mitigate them manually. The degree to which an intervention will work technologically hugely depends on its feasibility and practicality on paper. Experience is one of the key variants across a staff population that cannot be bought or quickened; yet is fundamental as it determines the speed of operating the technologies (Chou, 2012).

Age and Knowledge often vary directly and are also arguably important in promoting patient safety. Patient safety requires comprehension of circumstances leading to the safety concern. Knowledge could sometimes lead independently to better skills, although sometimes knowledge may be distractive. A good comprehension of circumstances though, may help in solving system bugs as well as contact further assistance based on the information collected regarding the safety concern (Henriksen *et al.*, 2005).

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Data, skills for data management and hybrid systems are sure to come in handy both for information security purposes as well as for purposes of reducing errors through artificial intelligence services which makes decisions based on a person or system's historical records (Henriksen *et al.*, 2005).

2.5 Summary of Literature Review

The literature review found out that the roles that HIT plays in patient safety are wide and diverse. However, the kind and variety of roles were dependent on the type of technology used. For instance, for diagnostic aid, decision support systems are used. Electronic Medical Records (EMRs) systems assist in management of all health information created for patients as well as facilitating communication between various departments. EMRs also improves adherence in clinic attendance as well as speed of execution of tasks such as registration of patients. Collaboration between the medics and paramedics, and health IT developers to reduce health IT–related safety risks was a major way to maximize health IT's effect in patient safety (WHO, 2014). Lack of HIT code of conduct was identified as an ethical issue globally.

MLKH reported as having the most (3/100) cases in 2015 due to negligence in Nairobi (MOH, 2016). MLKH was also the only public hospital in Nairobi with full computerized patient system. Mama Lucy Kibaki Hospital's location on the Eastern side of Nairobi City, makes it a candidate for a number of concerns from patients regarding their safety as it serves as the first point of contact for patients for most residents in that region.

3.0 MATERIALS AND METHODS

3.1 Research Design

This study was carried out within the framework of a cross-sectional research design employing both quantitative and qualitative data collection methods. Cross-sectional research design was used in this study to observe different groups (professionals) at one time and thereafter used to describe the characteristics that exist in a group. Data was collected at the same time from study subjects who are similar on other characteristics but different on a key factor of interest such as age, sex, professions and education background. This design was employed as the study intended to investigate the snapshot of patient safety concerns and the effectiveness of patient safety promotion though HIT at a particular point in time (Moskal & Leydens, 2000).

3.2 Variables

3.2.1 Dependent variable

The dependent variable was;

- Patient Safety Promotion

3.2.2 Independent variables

Independent variables were;

- HIT utilization
- Organizational factors that influence HIT utilization
- Individual factors that influence HIT utilization
- Technological factors that influence HIT utilization

3.3 Location of the study

The study was conducted at Mama Lucy Kibaki Hospital (MLKH) in Nairobi City County. MLKH is located about 5km west of the Central Business District of Nairobi City County on Kayole Spine road, near Kangundo Road (Appendix 5). MLKH was used as it was the only public hospital in Nairobi City County with a fully operational comprehensive computerized system.

3.4 Study Population

The study population was the 411Health Care workers of Mama Lucy Kibaki Hospital who were from the various departments.

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

Only Health Care Workers who had been working at MLKH for more than three months, and who agreed to participate in the study were included. They should also be using computerized system.

3.5.2 Exclusion criteria

Health Care Workers who had been working at MLKH for more than three months but were on leave or night offs, or anyone who qualified but did not consent to take part in the study were excluded.

3.6 Sample Size Determination and Sampling Technique

3.6.1 Sample Size Determination

The sample size was calculated using the Fisher's formula (Moskal & Leydens, 2000).

$\boldsymbol{n}=Z^2pq/\,d^2$

Where;

n =is the total sample size

q = 0.1unknown characteristics of the target population;

p = 1- q= 0.9 Known characteristics of the target population (Patient safety);

Z= 1.96

d = 0.05

Therefore,

$\boldsymbol{n}= (1.96)^2 \text{ X } (0.90) \text{ X } (0.10) / (0.05)^2 = 138.2976$

$\boldsymbol{n'}= (n/(1 + n/N)), = (138.2976 / 138.2976/ 411)$

$\boldsymbol{n'}= 133.24$

A non-response rate of 10% was projected.

Therefore:

(110/100)*133.24 = 146.674

n= 147Respondents

3.6.2 Sampling Technique

MLKH was chosen purposively as it was regarded as one of the core government hospitals in Nairobi City County and also since it was known to have health IT systems in place, an infrastructure not possessed by other alternative hospitals. All departments were involved in the study and respondents were drawn from these departments.Proportionate random sampling was used to pick the sample from the population. The entire population was proportionately clustered into departments after which simple random sampling without replacement was used to pick respondents from each stratum until the required sample size was reached (Mugenda, 1999).

