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Original Article

### Uptake of Electronic Medical Record System by Health Workers in Selected Public Hospitals in Kiambu County, Kenya

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#### Keywords:

Electronic Medical Record System, Uptake, Healthcare Workers, Public Health Facility, Patient Information, Technology.

Electronic Medical Records (EMRs) are now exerting a more significant impact on healthcare industry than before. The objective of this study was to find out how public hospitals in Kiambu County were providing health care services using the health information technology. A simple random sampling technique was employed to select 359 participants who met the inclusion criteria out of the entire population of health workers in Kiambu county public facilities. Data was collected using structured and semi structured questionnaires. The study found that majority of respondents were using EMRs during the time of the study. Most of the respondents with internet connectivity utilized the EMRS. Further analysis showed that internet connectivity was 5.3 times more likely to utilize EMRS. The study found that most respondents aged between 40-44 years were utilizing EMRS followed by 30-34 years and 20-24 years. Additionally, more male healthcare workers were utilizing EMRS. Healthcare workers' who perceived patients' information as secure while using electronic medical record system were more likely to utilize EMRS. Although most healthcare workers disagreed that EMRS takes less time retrieving patient information, the respondents who indicated that the speed in retrieving patient's information was very good were three times more likely to utilize electronic medical record system. Hospital having a power backup system in place or not did not influence the overall uptake of EMRS. The study revealed that at least 89.6% of the healthcare workers utilizing EMRS disagreed that they had adequate knowledge and skills on EMRS operation, this was not significantly associated with uptake of EMRS. In conclusion, most health facilities in Kiambu County are utilizing EMRs with the Ministry of Health at the national and county government required to facilitate continuous training for health workers to promote EMR uptake.

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## INTRODUCTION

Electronic Medical Records (EMR) is key in current healthcare institutions since it is concerned with the overall patients' information management including patient's clinical history, laboratory results, drugs prescription and follow-up records. Proper patient information management is an important component of patient care. If the health information is not properly managed, it can negatively affect patients' care, making them lose trust in the services offered, thereby affecting work performance (Nzuki and Mugo, 2014).

Since April 2014, the increase in healthcare providers from 3% to 97% in England allowed patients to book appointments and order prescriptions. England health system had committed to make patients' records 'largely paperless' by 2020. EMR contains information about histories of patients, their health and lifestyles which is accessible to all health care providers and to patients (NHS, 2017). In 2017, in the US, about 96% of non-federal acute care health facilities and 86 % of office-based clinicians had adopted a "certified" EMRs. 80% of health facilities and 54% of clinician offices had adopted an EMR with advanced capabilities, like been able to track patient social-demographics, essential drugs, store health providers' notes, and track orders of medications, lab tests, and results of imaging (Holmgren, 2021).

According to Weeks (2013), African countries have not been successful in the EMRs uptake. Most healthcare workers still have not realized the importance of the EMR since there is slow uptake throughout the healthcare industry and they face several challenges. Weeks (2013) observed that health providers' beliefs, perceptions and their culture are crucial when adopting EMRs. This exposes cultural attributes which are deeply engrained in health providers and suggests a managed approach. This indicates how technology can be integrated into hospitals with less disruptions to health workers' way of work, that is, the utilization of paper work (Weeks, 2013).

Malawi and Ghana made attempts in implementation of national EMRs. However, challenges like lack of support by the government and inadequate necessary infrastructure, lack of continuous supply of electricity are unavailable and healthcare workers' resistance made these projects unsuccessful (Luna et al, 2014). In South Africa, the implementation of EMRs by different vendors presents a challenge as these systems are built with different underlying database architectures, and they often fail to communicate and share information with each other. Also, while these systems have been implemented in some areas, more than half of the public hospitals in South Africa still use manual filing system (Weeks, 2013).

According to Chebole(2015), HIV donor programs introduced open source EMR systems in

more than 600 Kenya clinics. In 2012, I-TECH designed and developed EMRs, Kenya EMR, to support the management of HIV/AIDS. Kenya EMR is built on the Open MRS platform. I-TECH supported Kenya EMR implementation in over 300 hospitals throughout Kenya, one of the largest open sources of roll outs of EMR in Africa (Chebole, 2015). Despite Kiambu County having good mobile network coverage estimated at 98%, EMR has only been established in levels 5 and 4 facilities and a few level-3 facilities. Most record of patients in the county are still documented on manual medical records despite major inherent shortcomings with this method. Limited studies have been done to ascertain the uptake of EMR within the County and how specifically the attitude of healthcare workers play a role in this. The study will be very important to both the national government, county government and other important stakeholders like NGOs in targeting health policies, making informed decisions and measures to support information technology. Resource allocation will also be pegged on the fact that the EMRs is crucial and of importance to the health care organization

