

# Journal of Health, Medicine and Nursing (JHMN)

## **FACTORS INFLUENCING THE ADOPTION OF ELECTRONIC HEALTH RECORDS IN PUBLIC HEALTH FACILITIES IN KISUMU COUNTY, KENYA**

Christine Semo Isemeck, Prof. Kenneth Ngure, Mr. James Kariuki and Ms. Olive Muchene



## FACTORS INFLUENCING THE ADOPTION OF ELECTRONIC HEALTH RECORDS IN PUBLIC HEALTH FACILITIES IN KISUMU COUNTY, KENYA

<sup>1\*</sup>Christine Semo Isemeck

<sup>1</sup>Post Graduate Student: Jomo Kenyatta University of Technology

\*Corresponding Author's Email: [christinesemo@gmail.com](mailto:christinesemo@gmail.com)

<sup>2</sup>Prof. Kenneth Ngure

Lecturer: Jomo Kenyatta University of Technology School of Public Health

<sup>3</sup>Mr. James Kariuki

Centre of Public Health Research: Kenya Medical Research Institute (KEMRI) – Kenya

<sup>4</sup> Ms. Olive Muchene

Lecturer: Jomo Kenyatta University of Technology School of Public Health

### Abstract

**Purpose:** The purpose of the research study was to determine the factors influencing the adoption of electronic health records in public health facilities in Kisumu County.

**Methodology:** The study adopted was cross-sectional design where it targeted 12 public hospitals with a sample size of 132 health care workers. Out of 132 health care workers who were sampled out from 12 public health facilities, 108 consented to take part in the study. Questionnaires with both structured and semi-structured questions were administered. Qualitative data was recorded, transcribed, coded then analyzed while quantitative data was coded and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics of frequencies and percentages were used to summarize the data while inferential statistics applied Chi-square to test for the association between the dependent and independent variables. A p value which was less or equal to 0.05 was considered significant.

**Results:** The study revealed that there was a significant statistical relationship between techno-organizational factors and existing EHR levels; Inadequate & non-functional EHR related infrastructure, weak internet connectivity and unstable power supply were the key technological factors while lack of adequate financial resources, inadequate training support by the hospital management, inadequate technical expertise, non-user involvement and lack of harmonized standard legal enforcement were the major organizational factors that contributed to low rate of EHR adoption. Individual factors had the least influence towards low rate of adoption.

**Unique Contribution to Theory, Practice and Policy:** The study recommended that in a move towards universal health coverage, it is necessary for health facilities to streamline the techno-organizational structures that strengthen the adoption of health system projects like EHR towards the provision of improved and quality health services.

**Keywords:** *Adoption, Electronic Health Records. Public Health Facilities, Kisumu County*

## **1.0 INTRODUCTION**

### **1.1 Background to the Study**

Electronic health records (EHRs) are the fundamental building blocks of any national health information system (Castro, 2009). A country with low acceptance of health systems implementation is bound to have poor quality of healthcare services and low economic growth, as productivity of citizens might be greatly affected when they fall sick and are not attended to as required. However, influenced by government policies to begin using new technologies, reception and adoption of health systems has allowed the process of technology diffusion to commence which ultimately determines the rate of change of productivity (Hall and Khan, 2002). As such, many countries including developing countries have realized that EHR can be considered as good solution for them to overcome most of their problems in healthcare delivery services (Hassibian, 2013).

However, serious problems continue to be experienced. Certain hospital cultures tend to resist technological changes which result to low adoption and use of technology, yet effective diffusion requires user acceptance. Resistance by users to transform from an existing health system to a new system such as from paper based health record (PBHR) to EHR system (Peansupap and Walker, 2005) is among the list of complex issues that various researchers have attempted to document. Multiple factors have attributed to low rate of adoption (Al-Aswad et al, 2013) which may range from individual, organizational to technological factors such as human skills, organizational structures, training, user confidence, culture, technical infrastructure, financial resources and coordination (Heeks, 2006; Jihayet al, 2009; Boonstra, 2014; I-TECH, 2015) among others. Several studies have also recognized that, despite the ever increasing interest in EHR implementation, the rate of adoption still remains low in many developing countries (Ajami *et al*, 2011; Njoroge, 2014; Chebole, 2015).

### **1.2 Problem Statement**

Manual PBHR system has been used for a long time to store large files of patient data (Njoroge, 2014). This has not been an efficient way to record and store data since there are many disadvantages associated: loss of cards, loss of files, untraceable file and time wasted trying to retrieve files. However, with the use of new technology in every walk of life, more hospitals are considering the use of EHR system in place of PBHR (Thakkar *et al*, 2006). EHR has distinct advantages over paper records which include: enabled access to medical records from remote locations, improved speed and ease of retrieval of records, avenues to flag abnormal results and the elimination of hand written prescriptions, which reduces the occurrence of prescription errors, greater work efficiency and streamlined workflow (Ohemeng *et al*, 2010; Gaylin *et al*, 2011; Akanbi *et al*, 2012). This enables health care workers to acquire, use and communicate high quality information about patients.

Successful use of EHR transforms the healthcare system and assists providers to deliver efficient and quality healthcare services to patients (Menachemi and Collum, 2001; Singh *et al*, 2013). However, despite the emerging evidence about the positive effects of EHR on the performance of hospitals (Boonstra, 2014), resistance to technological change among healthcare workers and various public health facilities is a major setback to realization of successful EHR adoption and provision of quality patient care due to several influencing factors that act as barriers to adoption

of EHR system. These factors range from technological, organizational to individual association (Heeks, 2006; Jhaet *et al*, 2009; Boonstra, 2014). This occurs when there is a system shift from the old manual system to the new electronic method. As a result, the pace of adoption among healthcare providers is slow (Ajami *et al*, 2011) and acceptance rate from one hospital to another widely varies, though still low.

Therefore, with the increasing resistance of hospitals to fully support technological change and increased limiting factors, employees tend towards being reactive to constant change (Reid, 2013) and given this, there is likelihood that few user groups adopt the new technology. Eventually, it is possible that very little is contributed to the well-being of the patients (Hall and Khan, 2002) as the qualities of services offered are deemed less satisfying. When this occurs, healthcare facilities are likely to be reluctant to implement the use of EHR systems due to persistent cultural resistance and poor organizational management which may lead to poor work performance among health workers, lack of job satisfaction, poor service delivery among other factors. This therefore results to a relatively low rate of adoption of EHR.

## **2.0 LITERATURE REVIEW**

### **2.1 Factors Influencing the Adoption of EHR in Public Health Facilities in Kenya**

The use of IT related infrastructure to support clinical data management has undergone significant evolution over the past 40-50 years. This includes the use of various electronic systems including EHR and related infrastructure to improve on quality of healthcare service delivery and workflow. In fact, the EHR system has been the ultimate goal for those who intend to appreciate the value of IT in the care of patients (Carter, 2006). As such, benefits cannot be realized without the adoption of the system either by users in the healthcare facilities or the respective hospitals (Najaftorkaman *et al*, 2014) since it occurs in two separate trajectories; starting from the primary care providers and then the hospitals (Castro, 2009).

However, in spite of the two existing adoption trajectories, several researches reveal that the adoption of EHR in hospitals has not been as per the required expectation. It is reported to be relatively low due to the variation in the levels of EHR implementation from one hospital to another. According to Bhounsule and Peterson (2016), the levels of EHR implementation can be categorized into nominal variables represented as; ‘not implemented’, ‘partially implemented’ or ‘fully/completely implemented’. Full implementation refers to the putting into practice of the use of all EHR systems across all departments within an organization, partial implementation takes place when parts of the EHR systems are gradually implemented alongside paper based system across all hospital departments whereas no implementation occurs when only paper based systems are applied across all existing departments in the hospital. This variation occurs due to several influencing factors that contribute to low adoption of the new technology. Therefore, this study seeks to lay a comprehensive focus on what and how technological, organizational and individual factors influence the adoption of EHR in public health facilities in Kenya.

### **2.2 Influence of Technological factors on EHR adoption**

Technological factors determine how the operations within a hospital setup is maintained and fast tracked using IT resources like EHR for improved service delivery. These EHR related infrastructure (hardware, software, network and related equipment) are key determinant to

successful implementation and adoption of the system (Juma *et al*, 2012) since they improve the general work performance output of the healthcare workers who interact with it frequently. Moreover, when positively incorporated by hospitals, reversed adoption decisions are mostly avoided, if not reduced (Castillo *et al*, 2010). However, it has not been fully harnessed by health care workers and hospitals in most developing countries, including Kenya, due to technological challenges that delay the adoption of EHR. Therefore, there was need to determine how technological factors: EHR related infrastructure, hardware-software compatibility, internet connectivity and power supply influence EHR adoption.