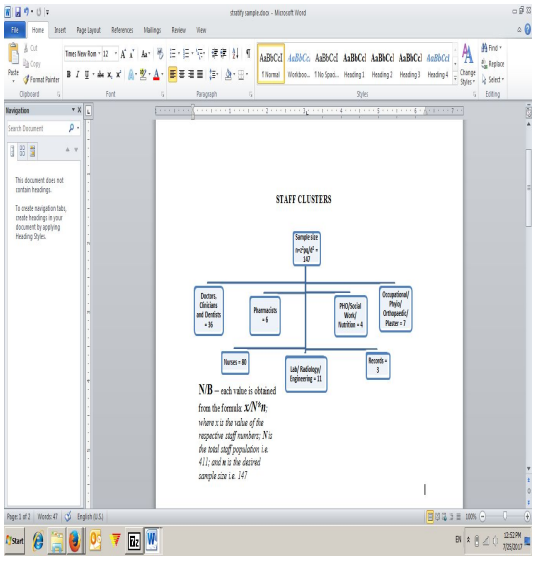

Figure 3.1: Sampling Procedure and Sample Selection

3.7 Construction and Research instruments

Self-administered Questionnaires were used to collect both qualitative and quantitative data. The questionnaires were developed based on the reviewed literature gaps identified (Appendix 3). Key informant guides were then also developed to find out more on the gaps identified by the literature review, especially on issues that were deemed obtainable best from those in management positions or professionals in certain areas that interacted with Health IT in one way or another(Appendix 4) (Moskal & Leydens, 2000).

3.8 Data Collection Techniques

Four Research assistants were recruited and trained on the purpose of the study in relation to the data collection tools. Open ended questions were answered superficially especially if the questionnaire took the respondent long to complete. Key informant guides were used to elicit information from professionals in certain areas core to health IT and patient safety (Mugenda, 1999).

3.9 Reliability and Validity

3.9.1 Reliability

A pre-test was conducted at Mbagathi Sub County Hospital so as to obtain issues as relevant as possible to the study population. (Appendix 3) The pre-test assessed the reliability of the data collection instruments where 50% of the sampled population was used in the test. After the issue of the pretest questionnaires, Cronbach's alpha was used where any value of more than 0.7 indicated that the questionnaires were reliable. Thirty-two (32) items (excluding the socio demographic section) in the questionnaire (Appendix 3), and 8 items in the Key Informant Guide (Appendix 4) were used in the generation of the alpha. An alpha of 0.7 or higher was considered acceptable reliability for the tools. The alphas for the questionnaire and key informant guide were 0.80 and 0.84 respectively.

3.9.2 Validity

Research assistants were trained prior to data collection to ensure they collected the desired data. The researcher accompanied each assistant on different days to ensure accuracy and counter-check all filled in questionnaires at the end of each day to address any mistakes or errors (Mugenda, 1999).

3.10 Data Analysis

Data entry was done; cleaning of data was carried out. Pre analysis was done to check for inconsistencies, incorrect and missing data. Quantitative data was first compiled and coded in STATA 12 software. Descriptive statistics comprising frequencies and percentages were used to describe variables used in the study. Descriptive statistics were computed based on the themes of the study. Ordered logistic regression analysis was used to establish the influence of the study variables on patient safety. Statistical significance of the relationship between variables in the regression model was inferred at 5 percent. The results were then presented in form of pie charts, bar charts and frequency tables (Mugenda, 1999).

3.11 Logistical and Ethical Considerations

Clearance was sought from Kenyatta University Graduate School, an Ethical clearance was also sought from Kenyatta University Ethical and Review Committee and permission obtained from Nairobi City County's Ministry of Health(Appendices 8 and 6 respectively). A research Permit was then sought from National Commission for Science, Technology and Innovation (NACOSTI)(Appendix 7).Research Authorization was granted by National Commission for Science, Technology and Innovation as per (Appendix 9).Participation was

made voluntary, confidentiality assured for all participants (Appendices 1 and 2), and findings disseminated to all those in need of the same (Resnik, 2007).

4.0 RESULTS

4.1 Introduction

This chapter presents the findings of the study on promoting patient safety through effective health information technology risk management at Mama Lucy Kibaki Hospital, Nairobi City County, Kenya. Detailed analysis of the data, interpretation and explanation of the results with regard to objectives and the research questions are given. The findings are based on information from questionnaires for a representative sample of 147 medical and paramedical staff at the study site and consultative discussions using 30Key Informant (KI) interviews. The chapter is organized as follows: Socio- demographic characteristics, utilization of HIT in promoting patient safety, organizational factors, technological factors and individual system components affecting patient safety promotion.

4.2 Socio-demographic Characteristics of the Respondents

This section presents the results for various background characteristics of the respondents. Table 4.1 shows the presentation of the descriptive statistics for age, gender and marital status of the respondents.

The mean age was 28(SD=6.8). Female were the majority of the respondents with (56%). Most of the respondents were single (52%), followed by those who were married (41%). The marital status findings could be due to the age distribution which vastly consisted of youthful participants.