### **Electronic Medical Record System**

Uptake of electronic medical record system is the measure of acceptance of the digitalized health information technology. EMR uptake among doctors, clinical officers, nurses, pharmacists, laboratory technologists and other health professionals is crucial (Moh & Mohamad, 2005). The 21st Century Cures Act, passed in 2016 to promote the use of ERs overall, requires that all health care providers make electronic copies of patient records available to patients, at their request, in machine-readable form. Transmission of health information between health institutions, health institutions and patients, health institution and third parties such as insurance companies, patients and health institutions are negatively affected if telecommunication and internet penetration is low, Muchangi and Nzuki (2014). Access to a computer and printer is one of the minimum specifications for the EMR system (Chebole, 2015).

## **METHODS AND MATERIALS**

### **Data Collection**

This study adopted a descriptive cross-sectional research design that used both quantitative and qualitative methods. The study target population consisted of healthcare workers who have worked in the county for more than one year. The study population is the health professionals i.e., the medical officers, clinicians, pharmacists, laboratory technologists, health information officers and nurses in public health facilities who use EMRs. The sample were selected using simple random sampling technique. Cochran, (1977) formula,  $nf = n / (1+n/N)$ , was used to calculate the sample size (n) for population less than 10,000 since Kiambu county has approximately 2,703 health workers. This gave a sample size of sample size of 336 which was adjusted by 10% to cater for non-response that totalled to 370.

Data collection was done using structured questionnaires that contained questions on; socio-demographic characteristics of respondents, individual characteristics influencing EMRS uptake, technological factors influencing EMRS uptake, organizational factors influencing EMRS uptake, uptake of Electronic Medical Record system. Of 370 questionnaires administered to respondents, 359 were filled and collected. The validity of the tool was checked in terms of constructing the questionnaire and what the questionnaire entailed. Content related validity is ideal for this study since it is consistent with the study objectives. The study used internal consistency methods to strengthen the instruments reliability in addition to utilizing the Cronbach alpha to measures the internal consistency of results across the items. Therefore, a response rate was 97.0% was achieved.

### **Logistical and Ethical Considerations**

Permission to carry out the study was sought from; Kenyatta University Graduate school, Kenyatta University Ethics and Review Committee (KUERC), National Council for Science and Technology Innovation (NACOSTI), Kiambu County Government-Health Department

as well as the management of the various public health facilities involved in the study. All the respondents were asked for their consent before participating in the study. The respondents were also briefed on the purpose of the study and assured of anonymity before proceeding to fill the questionnaires voluntarily.

### Data Analysis

Field data was analysed using SPSS version 21. Since majority of the study's data was quantitative, descriptive statistics were primarily used to summarize them showing the individual characteristics of the health workers, the technological factors, organizational factors, and uptake of EMR system. Thematic data analysis was used to present the study's qualitative data that included; the challenges encountered by

respondents while using EMRS as well as suggestions by respondents on EMRs use can be improved.

## RESULTS

### Socio-Demographic Characteristics of the Respondents

Most of the respondents were between the ages of 25 and 29 at 33.1%. Majority were female (61.6%). More than half of them had attained college education at 55.4%. Slightly less than quarter at 24.0% of respondents were clinical officers while 21.2% were nursing officers and a similar percentage (21.2%, were health records officers. Additionally, 48.2% and 30.4% had a working experience of between 1-4 years and 5-9 years respectively.