### **2.2.1 Lack of EHR related infrastructures and EHR adoption**

In most developed countries like Denmark, Finland, Netherlands and Sweden there has been growing availability of healthcare infrastructure like computers, printers, software and interconnectivity due to the financial support that they receive from their governments, hence high rate of adoption (Sood *et al*, 2008; Swanzy, 2015). Nevertheless, most developing countries lack adequate technical infrastructure that is required to handle the need of an EHR safely. Lack of infrastructure to support the requirement for health information is one of the major challenges to technology adoption (Des Roches *et al*, 2012). This state of infrastructure in healthcare is depicted by lack of basic hardware like computers, printers, spotty wireless coverage, low bandwidth for networking and severe redundancy (Laerum *et al*, 2001; Vishwanath & Scamurra, 2007; Staren, 2009; Boonstra & Broekhuis, 2010).

### **2.2.2 Hardware-Software incompatibility and EHR adoption**

EHR incompatibility occurs when the system components cannot operate satisfactorily within the same computer or different computers linked by a common network. It is likely that the system component can be compatible in a given hardware and incompatible in another. Therefore, the implementation of EHR is totally dependent on the complex and compatible working components of the hardware and software (Razi *et al*, 2011) as the operability requires additional functional devices to complement the system.

### **2.2.3 Lack of Internet connectivity and EHR adoption**

Internet connectivity is an important factor for progress of any nation. It is gradually improving in many parts of Africa (Oyeyemi, Gabarron & Wynn, 2014). Access to information can improve the quality of health care, communication among health care team members and other care partners (e.g., laboratory, radiology, and pharmacy) as well as with patients (Tang, 2003). Unfortunately, internet access is not evenly distributed across the globe and the penetration levels seems relatively low while even basic connectivity is still lacking in many developing regions (Pejovic *et al*, 2012). In fact, global statistics reported in 2011 that only 26% of individuals in developing world were connected to the internet.

### **2.2.4 Unstable Power supply and EHR adoption**

The vast majority of health facilities in developing countries tend to have no mains power and where available, such power is extremely unreliable or unstable, which may likely pose threat to unprotected electronic equipment (Blantz, 2008). Kenya has a relatively stable power supply as compared to other neighboring countries. The major sources of this energy is hydroelectricity and fossil fuel, although, diesel generators are occasionally used. However, generators rarely

operate for longer hours in a day since they are prone to abrupt and unannounced failure. As such, the potential to provide Uninterrupted Power Supply (UPS) may still be a challenge as it invariably affects the provision of any good ICT service like EHR (Achampong, 2012).

### **2.3 Influence of Organizational Factors on EHR adoption**

Organizational factors are internal influences that describe the characteristics of health care practice within a given health care facility. Institutions with strong organizational features tend to be receptive towards introduction of new technology (Yarbrough and Smith, 2007).

This is because of the large and stable human, organizational and financial capital that is provided, to sustainably manage technological projects. Health facilities in developing countries, with EHR systems can as well benefit from this strength. However, this still remains a challenge, especially in most hospitals in Kenya due to certain organizational barriers that contribute to low EHR adoption. This study laid key focus on factors like; financial resources, training support, technical expertise and human workforce, user involvement in the designing stage of technology, harmonized legal standards enforcement and social proximity. These will help to assess how technological factors influence EHR adoption.

#### **2.3.1 Lack of adequate financial resources and EHR adoption**

The cost of implementing an EHR project in hospitals in developing countries is considered to be one of the major challenges to its adoption in most health facilities (Xue & Liang, 2007). According to Odekunle et al, 2017, the cost of EHR implementation has been cited as one of the most frequently identified factors that limit EHR adoption. Studies have shown that low adoption of EHR in Sub-Saharan Africa has been associated with high cost of implementation due to hardware, software and training costs (al Shorbaji, 2008; Alverson *et al.*, 2009; Durrani, & Khoja, 2009; Aknbi *et al.*, 2012). The cost of computerized machines in most hospitals in developing countries tend to be more prohibitive and to those who can afford them, the culture of routine maintenance is yet another costly problem to deal with (Kanyua, 2015). Moreover, several researchers have clearly pointed out that lack or insufficient funds, lack of adequate budget and inadequate financial assistance, continue to be the most critical obstacles to adoption of an new technology like EHR (Amekuedee 2005; Ramana and Rao, 2003; Ramzan, 2004; Raza and Nath 2007; Quatab et al 2014). Yet, preventive and corrective maintenance is very important for any ICT equipment (Achampong, 2012).

#### **2.3.2 Lack of training Support and EHR adoption**

The introduction of a new technology innovation like EHR has various repercussions for potential users in health facilities. Most countries that have assimilated ICT training for clinicians, record a relatively high acceptance and actual use of EHR (Khan et al, 2012). This is because training increases awareness and confidence level as potential users are able to overcome technophobia while relating usage to expected benefits (Sahay & Walsham, 2006).

#### **2.3.3 Inadequate technical expertise & human workforce and EHR adoption**

Another challenge for EHR adoption in developing countries like Kenya is the issue of limited staff expertise and availability of healthcare workforce. According to Achampong, 2012, the numbers of staffs with desired level of IT literacy in EHR are not adequate; yet, the few who have undergone IT training are not involved in mainstream ICT related activities like EHR

design and implementation because the existing human resource post does not have a structure for ICT professionals. On the other hand, recruiting and retaining full-time informatics staff with experience is quite difficult (Alexandria et al, 2011). In most cases, hospitals may lack health IT staff without any justifiable reason and if available, they end up being overworked due to the multiple responsibilities that they are engaged in, preventing them from fully engaging on the implementation of any new technology implementation (Zakaria et al, 2010). Therefore, in order to meet the efficiency and effectiveness of EHR system use, health care facilities need to provide sufficient staff expertise and workforce that are reliable and full of capabilities, otherwise, the issue of low adoption of EHR system will persist.

### **2.3.4 Lack of user involvement in EHR system development and EHR adoption**

User involvement is a crucial factor of success, especially in the adoption and implementation of a new system (European Project Report, 2010). It is key to note that the healthcare workers, who are the potential users of the system, are considered in defining the usability and usefulness of EHR throughout the process in order to meet their needs and expectations efficiently. Otherwise, there are likelihood that the implementation of a new system like EHR may be met with a lot of user resistance coupled by issues of trust and continued preference to use the old system which may seem quite easy for them to handle patients' information.

### **2.3.5 Lack of harmonized legal standard enforcement and EHR adoption**

Another potential barrier to EHR adoption is the violation of patients' privacy which is an increasing concern, based on the nature of information shared among healthcare workers. The privacy and security of patient records is guaranteed through privacy legislative rules and regulations stipulated by the hospital management and healthcare worker code of conduct to protect against non-user access. A number of research conducted reveal that health workers regard this information as very important and would not easily relay into an electronic system as this would create legal issues (Boonstra and Broekhuis, 2010) or otherwise if entered, there are possibilities of security concerns as they are likely to be followed by those who are involved in the use of the system. Additionally, the policy makers involved in the development of this system do not enforce stringent measures to ensure safety and privacy of patient data (Menachemi and Collum, 2011).

### **2.3.6 Lack of social proximity to prior hospital adopted and EHR adoption**

Social proximity can be defined as the tendency for a given healthcare facility to form interrelations with those that are nearby in order to conform to the standard of growth like technology innovation. It represents hospitals belonging to same health system of similar social network (Angst et al, 2010). This plays a critical role in the health system as it is a key contributory factor to EHR adoption. It entails the exchange of information among different healthcare workers of the same social system causing rapid adoption of a new technology (Najaftorkaman et al, 2014).

## **2.4 Influence of Individual factors on EHR adoption**

### **2.4.1 Lack of Knowledge and skills in computer applications and EHR adoption**

Majority of health care workers in developing countries lack or have insufficient basic ICT knowledge or skills that are desired to effectively use the EHR systems (Alverson et al., 2009;

Bedeley & Palvia, 2014) and this may influence users' behavior to accept or reject the EHR systems. According to Ajami and Tadi, (2013), the developers of EHR tend to underestimate the computer knowledge and skills required from the healthcare workers, yet the system is not only seen complex but also in practice, is very complicated to be used. Additionally, the skills and speed of typing data into the system may be quite slow while others lack this completely. Lack of knowledge and skills in the use of computer technology among users are some of the factors that affect the adoption of EHR in health facilities (Kanyua, 2015). In fact, it hampers the full utilization of the system by health professionals.

#### **2.4.2 Poor Perception on Usability of EHR system and EHR adoption**

Usability is important in promoting both the widespread adoption and meaningful use of EHR (Johnson *et al*, 2011). The perception of users can best be explained on basis of perceived usefulness or ease of use of a system. For instance, perceived ease of use and perceived usefulness of the system are two key features that impact on individual's usability of the system. According to Davis (1985), people tend to use or not use a new technology system depending on the extent to which they believe that it will help them improve their work performance (Perceived usefulness), or completely free them from the attempt to use any form of effort to manage the system (perceived ease of use). Therefore, the perception of a new technology depends on how it is conceptualized, accepted and used efficiently.

#### **2.4.3 Lack of user satisfaction and EHR adoption**

According to Kidd (2006), user satisfaction is defined as the feeling that employees have on jobs based on past experience, current expectation and alternatives that exist in the future. Key elements of consideration contains employee's loyalty, benefits of using a new system, working condition, working time and reputation of the health facility based on the quality of service provided to the patients (Antoncic & Antoncic, 2011). Therefore, with any inception of technology innovation, users need to realize maximum satisfaction in their daily activities. This is evidenced by a streamlined workflow and improved work practices.