Table 4.1: Respondent Age, Gender and Marital Status Descriptive Statistics

Variable and Values	Frequency, n (%) or Mean [SD]
Age	27.7 [6.8]
Gender	
Male	63(42.9)
Female	83(55.7)
Non Response	2(1.4)
Total	**147 (100.0)**
Marital Status	
Single	77(51.7)
Married	60(40.8)
Divorced	5(3.4)
Widowed	2(1.4)
Non Response	4(2.7)
Total	**147(100.0)**

Tables 4.2 and 4.3 show the frequencies of the level of education and professions of the respondents respectively. Majority (56%) had their highest level of education as College, followed by University (36%). This was expected of a hospital facility to have obtained at least certificate. Nurses comprised most (52%) of those interviewed. This observation could be linked to the fact that most respondents were female and the nursing profession is usually dominated by the female gender.

Table 4.2: Respondent Level of Education

Variable and Values	Frequency, n (%)
Level of Education	
None	3(2.0)
Primary	4(2.7)
Secondary	3(2.0)
College	82(55.8)
University	53(36.1)
Non Response	2(1.4)
Total	**147(100.0)**

Table 4.3: Respondent Level of Profession

Variable and Values	Frequency, n (%)
Profession	Respondents
Nurse	77(52.4%)
Pharmacist	9(6.1%)
Doctor	24(16.3%)
Records and IT	15(10.2%)
Others e.g.Labtechs, social worker	15(10.2%)
Non Response	7(4.8%)
Total	**147(100.0%)**

4.3 Findings on Objectives

4.3.1Utilization of HIT in promoting Patient Safety

The HIT usage in promotion of patient safety was computed by adding up the ratings on various specific objectives and dividing by the number of items to come up with a composite score. The composite score was then classified into two groups: “Patient safety promoted”, consisting of scores below the mean score and “Patient safety not promoted” consisting of scores above mean. The recoded scores were then later used to calculate the effect of various specific variables on the outcome variable (HIT utilization on patient safety). Table 4.4 presents the univariate analysis of various identified uses of HIT. Figure 4.1 shows the aggregation of the HIT uses with subsequent classifications into whether or not HIT promoted safety.

Table 4.4: Respondent level of agreement on various uses of HIT on patient safety

Variable	Ratings on HIT utilization, n (%)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
HIT Reduces Medical Errors	59 (43.7)	47 (34.8)	19 (14.1)	9 (6.7)	1 (0.7)	135 (100.0)
HIT minimizes delays in service delivery	55 (40.7)	49 (36.3)	13 (9.6)	11 (8.2)	7 (5.2)	135 (100.0)
With HIT use, there is less fatigue	48 (36.6)	47 (35.9)	18 (13.7)	15 (11.5)	3 (2.3)	131 (100.0)
HIT improves adherence to appointment	42 (31.1)	46 (34.1)	28 (20.7)	10 (7.4)	9 (6.7)	135 (100.0)
DSSs are efficacious to service delivery	46 (34.6)	44 (33.1)	33 (24.8)	6 (4.5)	4 (3.0)	133 (100.0)
Non-automated risks minimized through HIT	51 (38.9)	34 (26.0)	30 (22.9)	12 (9.2)	4 (3.0)	131 (100.0)

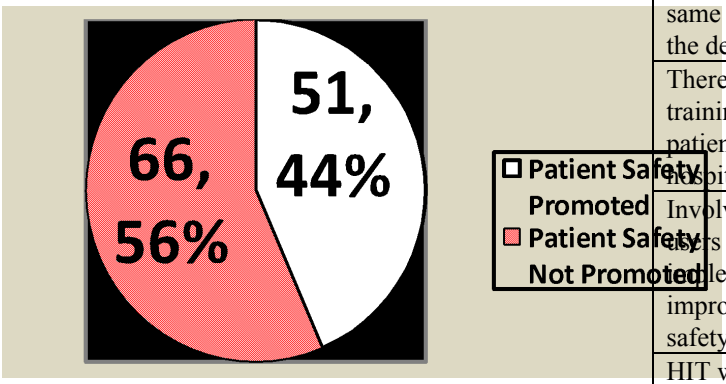

Figure 4.1: Pie Chart of HIT utilization on Patient Safety Promotion

From the tabular distributions of individual HIT usage, most respondents agreed or strongly agreed to all the HITs assessed. The results of aggregation revealed that most respondents (56%) felt that HIT was used in promoting patient safety whereas only 44% felt that HIT was not utilised in promoting patient safety. These findings were backed by KI responses which indicated that:

"*…EMRs have hugely helped in solving most storage and automation issues, the processes are faster and report generation is made easier...*" and "*…The HIT systems are less tedious and provide for the reproducibility of the patient records. The systems also detect errors automatically…*"

The two statements above provide affirmations of the functions of HIT in the facility. Auto-detection of errors improves accuracy whereas reproducibility of the HIT output proves its reliability thereby contributing to the patient safety.

4.3.2 Organizational Factors influencing HIT utilization in patient safety promotion

Table 4.5 shows the frequencies of the ratings on organizational factors influencing promotion of patient safety. Similarity of Access passwords was denied by majority (57%) of the respondents. Patient safety trainings were affirmed by more than 60% of the respondents. Most respondents (62%) also believed that HIT had not lived up to the expectation, whereas most (78%) of them also affirmed that staff knowledge of HIT policies improved HIT performance. Table 4.5: Organizational factors influencing HIT utilization in patient safety promotion

Ratings on Organizational factors influencing Patient Safety, N (%)				
Variables	**True**	**False**	**Don't Know**	**Total**
Access passwords into the HIT system are the same for everyone in the department	57(42.5)	77(57.5)	0(0.0)	134(100.0)
There are periodic trainings on HIT for patient safety in the hospital	81(60.5)	48(35.8)	5(3.7)	134(100.0)
Involvement of all users in HIT implementation improves patient safety	110(82.7)	21(15.8)	2(1.5)	133(100.0)
HIT within the hospital has not lived up to the hype or expectation	82(61.7)	45(33.8)	6(4.5)	133(100.0)
Top Management support is a major hindrance to health It uptake	64(48.1)	59(44.4)	10(7.5)	133(100.0)

Knowledge of Health IT policies and legal issues improves use of health information technology	102(78.4)	21(16.2)	7(5.4)	130(100.0)

4.3.3 Technological Factors influencing HIT utilization in patient safety promotion

Table 4.6 shows the frequencies of the ratings on technological factors influencing the utilization of HIT in patient safety promotion. Automatic logouts from the system and anti-update were affirmed by most respondents (79% and 74% respectively). EMR, CPOE and DSS were also regarded as important by most respondents (57%, 54% and 51%) respectively.

Table 4.6: Technological Factors influencing HIT usage Patient safety promotion

Variable	Ratings on Technological factors influencing Patient Safety, n (%)			
	True	False	Don't Know	Total
Auto log-outs of users helps ensure patient safety	112(79.4)	18(12.8)	11(7.8)	141(100.0)
Antivirus Update helps ensure patient safety	107(74.3)	29(20.1)	8(5.6)	144(100.0)
Electronic Medical Records (EMR) are the most important health IT employed at this institution	80(57.1)	48(34.3)	12(8.6)	140(100.0)
Computerized Physician Order Entry (CPOE) are the most important health IT employed at this institution	74(53.6)	37(26.8)	27(19.6)	138(100.0)
Decision Support Systems (DSS) are the most important health IT employed at this institution	73(51.4)	44(31.0)	25(17.6)	142(100.0)

4.3.4 Individual system componentsinfluencing HIT utilization in patient safety promotion

Table 4.7 shows the frequencies of the ratings on individual factors influencing the utilization of HIT in patient safety promotion. That HIT was used to notify patients on the queue was unknown to most. The other statements on individual components had most of the respondents affirming their truth.

Table 4.7: Individual system components influencing HIT usage in patient safety Promotion

Variable	Ratings on individual system components influencing Patient Safety Promotion, N (%)			
	True	False	Don't Know	Total
Alerts on patients similar names	75(54.0)	15(10.7)	49(35.3)	139(100.0)
Alerts on similar patients identification numbers	64(46.0)	19(13.7)	56(40.3)	139(100.0)
Alerts on Age of patients	56(40.8)	26(19.0)	55(40.2)	137(100.0)
Notification on patients waiting in a queue	52(37.7)	32(23.2)	54(39.1)	138(100.0)
Alert in patient conditions deteriorating	55(40.4)	43(31.6)	38(28.0)	136(100.0)
Alerts on wrong medication for patients	70(50.7)	38(27.6)	30(21.7)	138(100.0)
Notification on wrong dosages of drugs for patients	80(58.0)	27(19.6)	31(22.4)	138(100.0)
Alerts on patients medication errors	69(50.0)	31(22.5)	38(27.5)	138(100.0)
Notification of many staff modifying a patient record	65(47.5)	34(24.8)	38(27.7)	137(100.0)
Notification on Morbidity and mortality data review	86(62.7)	19(13.9)	32(23.4)	137(100.0)

Alerts on Evasion of deaths due to medical error	54(39.1)	44(31.9)	40(29.0)	138(100.0)
There is back up of patient data	111(79.8)	14(10.1)	14(10.1)	139(100.0)
Presence of updates of Health IT system	94(69.1)	16(11.8)	26(19.1)	136(100.0)

4.4 Socio-demographic Factors influencingutilization of HIT on Patient Safety Promotion

The utilization of HIT on patient safety promotion was computed by summing the variable ratings on statements that assessed the utilization of HIT, and then dividing by the number of variables so as to come up with a composite score. The composite score was then categorized into either "Patient safety promoted" or "Patient safety not promoted" depending on whether the scores were below or above the mean scores respectively.

Table 4.8 presents the results of a binary logistic regression on the distribution of age, gender and marital status and their contribution on the utilization of HIT on patient safety promotion. There is also a positive association between age and patient safety promotion through HIT (OR=0.462 [95% CI 0.063-1.060]).However, since the confidence interval overlaps 1, there is not sufficient evidence to suggest that age has a marked influence on the utilization of HIT to promote patient safety.