#### **2.5 Strategic organizational change and EHR adoption**

According to Pettigrew (1985), organizational change must take account of the organizational environments, the type of change under consideration and the development of change programs. This is underpinned by a three organizational features: context, content and process of change and the interactions between them. The three aspects were used by Pettigrew to organize the analysis of change as they provide the structure for considering a particular change that occurs in a given organization, as well as how it influences the adoption (Lin, 2003). The context of change refers to the healthcare facilities within which employees work (the change that facilities initiate), the content of change is the specific change of EHR from PBHR (the specific new technology innovation) while the process of change is the actions that the health workers take as they move from previous to its changed state.

Although organizational change is often about change in structures, hierarchy, technology, which leads to increased job satisfaction and organizational commitments, it is mainly facilitated by individual change (Buelens, 2006). According to Armenakis and Schaninger (2001), context, content and process tend to shape the reactions to change efforts by employees and the impact of



change becomes severe when the workers perceive the change as less acceptable. Therefore, the three aspects of change have a significant impact on organizational change and users' attitude as they are independent of each other. It is virtually impossible to neglect any of these dimensions in order to realize the potentiality of people's readiness to accept a new technological innovation.

## **2.6 Organizational structure and EHR adoption**

Generally, organizations tend to operate within a defined structure and have a socialization process that is determined by the governance of that institution (Roberts, 2013). In the case of a public health care facility, a defined structure may be limited to the characteristic location, size and type of the hospital as well as individuals' practices that depicts the socialization aspect that may influence the adoption of a new technology like EHR systems. In most cases, size is the major driving factor of any organizational structure which includes number of employees and infrastructural capacity that the health facility contains. On the other hand, the type of facility is determined by the various categories of the level of hospital as per the devolved county government system in Kenya.

## **3.0 METHODOLOGY**

The study adopted was cross-sectional design where it targeted 12 public hospitals with a sample size of 132 health care workers. Out of 132 health care workers who were sampled out from 12 public health facilities, 108 consented to take part in the study. Questionnaires with both structured and semi-structured questions were administered. Qualitative data was recorded, transcribed, coded then analyzed while quantitative data was coded and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics of frequencies and percentages were used to summarize the data while inferential statistics applied Chi-square to test for the association between the dependent and independent variables. A p value which was less or equal to 0.05 was considered significant.

## **4.0 RESEARCH FINDINGS AND DISCUSSION**

### **4.1 Socio demographic data profile**

A total of 108 respondents participated in the survey carried out between December 2016 and May 2017. Out of which 52.8% were males and 47.2% were females. With regard to age representation, 26-30 years accounted for 48.1%. Out of 108 respondents 56.5% reported to have been in the current position for between 1-5 years. Table 1 profiles the socio demographic information.

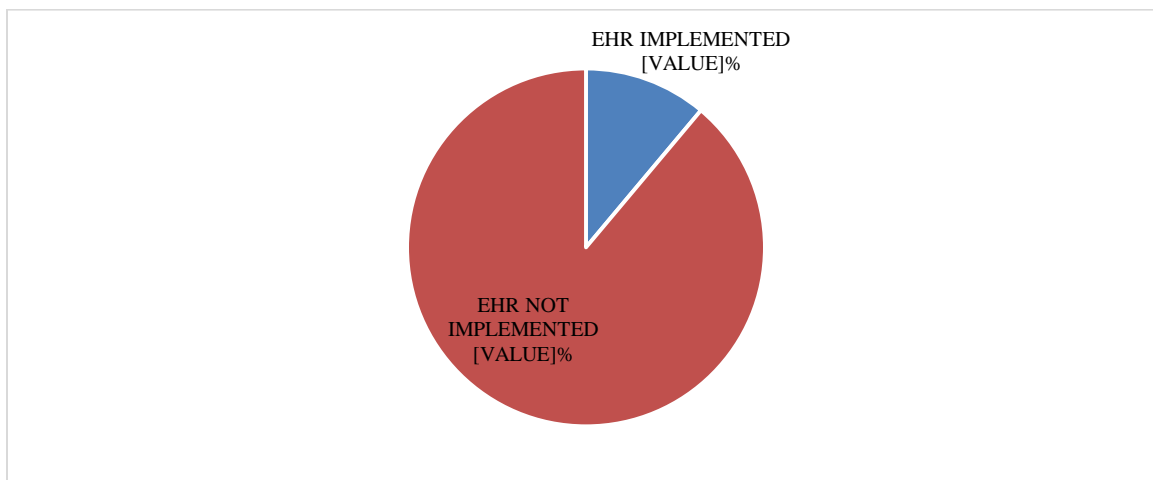
**Table 1: Socio-demographic characteristics in public facilities among levels of EHR**

Socio demographic characteristics	Description	Frequency (n=108)	Percentage (%)	95% C.I
Gender	Male	57	52.8	43.4-62.2%
	Female	51	47.2	37.8-56.6%
Age group (Years)	<25	3	2.8	-0.3-6.0%
	26-30	52	48.1	36.7-57.5%
	31-39	29	26.9	18.5-35.3%
	40-49	11	10.2	4.5-15.9%
	50+	13	12.0	5.9-18.1%
Level of Education	Certificate	5	4.6	0.7-8.6%
	Diploma	64	59.3	50.-68.6%
	Graduate	35	32.4	23.6-41.2%
	Post Graduate	4	3.7	0.10-7.3%
Current Department	Outpatient	25	23.1	15.2-31.1%
	Radiological	8	7.4	2.5-12.3%
	Laboratory	14	13.0	6.7-19.3%
	Pharmacy	15	13.9	7.4-20.4%
	Other	46	42.6	33.3-52.0%
Years in current position (in service)	<1	24	22.2	14.4-30.0%
	1-5	61	56.5	46.8-65.6%
	6-10	19	17.6	10.4-24.8%
	11+	4	3.7	0.10-7.3%

Source: Author, field data 2017

#### 4.2 Existing levels of EHR adoption

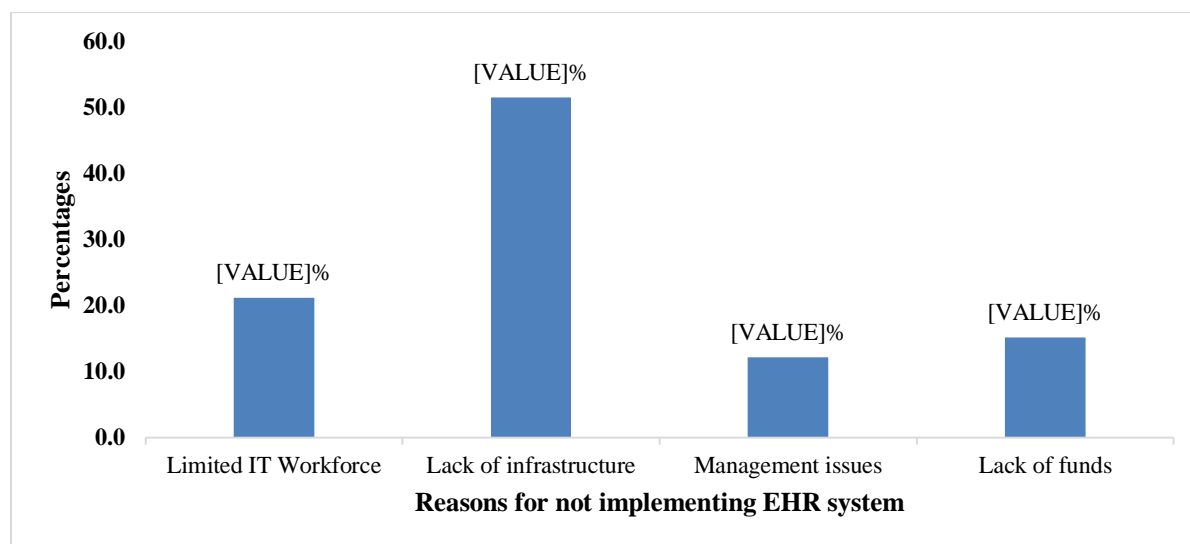
The study sought to identify the current EHR levels that exist in various healthcare facilities. Out of the 108 respondents 11.1% reported to be using EHR system while 88.9% have not implemented the use of the system. Figure 1 shows the levels of EHR implementation in various public health facilities.