Table 4.8: Socio-demographic factors influencing HIT utilization in patient safety promotion

Variable	Patient Safety Promoted		Odds Ratio	P-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Age	42(34.9)	75(64.1)	0.462	0.954	0.063	1.060
Gender						
Male	15(35.7)	33(44.0)	-	-	-	-
Female	27(64.3)	42(56.0)	0.709	0.383	0.3196	1.546
Marital Status						
Single	22(53.7)	40(54.0)	-	-	-	-
Married	16(39.0)	31(41.9)	0.76	0.876	0.733	1.860
Divorced	2(4.9)	2(2.7)	1.63	0.527	0.389	2.712
Widowed	1(2.4)	1(1.4)	2.46	0.648	0.175	3.498

The key informant guide also reported as follows:

"…*The older staff found it hard to cope with the new technologies, thereby hindering the effective use of the HITs…* " or that "…*The younger staff are usually overworked as they are considered to be more comfortable in their use of the HIT. As a result of the fatigue by the users, HIT's effect is also reduced…*"

Table 4.9 presents the results on the distribution of education and professions and the contribution of the two variables on the utilization of HIT on patient safety promotion. Differences were also noted across the various educational levels; however, the influence with advance in educational levels was not statistically significant at any of the levels. That observation was contradicted by 70% of the KI guides that indicated that Education level influenced the utilization of HIT on patient safety. However, some KI respondents also indicated that education does not influence HIT through statements such as:

"…*Education level can always be supplemented by the on-the-job training that works quite effectively in technological related issues such as HIT...*" and

"…*The influence of education is only realized when those with very low education are compared with those who have very high levels. However, in the health sector, such as this facility, the education level margins are so small that the effect may be negligible or absent altogether…*"

In terms of professional cadres, there is sufficient evidence to conclude that doctors were 0.56 times less likely than pharmacists to perceive HIT as playing a role on patient safety (OR= 0.56 [95% CI 0.131-2.135]).

Table 4.9: Socio-demographic factors influencing HIT utilization in patient safety promotion

Variable	Patient Safety Promoted		Odds Ratio	p-value	95.0% CI	
	No, n (%)	Yes, n (%)			Lower	Upper
Level of education						
None	3(7.1)	0(0.0)	-	-	-	-
Primary	3(7.1)	0(0.0)	0.13	1.000	0.100	0.254
Secondary	1(2.4)	2(2.7)	0.01	0.992	0.003	0.065
College	16(38.1)	47(62.7)	0.37	0.991	0.294	0.417
University	19(45.3)	26(34.6)	0.21	0.992	0.120	0.401
Professional cadre						

Nurse	20(50.0)	42(59.7)	-	-	-	-
Pharmacist	2(5.0)	4(5.6)	0.80	0.936	0.706	0.851
Doctor	13(32.5)	9(12.5)	0.560	0.027	0.131	2.135
Records and IT	2(5.0)	8(11.1)	1.74	0.458	1.017	2.259
Others e.g Lab, Social	3(7.5)	8(11.1)	1.30	0.768	1.214	1.644

4.5 Organizational factors influencingHIT utilization

Tables 4.10 and 4.11 present the results of a logistic regression on various organizational factor responses and utilization of HIT on patient safety promotion (outcome variable). The similarity of access passwords, periodic trainings on HIT and involvement of HIT users (OR=1.2 [95% CI 1.075-1.600]; OR =2 [95% CI 1.456-2.027]; OR=1.5 [95% CI 1.180-1.654] respectively) all produced significant influences in determining the usage of HIT in promoting patient safety. The odds of HIT being utilized in promoting patient safety is 1.2 times likelier when the passwords are similar than when the passwords are not similar. In the same manner, those who indicated that periodic trainings took place at the hospital were found to be twice more likely to recognize presence of patient safety, compared to those who opposed the statement on periodic training. As for the involvement of users, those who affirmed the truth of that statement were 1.5 times more likely than those who indicated that the statement was false to also indicate that there was patient safety in the facility. Regarding hospital policies on heath information management, the key informant guide found that:

"…*Patient information disclosure (confidentiality and privacy) together with physically keeping the records safe is very important in trying to ensure safety of the patient…*"

Table 4.10: Organizational factors (Access passwords, periodic training and Involvement users in implementation) influencing utilizationof HIT in patient safety promotion

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Access passwords into the HIT system are the same for everyone in the department						
True	12(28.6)	39(52.0)				
False	30(71.4)	36(48.0)	1.205	0.002	1.075	1.600
There are periodic trainings on HIT for patient safety in the hospital						
True	22(52.4)	55(73.3)				
False	20(47.6)	15(20.0)	1.961	0.017	1.456	2.027
Involvement of all users in health IT implementation improves patient safety						
True	36(71.4)	12(88.0)				
False	12(28.6)	7(9.3)	1.456	0.008	1.180	1.654

Table 4.11: Organizational factors (HIT hype, management support and knowledge of policies) influencingutilization of HIT in patient safety promotion

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Health IT within the hospital has not lived up to the hype or expectation						
True	True	True	True	True	True	True
False	False	False	False	False	False	False
Top Management support is a major hindrance to health IT uptake						
True	True	True	True	True	True	True
False	False	False	False	False	False	False
Knowledge of Health IT policies and legal issues improves the efficacy of use of health information technology.						
True	True	True	True	True	True	True
False	False	False	False	False	False	False

4.6 Technological factors influencing utilizationof HIT

Table 4.12 and 4.13 shows the cross-tabulations and regression of various technological factors statements with Patient safety promotion. The influence of the auto-logout systems on patient safety was not statistically significant, understandably because the responses were mainly one-way for those who agreed whereas those who denied the statement were balanced between patient safety statuses. There is sufficient evidence to conclude that auto logout of users (OR=0.2 [95% CI 0.052-0.801]), and the

use of EMR (OR=0.4 [95% CI 0.195-0.877]) promote patient safety. The odds of obtaining a major role on HIT if EMR is perceived as most important technology is 0.4 times more likely than when it is not viewed as most important. These observations are further compounded by the reports from the KIs which stated that:

"*…Rights and privileges based on the various HITs within the hospital have played a huge role in ensuring patient safety and improving the quality of care…*" or that

"*…The HIT systems' auto-logout capability is one of the greatest reasons for reduced complaints by the patients visiting the hospital…*"

Table 4.12: Technological factors (Antivirus Update and Auto-user logout) influencing utilization of HIT in patient safety promotion

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Auto log-outs of users helps ensure patient safety						
True	27.0(67.5)	67.0(93.1)				
False	5.0(12.5)	5.0(6.9)	0.205	0.023	0.052	0.801
Antivirus Update helps ensure patient safety						
True	23(56.1)	63(86.3)				
False	12(29.3)	9(12.3)	0.733	0.600	0.230	2.341

Table 4.13: EMR, CPOE and DSS as HIT utilizing patient safety

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Electronic Medical Records are an important health IT employed at this institution						
True	18(45.0)	47(64.4)				
False	15(37.5)	23(31.5)	0.413	0.021	0.195	0.877
Computerized Provider Order Entry are an important health IT employed at this institution						
True	16(41.0)	48(65.8)				
False	11(28.2)	16(21.9)	0.702	0.290	0.364	1.352
Decision Support Systems are important health IT employed institution						
True	14(34.2)	46(63.0)				
False	15(36.6)	18(24.7)	0.747	0.366	0.397	1.406

4.7 Individual system components influencing HIT utilization

Tables 4.14-4.17 show the cross-tabulation and regression analysis of Individual system components statements against patient safety. From the four tables, responses were statistically significant for statements on notification on patients' identification number similarity and presence of backups to the systems yielded significant contributions to the utilization of HIT on patient safety (OR=3.6 [CI 0.072-0.572] and OR=0.2 [95% CI 1.306-9.916]). The probability of the HIT promoting patient safety effectively was 3.6 times higher among those who denied presence of alerts on similarity of patient identification number compared to those who indicated that there was presence of these kinds of alerts. The odds of observing HIT as being utilized in patient safety promotion was 0.2 times higher among those who were not aware of the existence of the backup systems compared to those who knew of the existence of the same. The presence of updates for the systems was also confirmed by the KI results which showed that over 65% (n=32) of the respondents knew of the updates.

Table 4.14: Alerts on similar patient names, patient ID and Missing age information, influence on patient safety

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Alerts on patients similar names						
True	21(55.3)	34(47.9)				
False	2(5.3)	10(14.1)	0.635	0.414	0.213	1.889
Alerts on similar patients identification numbers						
True	19(50.0)	28(39.4)				
False	6(15.8)	9 (12.7)	3.600	0.013	1.306	9.916
Alerts if Age of patient is not entered						
True	19(50.0)	24(34.8)				
False	8(21.1)	10(14.5)	1.600	0.314	0.639	4.027

Table 4.15: Alerts on patient waiting on a queue, and deteriorating patient conditions, and Medical errors utilization in patient safety

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)				Minor, n (%)
Notification on patients waiting in a queue						
True	926(23.6)	34(47.9)				
False	10(26.3)	11(15.5)	0.536	0.173	0.219	1.314
Alert in patient conditions deteriorating						
True	15(41.7)	33(47.1)				
False	8(22.2)	24(34.3)	0.970	0.942	0.425	2.215
Alerts on wrong medication for patients						
True	15(42.0)	45(63.4)				
False	11(29.0)	16(22.5)	0.699	0.229	0.389	1.254

Table 4.16: Notification on wrong dosage, multiple record editing by different staff, and Morbidity and mortality data review on utilization of HIT on patient safety promotion

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Notification on wrong dosages of drugs for patients						
True	16(42.1)	49(69.0)				
False	9(23.7)	12(16.9)	1.411	0.552	0.453	4.390
Alert on Medical Error						
True	13 (48.1)	48 (85.7)				
False	14 (51.9)	8 (14.3)	0.811	0.671	0.308	2.135
Notification of many staff modifying a patient record						
True	10(26.3)	42(59.2)				
False	8(21.1)	17(23.9)	0.860	0.704	0.396	1.869
Notification on Morbidity and mortality data review						
True	14(38.9)	55(77.5)				
False	6(16.7)	7(9.9)	0.414	0.109	0.140	1.218

Table 4.17: Alerts on Death Evasion due to Medical error, presence of a backup and updates for the HIT system utilization in patient safety

Variable	Patient Safety Promoted		Odds ratio	p-value	95.0% CI for OR	
	No, n (%)	Yes, n (%)			Lower	Upper
Alerts on Evasion of deaths due to medical error						
True	15(39.5)	33(46.5)				
False	11(29.0)	24(33.8)	1.700	0.271	0.662	4.347
There is back up of patient data						
True	22(57.9)	64(90.2)				
False	7(18.4)	5(7.0)	0.203	0.003	0.072	0.572
Presence of updates of Health IT system						
True	18(47.4)	57(82.6)				
False	7(18.4)	4(5.8)	0.515	0.142	0.212	1.248

5.0 CHAPTER FIVE: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the discussion, conclusions and recommendations of the study based on the study objectives and findings. The chapter relates the qualitative and quantitative findings of a study and interprets them according to the literature reviewed and according to the researcher's observations. The findings are analyzed according to the research questions and objectives. The outcomes are further compared with other similar studies to help highlights similarities and differences in findings.