**Figure 1: Percentage in Levels of EHR adoption**

Source: Author, field data 2017

Regarding facilities that had not adopted the use of EHR system, 59.7% reported that computers were mainly used for data transfer (input), 19.4% for data display (output) and 11.1% for data storage purposes. It was also reported that among the major reasons for lack of EHR implementation, 51.5% of the facilities lacked proper infrastructure to support the implementation of the system, 21.2% had limited IT workforce to use the system while 15.2% lacked funds to support the use of the system. This is illustrated in figure 2 below;



**Figure 2: Reasons for not implementing EHR systems**

Source: Author, field data 2017

### 4.3 Technological factors that influence the adoption of EHR

**Table 2: Availability Status of selected EHR related Infrastructure**

	Status of Hardware Availability			Status of Internet Connectivity			Status of EHR Software Availability		
	F	N.F	N.A	F	N.F	N.A	F	N.F	N.A
EHR Implemented	83.3%	16.7%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%
EHR Not Implemented	38.5%	26.0%	35.4%	53.1%	10.4%	36.5%	42.7%	13.5%	43.8%

Key: F=functional, N.F=nonfunctional and N.A = not available

Based on table 2, facilities with EHR implementation recorded a high rate of hardware availability (83.3%), internet connectivity (100%) and EHR software availability (100%). However, in facilities without EHR implementation, functionality rate was lower in hardware availability (38.5%) and in internet connectivity (35.4%) but EHR software was not available at

43.8%. There was a significant association between availability-functionality of hardware and EHR levels, ( $X^2(2,108) = 12.435, p < 0.05$ ), availability-functionality of internet connectivity and EHR levels, ( $X^2(2,108) = 13.997, p < 0.05$ ) and availability-functionality of EHR software and EHR levels, ( $X^2(2,108) = 18.647, p < 0.05$ ).

**Table 3: Distribution of Respondents based on the use of EHR related infrastructure**

	LEVELS OF EHR	Sample Size (N)	RESPONSES		STATISTICAL INFERENCE	
			STRONGLY AGREE/ AGREE	STRONGLY DISAGREE/ DISAGREE	CHI SQUARE VALUE, d.f	P VALUE
Full access to desktop/laptop everyday	EHR Implemented	108	91.7%	8.3%	8.383 (d.f =1)	0.004
	EHR Not Implemented		47.3%	52.7%		
Full access to printer whenever I want to use	EHR Implemented	108	83.3%	16.7%	20.146 (d.f =1)	0.000
	EHR Not Implemented		21.1%	78.9%		
Full access to camera when I need	EHR Implemented	108	8.3%	91.7%	1.229 (d.f =1)	0.333
	EHR Not Implemented		2.4%	97.6%		
Sufficient access to internet	EHR Implemented	108	81.8%	18.2%	18.028 (d.f =1)	0.000
	EHR Not Implemented		21.1%	78.9%		
Operating system compatible with hardware	EHR Implemented	108	83.3%	16.7%	5.743 (d.f =1)	0.017
	EHR Not Implemented		46.3%	53.8%		
Power is in constant supply	EHR Implemented	108	81.8%	18.2%	6.052 (d.f =1)	0.022
	EHR Not Implemented		42.5%	57.5%		

\*d.f = degree of freedom

From table 3, accessibility to desktop/laptop, printers, compatibility of hardware and sufficient internet was higher in facilities where EHR has been implemented and lower in facilities that lacked EHR implementation. A higher percentage of 91.7% and 97.6% of facilities with and without EHR implementation lacked full access to camera whenever they needed while 57.5% of the respondents in facilities with no EHR implementation confirmed that the supply of power was not constant. These results clearly show that there is a significant association between the

accesses to EHR related infrastructure and EHR levels. For instance, in the case of power, EHR levels are dependent on constant supply of electricity, ( $X^2(1,108) = 8.383, p < 0.05$ ).

**Table 4: Speed of Response in case of EHR system breakdown**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		FAST	SLOW	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	91.7%	8.3%	5.304	0.026
EHR Not Implemented		57.3%	42.7%		

\*d.f = degree of freedom

Out of 108 respondents, facilities with EHR implementation confirmed that 91.7% experienced a faster response by the replacement protocol team in case of EHR breakdown while in facilities without EHR implementation had 57.3% response rate. Therefore, there is a statistical significant relationship between the speed of response by the protocol team in case of system breakdown and EHR levels as shown in table 4.4, above.

#### 4.4 Organizational factors that influence adoption of EHR

The study sought to establish the extent to which financial resources influenced the use EHR system in various healthcare facilities. This was done to determine how far the management of hospitals could stretch to support the implementation of the EHR system. The results were as shown in table 5;

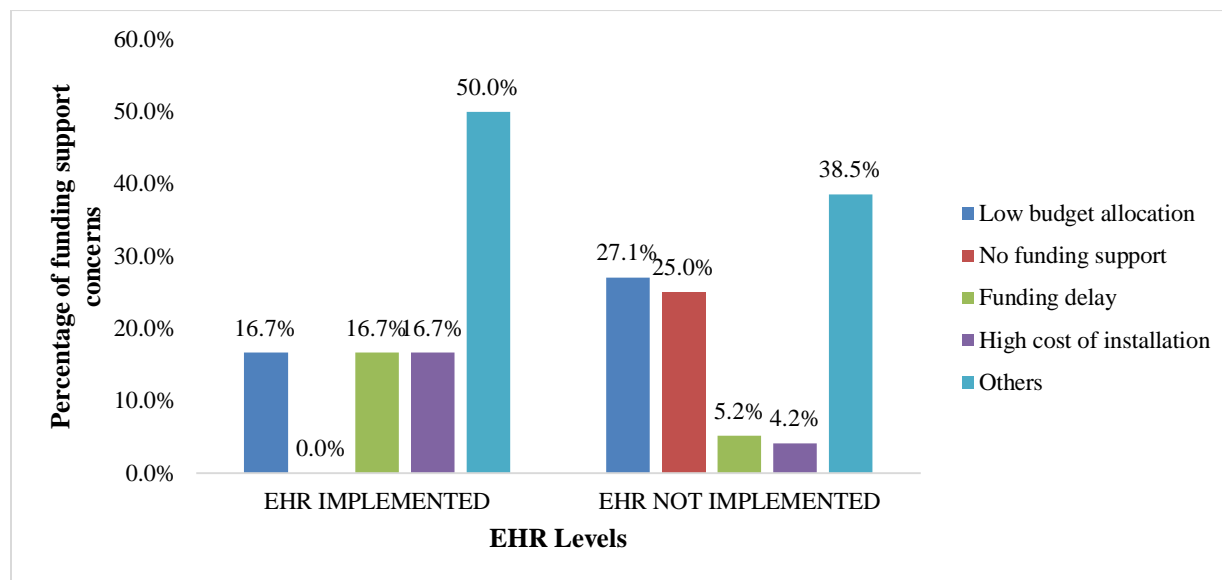
**Table 5: Respondents' response on influence of financial resources on EHR implementation**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES			STATISTICAL INFERENCE		
		LARGE DEGREE	NO DEGREE	SMALL DEGREE	CHI SQUARE VALUE, d.f	P VALUE	
EHR Implemented	108	66.7%	33.3%	0.0%	6.430	0.040	
EHR Not Implemented		69.8%	12.5%	17.7%	(d.f = 2)		

\*d.f = degree of freedom

Out of the 108 respondents, 66.7% and 69.8% of facilities with and without EHR implementation reported that the influence of financial resources greatly contributed to EHR implementation. The statistical analysis established that there is a relationship between the degree of financial resources and EHR levels, ( $X^2(2,108) = 6.430, p < 0.05$ ).

Some of the concerns that notably arose from the funding support of the EHR project in hospitals with EHR implementation reported that low budgetary allocation (16.7%), delay in funding disbursement (16.7%) and high cost of EHR installation (16.7%) were the key challenges. On the other hand, facilities that lacked EHR implementation confirmed that 27.1% suffered from low budgetary allocation while 25% received a relatively low funding support from external sources. Thus, the funding concerns that arose from the EHR projects were associated with the EHR levels, ( $X^2(4,108) = 10.170, p < 0.05$ ). This is shown in figure 3 below;



**Figure 3: Notable concerns from funding support of EHR projects**

Source: Author, field data 2017

#### 4.4.1: Distribution of respondents on training support by the hospital management

The study sought to find out the number of health care workers who received formal training on the use of EHR system especially in support by the hospital management. It further determined the extent to which the training support had an influence on the adoption of EHR in the facilities.

**Table 6: Distribution of respondents trained by the Healthcare facility**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		YES	NO	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	83.3%	16.7%	10.144	0.003
EHR Not Implemented		35.4%	64.6%	(d.f=1)	

\*d.f = degree of freedom

From table 6 above, 83.3% of facilities with EHR implementation received training in support by the hospital management while 64.6% of respondents in facilities without EHR implementation did not receive any training support by the management. This shows that the findings are statistically significant as training of respondents in support by the hospital management is associated with EHR levels, ( $X^2(1,108) = 10.144, p < 0.05$ ).

**Table 7: Distribution of response on technical training support by facility management**

	LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
			STRONGLY AGREE/AGREE/MODERATELY AGREE	STRONGLY DISAGREE/DISAGREE	CHI SQUARE VALUE, d.f	P VALUE
The cost of EHR training materials is considered too high to support staffs with little knowledge and skills of system	EHR Implemented	65	50.0%	50.0%	2.716 (d.f=1)	0.233
Training of staff members by the hospital management on the use of EHR system is selective	EHR Implemented	65	0.0%	100.0%	14.702 (d.f=1)	0.013
Most health care workers lack specialized training on the use of EHR system	EHR Implemented	65	0.0%	100.0%	0.985 (d.f=1)	1.000
Lack of training support by the hospital management contributes to low EHR adoption	EHR Implemented	65	0.0%	100.0%	12.840 (d.f=1)	0.017
Health facilities' management show reluctance to support the training of potential EHR users	EHR Implemented	65	85.7%	14.3%	10.130 (d.f=1)	0.026

\*d.f = degree of freedom

Out of 65 respondents who had not received any training support by the hospital management; facilities without EHR implementation, table 4.7 illustrates a number of challenges that contributed to lack of training support. It was reported that 88.9% of facilities without EHR system that the cost of EHR training materials was considered too high to support staffs with little knowledge, 90.5% of the respondents agreed that the hospital management only trained selected member of staff from selected departments, 88.9% approved that the low EHR adoption was mainly attributed by lack of training support by the hospital management while 85.7% stated that there was reluctance by the hospital management to support training of potential EHR users.

These findings were statistically significant as technical training support by the management is related to the EHR levels.

#### 4.4.2: Distribution of response to gauge the availability of human personnel with expertise to support EHR system

The study sought to establish the number of human personnel with required EHR expertise who were available to support the system in case of any breakdown per given department. The results were as shown in table 8

**Table 8: Availability of human personnel with expertise to support EHR system breakdown**

LEVELS OF EHR	OF	SAMPL E SIZE (n)	RESPONSE S			STATISTICAL INFERENCE	
			<1	1-5	>6	CHI SQUARE VALUE, d.f	P VALU E
EHR Implemented		108	33.3%	41.7 %	25.0 %	9.724 (d.f=2)	0.008
EHR Not Implemented			50.0%	49.0 %	1.0%		

\*d.f = degree of freedom

From table 8 above, 33.3% of facilities with EHR implementation and 50.0% without EHR system, reported that at least one human personnel with the necessary training expertise to support EHR system was available. This was closely followed by respondents who stated that they had at least 5 human personnel to support the system breakdown as shown by 41.7% and 49.0% in facilities with EHR implemented and without EHR implementation, respectively. Hence, there was a significant statistical association between the availability of human personnel and EHR levels, ( $X^2(2,108) = 9.724, p < 0.05$ ).

#### 4.4.3: Distribution of respondents' on users' system involvement

The study sought to determine whether and how users were involved in decision making during the introduction of the use of EHR system.

**Table 9: Response on users' involvement in decision making**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		YES	NO	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	75.0%	25.0%	5.105 (d.f=1)	0.024
EHR Not Implemented		40.6%	59.4%		

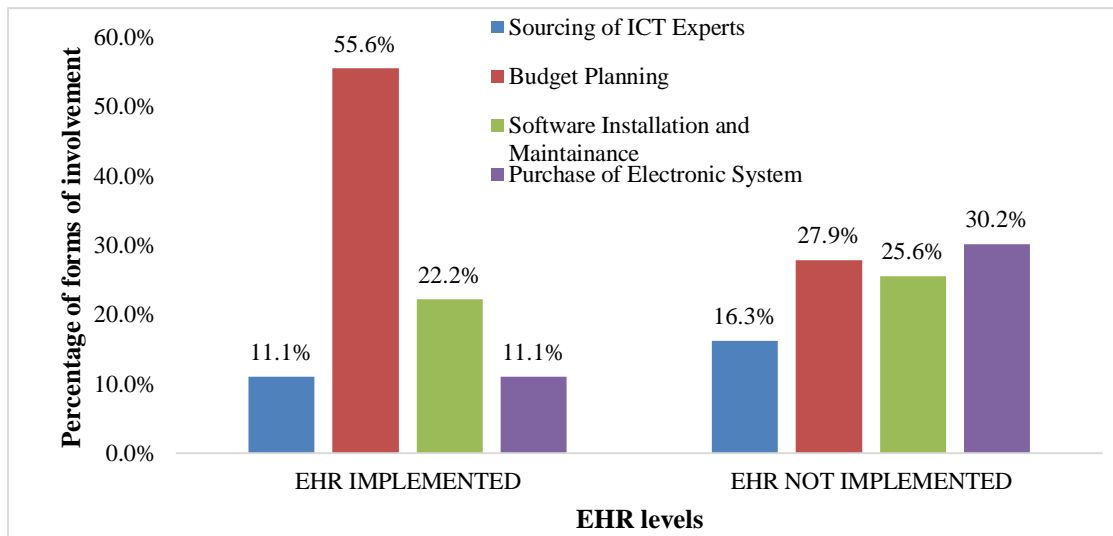
\*d.f = degree of freedom

From table 9, 59.4% of respondents from facilities with no EHR implementation confirmed that they were not involved in decision making while 75.0% of those with EHR implementation were involved in decision making during the introduction of the system. The results established a



strong significant association between users' involvement and EHR levels, ( $X^2 (1,108) = 5.105, p < 0.05$ ).

However, 75.0% and 40.6% of respondents with and without EHR system implementation respectively, who confirmed their involvement in the process were able to communicate their intentions clearly including; 55.6% and 27.9% proposed that there was need to develop a budget plan for the EHR project before installation, 22.2% and 25.6% stated that it was important to install compatible EHR software and ensure maximum maintenance while 11.1% and 30.2% suggested that there was need to purchase essential electronic systems before the onset of the project. Figure 4.3 illustrates the following results.

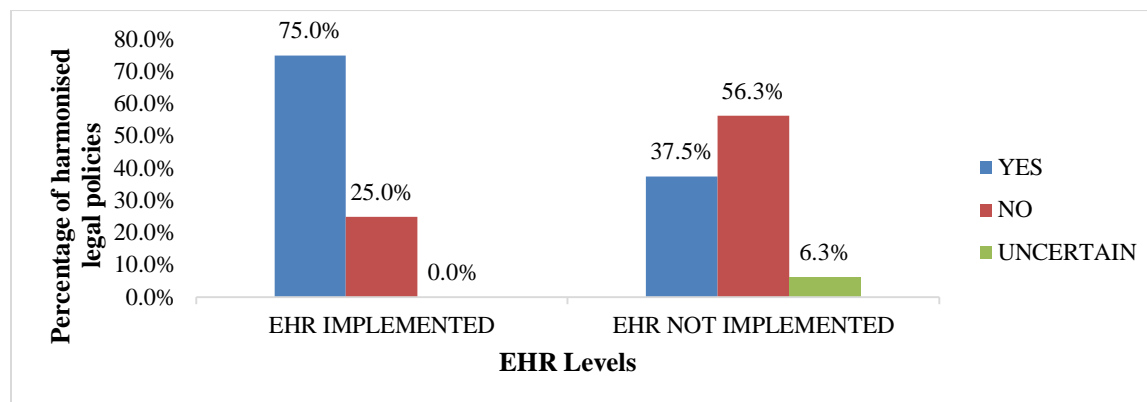


**Figure 4: Forms of involvement in decision making**

*Source: Author, field data 2017*

#### 4.4.4: Distribution of respondents' response on harmonized legal policies that safeguard patient records

The study sought to find out whether the existing legal policies had been harmonized to safeguard the patient records against access by non-users in the health facilities. The results shown in figure 4 indicate that 75.0% of facilities with EHR implementation had harmonized legal policies unlike 56.3% of facilities without EHR implementation whose policies had not been harmonized. These results are statistically significant as there is a relationship between the existence of harmonized legal policies and EHR levels, ( $X^2 (2,108) = 6.806, p < 0.05$ ). This is shown in figure 4, below;



**Figure 5: Status of harmonized legal policies in various Health facilities**

Source: Author, field data 2017

**4.4.6: Distribution of health care facilities in close range with regard to staffs’ interaction**

The study sought to identify the hospitals in close range based on the physical location and social proximity that could easily influence interaction of health care workers on their use of EHR system. This is shown in table 10.

**Table 10: Social proximity to health care facilities of prior adoption**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES			STATISTICAL INFERENCE	
		<1	1-5	6+	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	16.7%	66.7%	16.7%	8.458 (d.f=2)	0.015
EHR Not Implemented		53.1%	44.8%	2.1%		

\*d.f = degree of freedom

From the research findings, the study revealed that areas with EHR implemented facilities recorded 66.7% with 1-5 close proximity while those without had 53.1% with at least one hospital in close range. This shows that the results are statistically significant as there is an association between social proximity of health care facilities and EHR levels, ( $X^2 (2,108) = 8.458, p<0.05$ ).

**Table 11: Frequency of Interaction of health care workers**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		OFTEN	NOT OFTEN	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	83.3%	16.7%	4.767 (d.f=1)	0.029
EHR Not Implemented		50.0%	50.0%		

\*d.f = degree of freedom

On the other hand, the frequency of interaction of health care workers from one facility to another was reported to be higher in facilities with EHR (83.3%) as opposed to those without

(50.0%). This equally shows that the results obtained were statistically significant. Hence, there is a relationship between the frequency of interaction of healthcare workers from one facility to another and EHR levels, ( $X^2(1,108) = 4.767, p < 0.05$ ).

#### 4.5: Individual factors that influence adoption of EHR

The study sought to determine the Individual association linked to low adoption of EHR, based on individual's level of computer knowledge, usability of the system, perception and users' satisfaction of the system.