It also provides the conclusion based on the discussions. Finally, the section presents the recommendations both for professionals in the field as well as for future researchers. The chapter is organized as follows: Social Demographic Characteristics, utilization of HIT in promoting Patient Safety, Organizational factors that influence patient safety, Technological factors influencing patient safety, Individual factors influencing patient safety, Conclusions, Recommendations and Further Research.

5.2 Discussions

5.2.1 Socio-demographic Characteristics of the Respondents

From the study findings, most of the respondents were youthful with a mean age of 28, especially considering that the deviation from the mean was six years. This observation could be due to the fact that the study site was a government hospital which benefited mostly from students or interns as well as young professionals in their respective fields. It could also be that the older staffs were not interested in the study or that the study appealed to the younger staff. The female population was greater, which is probably due to the similarly high number of nurses and health information staff – two professions that were dominated by that gender. The fact that those who were single were more than those who were married was shocking mainly owing to the fact that majority of the respondents were female. However, in relation to age, the greater proportion of singles was quite expected. Opinion was divided regarding whether or not age affected the utilization of HIT on patient safety. The questionnaires revealed that age does not influence HIT's utilization significantly which was contrary to what Henriksen *et al.* (2005) reported that age influences HIT's ability to ensure patient safety hugely. However, the key informant guide revealed that the older staff found hard to cope with the new technologies, thereby hindering their effective use of the HITs; and that overworking of younger staff reduced the effect of the HIT on patient safety. Those two reports are concurrent with Chou (2012)'s claim that patient safety required maturity and comprehension of circumstances, with or without HIT.

The study saw many respondents indicate their highest level of education as College. Since most nurses are usually KNRCN which is usually obtained at the college level, their high constitution in the respondent population makes it easy to know why most respondents had only reached that level. However, with nearly 40% of the respondents indicating their level of education as university, the overall level of education in the hospital was found to be fairly good. Since the chi-square test for independence also revealed significant differences across the various levels of education; there was even greater credibility of the education level results.

Education on the other hand also had mixed responses regarding the effect on HIT's utilization in promoting patient safety with sentiments that training can always supplement education. Others also felt that education margins in the health sector were also quite small. That observation was consistent with what Koppel *et al*. (2005) reported that training can be used by institutions to mitigate patient safety risks as well as cover up for challenges inherent in staff.

5.2.2 Utilization of HIT in promoting Patient Safety

The study findings revealed that EMRs have hugely helped in solving most storage and automation issues, the processes are faster and report generation was made easier and that the HIT systems were less tedious and provided for the reproducibility of the patient records. The systems also detected errors automatically. These observations were consistent with (Podean &Benta, 2012) who indicated that each health IT initiative involves transition from the old mode of operations to a new one, often there is need for proper change management. However, with the emergence of Big Data, all sectors were slowly transitioning into a world of endless bounds through Cloud functionalities. Cloud services as well as maintenance of storage as the world was revolutionized may be helpful so as to ensure scalability. The two statements above provided affirmations of the functions of HIT in the facility. Auto-detection of errors improved accuracy whereas reproducibility of the HIT output proved its reliability thereby contributing to the patient safety (Henriksen *et al.*, 2005).

5.2.3 Organizational factors that influence HIT utilization

Similarity of Access passwords was denied by majority of the respondents. Patient safety trainings were also affirmed by most of the respondents. Progress from truth to falsehood of the statement on similarity of access passwords resulted in a decline in the utilization of HIT on patient safety. Most respondents also believed that HIT had not lived up to the expectation, whereas most of them also affirmed that staff knowledge of HIT policies improved HIT performance. All those variables yielded statistically significant influences in determining the utilization of HIT usage in patient safety promotion. With reference to the use of passwords, Henriksen *et al*. (2005) explained that with increased and close to limitless storage facilities possible with HIT, there is need for use of highly secure measures. Uncommon and Frequently changing passwords are some of the ways of achieving that objective. The findings concurred with what Buntin *et al*. (2010) who claimed that policies exist so as to ensure that trainings, which are core to the functionality of HIT systems, may progress well. On the importance of the policies, (Chuo, 2012) also emphasized that besides helping on the training of the staff, the policies also helped align the necessary procedures and overcome hurdles that are related to the ethical issues of the technologies involved.