##### 4.5.1: Distribution of respondents' on their knowledge and skills in computer

Out of 108 respondents from different public facilities, 83.3% and 81.1% with and without EHR implementation confirmed that they had undergone training on the use of ICT related systems. The study sought to further establish their level of competence in computer applications. This was established as shown in table 12.

**Table 12: Level of competence in computer applications**

	LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES			STATISTICAL INFERENCE	
			STRONGLY AGREE/ AGREE	UNCERTAIN	STRONGLY DISAGREE/DISAGREE	CHI SQUARE VALUE, d.f	P VALUE
Competent in using Microsoft word	EHR Implemented	108	100.0%	0.0%	0.0%	2.357 (d.f=2)	0.308
	EHR Not Implemented		92.7%	3.1%	4.2%		
Competent in using Microsoft Excel	EHR Implemented	108	91.7%	0.0%	8.3%	2.460 (d.f=2)	0.292
	EHR Not Implemented		91.7%	6.3%	2.1%		
Competent in using Microsoft Access	EHR Implemented	108	66.7%	8.3%	25.0%	1.708 (d.f=2)	0.426
	EHR Not Implemented		75.0%	15.6%	9.4%		

\*d.f = degree of freedom

The study findings established that the staffs in facilities without EHR implementation were as competent in computer application as those with EHR implementation. However, these results were not statistically significant as there is no relationship established between staffs' competence in computer applications and EHR levels.

##### 4.5.2: Distribution of respondents on the Perceived usability of EHR System

The study sought to determine the significance of using the system based on the frequency of use, ease of learning, ease of documentation and work performance output in using the EHR system. Table 13 shows results on the frequency of using the system.

**Table 13: Distribution of respondents’ response on the frequency of EHR use**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		OFTEN	NOT OFTEN	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	83.3%	16.7%	7.448 (d.f=1)	0.006
EHR Not Implemented		41.7%	58.3%		

\*d.f = degree of freedom

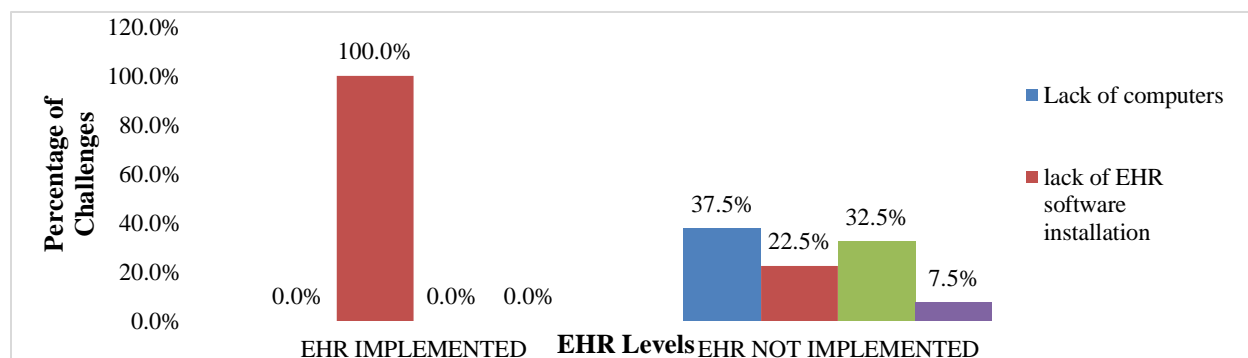
Based on Table 13, facilities with EHR reported to be using the system frequently (83.3%) unlike those without EHR implementation (58.9%). This is statistically significant as the frequency of using EHR system is linked to the EHR levels, ( $X^2(1,108) = 7.448, p<0.05$ ).

**Table 14: Distribution of respondents’ response on ease of learning EHR system**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		YES	NO	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	100.0%	0.0%	12.431 (d.f=1)	0.003
EHR Not Implemented		54.1%	45.9%		

\*d.f = degree of freedom

As shown in table 14, out of 108 respondents 100% with EHR implementation and 54.1 without EHR implementation confirmed that it was easy to learn how to use EHR system. However, 45.9% encountered certain challenges in learning to use the system. The key challenges among facilities without EHR implementation were; lack of computers (37.5%), lack of training expertise of EHR (32.5%) and lack of EHR software installation (22.5%). This is illustrated in figure 4.5 below. These findings illustrate that the ease of learning EHR system is associated with the EHR levels in facilities, ( $X^2(3,108) = 8.644, p<0.05$ ).



**Figure.6: challenges hindering the learning of EHR system**

Source: Author, field data 2017

**Table 15: Distribution of respondents' response on the ease of documentation using the system**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		EASY	NOT EASY	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	100.0%	0.0%	6.750 (d.f=1)	0.008
EHR Not Implemented		62.5%	37.5%		

\*d.f = degree of freedom

The results presented in table 4.15, show that 100% of facilities with EHR implementation and 62.5% of facilities without EHR implementation found it easy to document using the EHR system. This gives a statistically significant finding as the ease of documentation using EHR system is linked to the EHR levels, ( $X^2(1,108) = 6.750, p < 0.05$ ).

**Table 16: Distribution of respondents' response on work output using EHR system**

LEVELS OF EHR	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		HIGH OUTPUT	LOW OUTPUT	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	91.7%	8.3%	5.304 (d.f=1)	0.026
EHR Not Implemented		57.3%	42.7%		

\*d.f = degree of freedom

The table shows that respondents from facilities with EHR implementation (91.7%) and those without (57.3%) had a high rate of work output when EHR system was used as compared to paper based health record system. Therefore, there is a statistically significant association between the rate of work output in using EHR system and EHR levels, ( $X^2(1,108) = 5.304, p < 0.05$ ).

#### 4.5.3: Distribution of respondents on users' perception on EHR system

The study sought to determine the extent to which respondents agreed or disagreed with the statements related to individual's perception towards the use of EHR system. This is shown by results in table 17

**Table 17: Users' perception on use of EHR system**

		SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
			STRONGLY AGREE/AGR EE	STRONGLY DISAGREE/DI SAGREE/UNC ERTAIN	CHI SQUARE VALUE, d.f	P VALUE
EHR makes it easier to retrieve patients' historical records	EHR Implemented EHR Not Implemented	108	100.0% 66.7%	0.0% 33.3%	5.684 (d.f=1)	0.017
EHR reduces the time spent on each patient	EHR Implemented EHR Not Implemented	108	91.7% 49.0%	8.3% 51.0%	7.825 (d.f=1)	0.05
EHR enables easier access and sharing of data at multiple sites	EHR Implemented EHR Not Implemented	108	100.0% 67.7%	0.0% 32.3%	5.435 (d.f=1)	0.018
EHR has too many procedures to follow	EHR Implemented EHR Not Implemented	108	8.3% 45.8%	91.7% 54.2%	6.171 (d.f=1)	0.0.13
Transition to EHR interferes with my work performance	EHR Implemented EHR Not Implemented	108	16.7% 49.0%	83.3% 51.0%	4.488 (d.f=1)	0.034
EHR improves work flow	EHR Implemented EHR Not Implemented	108	91.7% 57.3%	8.3% 42.7%	5.304 (d.f=1)	0.026
EHR meet the specific needs of its users	EHR Implemented EHR Not Implemented	108	33.3% 62.5%	66.7% 37.5%	3.759 (d.f=1)	0.066
EHR is unreliable due to increased occurrence of security issues	EHR Implemented EHR Not Implemented	108	25.0% 45.8%	75.0% 54.2%	1.884 (d.f=1)	0.170
Users are satisfied with EHR usage compared to the old system	EHR Implemented EHR Not Implemented	108	83.3% 50.0%	16.7% 50.0%	4.767 (d.f=1)	0.029

\*d.f = degree of freedom

Out of 108 respondents, it was observed that EHR makes it easier to retrieve patients' records, reduces time spent on each patient, makes it easier to access and share data at multiple sites, improves work flow and that users are more satisfied with the use of EHR compared to the old system of paper based record system. On the other hand, there were disagreements among

respondents who stated that EHR has only few procedures to follow, transition to EHR does not interfere with work performance and that it is reliable without any security concerns. Therefore the results in table 17 are statistically significant as the users' perception on the use of EHR system is associated with the EHR levels.

#### 4.5.4: Distribution of respondents on users' satisfaction on use of EHR system

In table 18, the study sought to determine the level of users' satisfaction towards the use of the system.

**Table 18: Users' satisfaction on use of EHR system**

	SAMPLE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		YES	NO	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	100.0%	0.0%	12.079 (d.f=1)	0.001
EHR Not Implemented		46.9%	53.1%		

\*d.f = degree of freedom

Based on users' satisfaction on the use of EHR system, respondents from facilities with EHR implementation confirmed that they were 100% satisfied with the use of the system while those without were not satisfied (53.1%) with the use of the system. These findings are statistically significant since there is a moderately strong relationship between users' satisfaction on the use of EHR system and the levels of EHR system, ( $X^2(1,108) = 12.079, p < 0.05$ ).

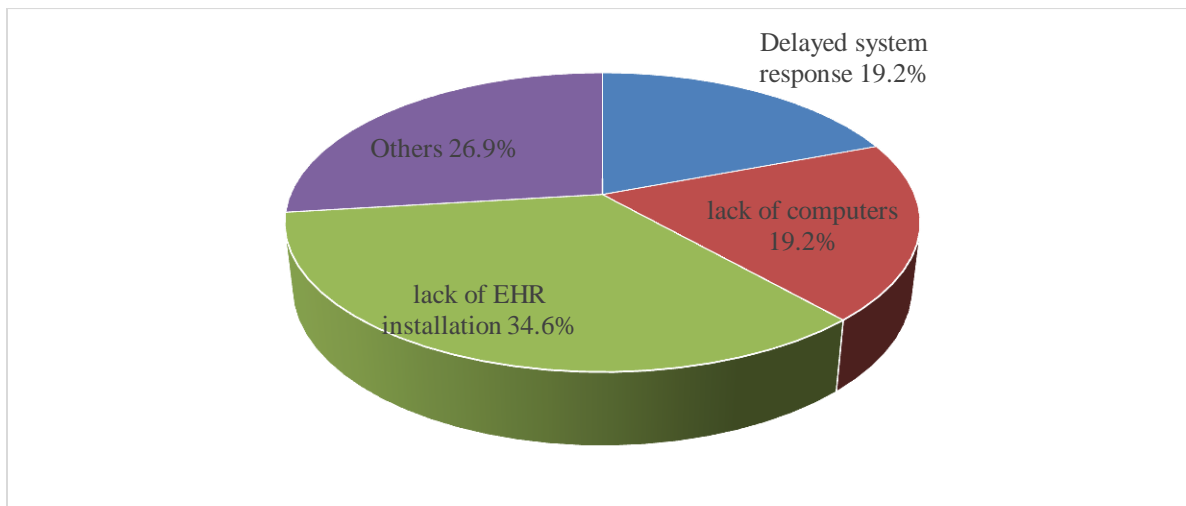
**Table 19: Level of satisfaction on the use of EHR system**

	SAMP LE SIZE (n)	RESPONSES		STATISTICAL INFERENCE	
		Very Satisfied/Satisfied	Less Satisfied/Moderately Satisfied/Not Satisfied	CHI SQUARE VALUE, d.f	P VALUE
EHR Implemented	108	83.3%	16.7%	9.164 (d.f=1)	0.002
EHR Not Implemented		37.5%	62.5%		

\*d.f = degree of freedom

Among respondents who expressed their satisfaction, 83.3% from facilities with EHR implementation revealed that they were highly satisfied in using the system as opposed to 62.5% who were not satisfied. These findings are statistically significant as there is a statistically significant relationship between the level of satisfaction on the EHR use and the levels of EHR implementation ( $X^2(1,108) = 9.164, p < 0.05$ ).

Those who were not satisfied expressed their dissatisfaction in the use of the system owing to certain key challenges; delay in system response, lack of computers and lack of EHR software installation in some computers. This is shown in figure 6.



**Figure 6: Reasons for non-satisfaction in the use of EHR system**

*Source: Author, field data 2017*

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

In conclusion, the study established that there are two existing levels of EHR implementation; EHR fully implemented and not implemented. Among these facilities, three major categories of factors influenced the adoption of EHR system in public health facilities; technological, organizational and certain individual associations (perceived usability and satisfaction on system use) which were the key contributing factors to low rate of EHR adoption. The results reveal that these factors are statistically significant to the existing levels of EHR implementation. In addition, the adoption of EHR system in public health facilities in Kisumu County has not completely attained its maximum potential as majority of the facilities are still struggling to accept the techno-organizational change that has been instituted to improve service delivery for a holistic health care.

### Recommendations

Based on the results and conclusions, the study recommends the following:

Public health facilities need to liaise with the Ministry of ICT and County Government to increase supplies of EHR related infrastructure and budgetary allocation on EHR projects to overcome technological and financial obstacles. Increase EHR technical experts and provide training support of the system to run and maintain the system in order to address any associated error timely. Harmonization of legal policy framework and regulations for EHR system interoperability especially across facilities in one region for effective healthcare service deliver. The system developers and hospital management need to engage the users throughout the stages of EHR implementation for identification of likely difficulties to be faced in the system use.



## References

- Achampong, E.K., 2012, 'The State of information and communication Technology and Health Informatics in Ghana', *Online Journal of Health Informatics*, 4(2)
- Akanbi, M., Ocheke, A., Agaba, P., Daniyam, C., Agaba, E., Okeke, E., and Ukoli, C., 2012, 'Use of Electronic Health Records in Sub-Saharan Africa: progress and Challenges', *Journal Med Trop*, 14(1), 1-16.
- Al-Aswad, A.M., Brownsell, S., Plammer, R., Nichol, J.P., & Altuwajiri, M.M., 2008, 'Electronic-health in Saudi Arabia: Just around the corner', *Saudi Med Journal*, 29(2), 171-178.
- Aldosari, B., and Abdul-Aziz, K.S., 2017, 'Patients 'safety in the era of EMR/EHR automation', *Journal of health informatics*, 9 (2017), 230-233
- Angst, C.M., Agarwal, R., Sambamurthy, V., and Kelly, K., 2010, 'Social Contagion and Information Technology Diffusion: The adoption of electronic Medical Records in US Hospitals', *Management Science* (56:8), 1219-1241.
- Awokola, B.I., Abioye-Kuteyi, E.A., Otoru, O.O., Oyegbade, O.O., Awokola, and E.O., Awokola, O.A., 2012, Practical challenges of setting up an electronic medical record system in Nigeria tertiary hospital: The Wesley guild hospital experience', *Middle East Journal of Family Medicine*, 7, 37-42.
- Bagozzi, R., Davis, F., and Warshaw, P., 1992, 'Extrinsic and Intrinsic motivation to use computers in the work place', *Journal of applied social psychology*, 22(14), 1111-1132
- Bates, D.W., and Gawande, A.A., 2003, 'Improving Safety with Information Technology' *N Engl J Med* 348, 2526-2534.
- Boonstra, A., Brekhuis, M., 2010, 'Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions', Viewed on 24 August 2016
- Bedeley, R.T., and Palvia, P., 2014, 'Study of the issues of E-Health in Developing Countries: The Case of Ghana', Twentieth Americas Conference on Information Systems.
- Carter, J. H., 2006, Infrastructure and Supporting Technologies: What is Electronic Health Record, USA, American College of Physicians.
- Chapli, B., Meloni, S., Esen, G., Jolayemi, T., Banigbe, B., and Adeola, J., 2015, 'Scale-up of networked HIV treatment in Nigeria: Creation of an integrated electronic medical records system, *International journal of Medical Information*, 84, 58-68
- Chebole, G.C., 2015, 'Factors influencing adoption of electronic medical record systems in public health facilities in Kenya', Master's Thesis, Department of Extra-Mural Studies, University of Nairobi.
- Cresswell, K., Morrison, Z., Crowe, S., Robertson, A., Sheikh, A., 2011, 'Anything but engaged: user involvement in the context of a national electronic health record implementation', *Journal of Informatics in Primary Care*, 19, 191-206.
- Des Roches, C.M., Worzala, C., Joshi M.S., Kralovec, P. D., and Jha, A.K., 2012, 'Electronic Health Record Systems: Small, Nonteaching and Rural Hospitals Continue to be slow in adopting', 31(5), 1092-1099.
- Ford, E. W., Menachemi, N., and Phillips, T.M., 2006, 'Predicting the Adoption of Electronic Health Records by Physicians: When will Health care be paperless?' *Journal of American Medical Informatics Association*, 13(1), 106-112