5.2.4 Technological factors influencing HIT utilization

The influence of the auto-logout systems on HIT's utilization on patient safety was not statistically significant, understandably because the responses were mainly one-way for those who agreed whereas those who denied the statement were balanced between HIT being effective or not. Antivirus update's usage in ensuring patient safety was also found to be majorly contributing to the patient safety promotion. The two observations were expected based on Henriksen *et al.* (2005) in the world of Big Data, skills for data management and hybrid systems were sure to come in handy both for information security purposes as well as for purposes of reducing errors through artificial intelligence services which makes decisions based on a person or system's historical records. One way of ensuring proper management of patient data is to log out users immediately once they have a period of inactivity. The globalization of the markets has led to innovations such as cloud resource management through services such as Software as a Service (SaaS) or Infrastructure as a Service (IaaS). These capabilities have enabled health institutions in the developed world to make strides in better management and accountability of all resources and improvement of patient's safety. Cloud based patient information management's efficiency was still not at 100% especially with fears emerging from viruses, spyware and malwares whose security is never guaranteed. In order to avoid the virus and malware infections, the systems therefore need frequent updating, which was reported in the facility (Koppel *et al.*, 2005).

5.2.5 Individual system componentsinfluencing HIT utilization

From the four tables, responses were statistically significant ($p<0.05$) for statements on notification on patients' waiting time, backup of the patient data as well as update of the systems. Presence of patient queue notification capabilities enhance HIT patient safety role. Backups and updates also enhance the utilization of HIT as far as patient safety was concerned. These results were in agreement with Prajogo *et al.*(2016)who found out that backups and storage and dynamic web content for health institutions, are part of the reasons behind HIT's success in the health sector. Henriksen *et al.* (2005) further reported that Cloud based patient information management's efficiency was still not at 100% especially with fears emerging from viruses, spyware and malwares whose security was never guaranteed. Malware and virus definitions on the system antiviruses must always therefore be kept up to date in order to eliminate such security issues. According to (WHO, 2014) collaboration between the medics and paramedics, and Health IT developers to reduce health IT related safety risks was a major way to maximize health IT's effect in patient safety.

5.3 Summary of Findings and their implications

The study found out that age and education influenced HIT utilization in promoting patient safety though not at a statistically significant level. A triangulation of the data collection tools revealed that both factors affected HIT's patient safety role considerably. The overall patient safety promotion through HIT revealed that if HIT in place at the hospital, there was a faster and secure process hence less waiting time, less tedious work processes, less medical errors and greater security of the patient records. The policies in place at the hospital included disease coding, patient confidentiality, privacy and security, recommended in all hospitals, however, there are no HIT-specific policies that were identified. Policies were however found not to be organizational-wide. Lack of HIT code of conduct was identified as an ethical issue globally. Storage and Antivirus update are the greatest technological issues that the study identified, with EMR, DSS and CPOE all found to be present and actively in use by the facility. Finally, system update and backup of the patient information were also identified by the study as useful components of HIT to promote patient safety. The lack of complete agreement between the various statements by the staff also implied that the structures were not uniform across the hospital.

5.4 Conclusions

The study conclusions are based on themes derived from study objectives.

5.4.1 Utilization of HIT

From the study, most respondents, 66 (56%) felt that HIT utilization promoted patient safety.

5.4.2 Organizational factors

From the results, similarity of access passwords (OR=1.2 [95% CI 1.075-1.600]); periodic trainings on HIT (OR =2 [95% CI 1.456-2.027]); and involvement of HIT users (OR=1.5 [95% CI 1.180-1.654]) had sufficient evidence to back their association with the utilization of HIT in patient safety promotion.

5.4.3 Technological factors

There is sufficient evidence to conclude that auto logout of users (OR=0.2 [95% CI 0.052-0.801]), and the knowledge and use of EMR (OR=0.4 [95% CI 0.195-0.877]) promoted patient safety.

5.4.4 Individual System components

Finally, the results also showed that there was sufficient evidence to suggest that notification on patients' identification number similarity and presence of backups to the systems contributed to the use of health IT

in promoting patient safety (OR=3.6 [CI 0.072-0.572] and OR=0.2 [95% CI 1.306-9.916]). There were also cadre specific results worth noting that doctors were more likely to perceive the utility of HIT in promoting patient safety compared to pharmacists (OR= 0.56 [95% CI 0.131-2.135]).

5.5 Recommendations for Policy, Program and Further Studies

The study recommends:

1) Overall, that the hospital's management and MoH should increase the investment on implementation of HIT given that most respondents already have a positive perception of the utility of the technologies. This would maximize the potential for the technologies in place in promoting patient safety.
2) Hospital-wide periodic training and involvement of the HIT users at all stages of HIT implementation to ensure ownership of the health information technology facilities.
3) The institution or installation of auto-logout of system users, after every 5-minute period of inactivity to improve the confidentiality and security of the patient information at all times. Also a technological action plan would be to incorporate fully the EMR functionalities to get the most of the systems.
4) Provision of server backups with limited access to only authorized persons and multi-layer privileges to assure patient safety through security of patient information.

5.6 Further Research

Having established a general utilization of various HITs, the study recommends further research on the breadth or magnitude of utilization of specific health information technologies (EMR, CPOE and DSS) identified in this study on patient safety.

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