- Furukawa, M.F., King, J., and Patel, V., 2015, Physician attitudes on ease of use of EHR functionalities related to meaningful use
- Gabbay, J., and LeMay, A., 2004, 'Evidence based guidelines or collectively constructed 'mindfulness': Ethnographic study of Knowledge management in primary care', *British Medical Journal*, 329, 1013
- Gaylin, D.S., Moiduddin, A., Mohamoud, S., Lundeen, K., Kelly, J.A., 2011, 'Public Attitudes about Health Information Technology and its Relationship to Health care Quality, Costs and Privacy: Health Services Research', 920-938
- Hasanain, R.A., Vallmuur, K., and Clark, M., 2015, 'Electronic Medical Record System in Saudi Arabia: Knowledge and Preferences of Healthcare Professionals', *Journal of Health Informatics in Developing Countries*, 9 (1).
- Hassibian, M.R., 2013, 'Electronic Health Record Acceptance and Implementation in Developing Countries: Challenges and Barriers', Department of medical informatics, Mashhad University of Medical Sciences.
- Hayrinen, K., Saranto, K., and Nykanen, P., 2008, 'Definition, structure, content, use and impacts of electronic health records: A review of the research literature, 77(5), 291-304.
- Jha, A.K., Bates, D.W., Jenter, C., Oray, E.J., Zheng, J., Cleary, P., and Simon, S.R., 2009, 'Electronic Health Records: Use, barriers and satisfaction among physicians who care for black and Hispanic patients', *Journal of Evaluation in clinical Practice*, 15, 153-163.
- Jimoh, L., Pate, M.A., and Schulman, K.A., 2012, 'A model for the adoption of ICT by health workers in Africa', *International Journal of Medical Information*, 81, 773-781
- Johnson, C.M., Johnson, D., Crowley, K., Culbertson, H., Rippen, H.E., Damico, D.J., Plaisant, C., Zayas-Caban, T., 2011, EHR Usability Toolkit: A background Report on Usability and Electronic Health Records Prepared for: Agency for Healthcare Research and Quality U.S.
- Kanyua, N.H., 2015, 'Factors influencing the adoption of ICT in Public hospitals in Nairobi', Master's Thesis, Department of Extra-Mural Studies, University of Nairobi.
- Khan, S.Z., Shahidi, Z., Hedstrom, K., and Andersson, A., 2012, 'Hopes and Fears in Implementation of Electronic Health Records in Bangladesh', *The Electronic Journal of Information systems in Developing Countries*, 54.
- Klosek, J., 2014, 'Exploring the Barriers to the More Widespread Adoption of Electronic Health Records', *Notre Dame Journal of Law, Ethics & Public Policy*, 25 (2), 11.
- Kumar, S., Aldrich, K., 2010, 'Overcoming barriers to electronic medical Records (EMR) implementation in US healthcare system: a Comparative Study', *Health Informatics Journal*, 16, 306-318
- Ludwick, D., and Doucette, J., 2009, 'Adopting Electronic Medical Records in Primary Care: Lessons learned from health information systems implementation experience in seven countries', *International Journal of medical Informatics*, 78 (1), 22-31.
- Luna, D., Almerares, A., Mayan, J.C., Gonzalez de Quiros, F., Otero, C., 2014, 'Going Beyond Pilot Practices to Sustainable Implementations: A review of the current Challenges', *Journal of Health Informatics in Developing Countries*, 20, 3-10.
- Marques, A., Oliveira, T., Dias, S.S., and Martins, M.F.O., 2011, 'Medical Record System Adoption in European Hospitals', *Electronic Journal of Information Systems Evaluation*, 14(1), 89-99.

- Meade, B., Buckley, D., and Boland, M., 2009, 'What Factors Affect the use of Electronic Patient Records by Irish GPs', *International journal of Medical informatics*, 78(8), 551-558.
- Menachemi, N., and Collum, T.H., 2011, 'Benefits and Drawbacks of electronic Health Record systems', *Risk management and Healthcare Policy*, 4, 47-55, accessed from <http://doi.org/10.2147/RMHP.S12985>.
- Menachemi, N., Langley, A., and Brooks, R. G., 2007, 'The use of information technologies among rural and urban physicians in Florida', *Journal of Medical Systems*, 31, 483-488,
- Menachemi, N., Matthews, M.C., Ford, E.W., and Brooks, R.G., 2007, 'The Influence of Payer Mix on Electronic Health Record Adoption by Physicians', *Health Care Management Review*, 32(2), 111-118.
- Menachemi, N., Powers, T., Au, D.W., and Brooks, R.G., 2009, 'Predictors of Physician satisfaction among electronic health records system users.
- Muga, R., Kizito, P., Mbayah, M., and Gakuruh, 2004, 'Overview of Health System in Kenya', *Ministry of Health Report*, 2, 13-27.
- Muhammad, A., Emmert, C., McAlpine, A.D., Tarn, J.M., and Islam, K.N., 2011, 'Electronic Health Records (EHR) Implementation and Post Implementation Challenges', *Transactions of the International Conference on Health Information Technology Advancement*, Accessed from [http://scholarworks.wmich.edu/ichita\\_transactions/7](http://scholarworks.wmich.edu/ichita_transactions/7)
- Najaftorkaman, M., Ghapanchi, A.H., Talaei-Khoei, A., and Ray, P., 2014, 'A Taxonomy of Antecedents to User Adoption of Health Information Systems: A synthesis of Thirty Years of Research', *Journal of the Association for Information Science and Technology*, 2318.
- Njoroge, C., 2014, 'Factors influencing adoption of electronic health record systems in small private health facilities', *Master's Thesis*, Department of Extra-Mural Studies, University of Nairobi.
- Odekunle, F.F., Odekunle, R.O., and Shankar, S., 2017, 'Why Sub-Saharan African lags in electronic health record adoption and possible strategies to increase its adoption in this region', *International Journal of Health Sciences*, 11(4)59-64
- Ohemeng-Dapaah, S., Pronyk, P., Akosa, E., Nemser, B., and Kanter, A., 2010, 'Combining vital events registration, verbal autopsy and Electronic Medical Records in rural Ghana for improved health services delivery', *Health Technology Information*, 160, 416-420.
- Oluoch, T., Santas, X., Kwaro, D., Were, M., Biondich, P., and Bailey, C., 2012, 'The effect of electronic medical record based clinical decision support on HIV care in resource-constrained settings', *A systematic review, International Journal of Medical Information*, 81, 83-92.
- Oyeyemi, S.O., and Wynn, R., 2014, 'Giving cell phones to pregnant women and improving services may increase primary health facility utilization: a case study of Nigerian project', *Reproductive Health*, 11(1), 8.
- Palvia, P., Lowe, K., Nemati, H., and Jacks, T., 2012, 'information technology issues in healthcare: hospital CEO and CIO perspectives', *Communications of the Associations for Information Systems*, 30(19), 293-312.

- Pantuvo, J.S., Naguib, R., and Wickramasinghe, N., 2011, 'Towards implementing a national wide electronic health record System in Nigeria', *International Journal of Health care delivery reform initiatives*, 3, 39-55.
- Pettigrew, A. M., Woodman, R. W., & Cameron, K. S., 2001, 'Studying organizational change and development: Challenges for future research', *Academy of management journal*, 44 (4), 697-713.
- Qureshi, Q.A., Shah, B., Najeebullah, Kundi, G.M., Nawaz, A., Miankhel, A.K., Chrishti, K.A., Qureshi, N.A., 2013, 'Infrastructure Barriers to e-health implementation in Developing Countries', *European Journal of Sustainable Development*, 2 (1), 163-170
- Randeree, E., 2007, 'Exploring Physician adoption of EMRs: A multi-case analysis', *Journal of Medical Systems*, 31, 489-496.
- Schmid, I.K., and Syarstab, B.L., 2002, 'nurse –physician Communication and Quality of Drug use in Swedish nursing homes', *social science medical journal*, 54(12), 1767-1777.
- Simon, S.R., McCarthy, M.L., Kaushal, R., Jenter, C.A., Volk, L.A., Poon, E.G., Yee, K.C., Oray, E.J., Williams, D.H., Bates, D.W., 2008, 'Electronic health records: which practices have them, and how are clinicians using them?', *Journal of Evaluation in Clinical Practice*, 14, 43-47
- Sinha, P.S.G., Bendale, P., Mantri, M., Dande, A., 2013, *Electronic Health Records: Standards, Coding systems, Frameworks and Infrastructures*, Wiley-IEEE Press.
- Singh, B., and Muthuswamy P., 2013, 'Factors influencing the adoption of electronic health records by nurses'. *World Applied Sciences Journal*, 28 (11), 1531-1535
- Sood, S.P., Nwabueze, S.N., Mbarika, V.W.A., Prakash, N., Chatterjee, S., Ray, P., and Mishra, S., 2008, 'electronic medical records: a review comparing the challenges in developed and developing countries', Hawaii International Conference on System Sciences, Proceedings of the 41<sup>st</sup> Annual, 248-248.
- Sun, Z., 2013, 'User Involvement in System Development Process', International Conference on Computer Science and Electronics Engineering, Department of Information Science and Technology, Tianjin University of Finance and Economics.
- Tang, P.C., 2003, 'Key capabilities of an electronic health record system', accessed on from <http://www.nap.edu/openbook/N1000427/html/index.html>.
- Tang, P.C., and McDonald, C.J., 2006, *Electronic health record systems, Biomedical Informatics: Computer applications in health care and biomedicine*, New York, Springer, 447-475.
- Terry, A.L., Thorpe, C.F., Giles, G.G., Brown, J.B., Harris S.B., Reid, G.J., Thind, A., and Stewart, M., 2008, *Implementing Electronic Health Records, Canadian Family Physicians*, 54, 730-736
- Venkatesh, V., and Davis, F., 1996, 'A critical assessment of potential measurement biases in the technology acceptance model: Three experiments', *International Journal of Human Computer Studies*, 45(1), 19-45.
- Vishwanath, A., and Scamurra, S.D., 2007, 'Barriers to adoption of electronic health records: using concept mapping to develop a comprehensive empirical model', *Health Informatics Journal*, 13, 119-134
- Wagner, E. H., 2000, 'The role of patient care teams in chronic disease management', *Biomedical Journal*, 320(7234), 569-572.

Williams, F., and Boren, S.A., 2008, 'The role of electronic medical record in care delivery in developing countries', *International journal of information management*, 28, 503-507.

World Health Organization, 2006, E-Health tools and Services: Global Observatory for eHealth, *World Health Organization*