**Table 1: Socio-demographic characteristics of respondents**

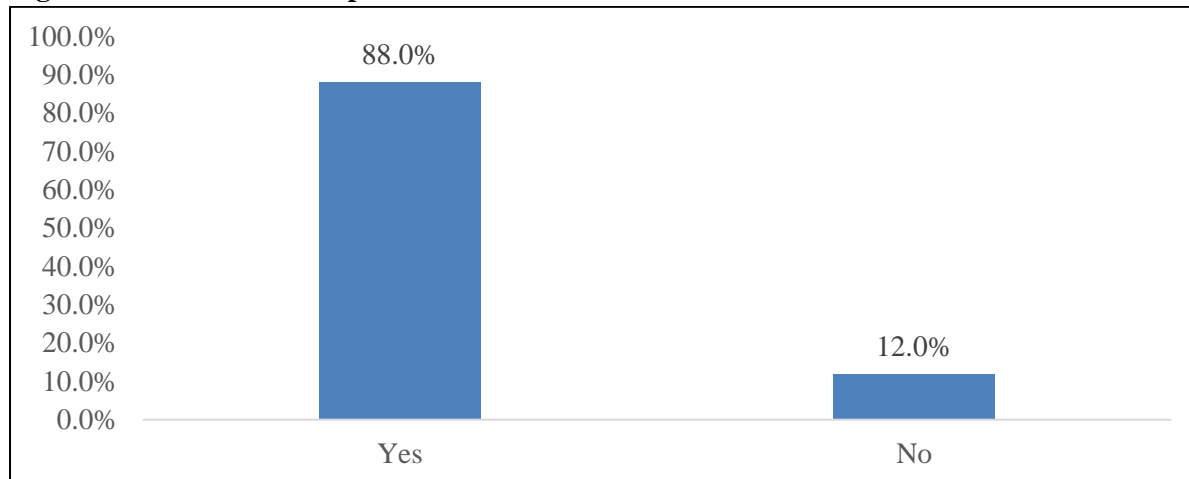
		Frequency	Percent
Age	20-24 years	50	13.9%
	25-29 years	119	33.1%
	30-34 years	81	22.6%
	35-39 years	60	16.7%
	40-44 years	19	5.3%
	45-49 years	11	3.1%
	50- years and above	19	5.3%
Gender	Male	138	38.4%
	Female	221	61.6%
Education	College	199	55.4%
	University	138	38.4%
	Postgraduate	22	6.1%
Designation	Clinical officer	86	24.0%
	Doctor	27	7.5%
	Health records officer	76	21.2%
	Laboratory technologist	45	12.5%
	Nurse	76	21.2%
	Nutrition officer	10	2.8%
	Pharmaceutical technologist	31	8.6%
	Public health officer	8	2.2%
Experience in years	1-4 years	173	48.2%
	5-9 years	109	30.4%
	10-14 years	49	13.6%
	15-19 years	14	3.9%
	20-24 years	3	0.8%
	25 years and above	11	3.1%

### Overall Level of Uptake of EMRS

Majority of respondents (n = 316, 88.0%) were using EMRS during the time of the study

compared to 12.0% (n = 44) who were not using at the time of study.

**Figure 1: Level of EMRs Uptake**



Most of the healthcare workers (68.7%, n = 217) used EMRS between 1-4 years. Additionally, 1.3% (n = 4), 24.4% (n = 77) and 2.5% (n = 8) had used the system for less than one year, between 5-9 years and 15 years and above respectively. Regarding devices used to access EMRS, majority

of respondents (95.9%, n = 303) were using office desktop in utilization of EMRS. Additionally, 20.6% (n = 65), 18.4% (n = 58) and 16.8% (n = 53) were using portable laptops, mobile phones, and hand-held gadget, such as tablets, respectively as shown.

**Table 2: Duration of use and device used**

		Frequency	Percent
Duration of use of EMRS	Less than a year	4	1.3%
	1-4 years	217	68.7%
	5-9 years	77	24.4%
	10-14 years	10	3.2%
	15 years and above	8	2.5%
Devices used	Office desktop	303	95.9%
	Portable laptop	65	20.6%
	Hand held gadget (tablet)	53	16.8%
	Mobile phone	58	18.4%

**Individual Characteristics Influencing EMRS Uptake**

Majority of the respondents 18(94.7%) between 40-44 years were utilizing EMRS followed by 30-34 years (91.4%) and 20-24 years (88.0%). There was no statistically significance association between age of healthcare workers and utilization

of EMRS at (p=0.610). Further, findings showed that at least 91% male healthcare workers were utilizing EMRS, which was also not significantly associated with uptake of EMRS ( $\chi^2=2.290$ ; df=1; p=0.130). Besides, education of the health workers (p = 0.617), designation (p = 0.647), and years of experience (p = 0.645) were not statistically associated with uptake of EMRS.

**Table 3: Influence of individual characteristic on uptake EMRs**

Variables	EMRS	Manual	Statistics
Age	20-24 years	44(88.0%)	p=0.610*
	25-29 years	103(86.6%)	
	30-34 years	74(91.4%)	
	35-39 years	52(86.7%)	
	40-44 years	18(94.7%)	
	45-49 years	8(72.7%)	
	50- years and above	17(89.5%)	

Variables		EMRS	Manual	Statistics
Gender	Male	126(91.3%)	12(8.7%)	$\chi^2=2.290$ ; df 1; p=0.130
	Female	190(86.0%)	31(14.0%)	
Education	College	175(87.9%)	24(12.1%)	p=0.617*
	University	123(89.1%)	15(10.9%)	
	Postgraduate	18(81.8%)	4(18.2%)	
Designation	Clinical officer	71(82.6%)	15(17.4%)	p=0.647*
	Doctor	23(85.2%)	4(14.8%)	
	Health records officer	69(90.8%)	7(9.2%)	
	Laboratory technologist	39(86.7%)	6(13.3%)	
	Nurse	69(90.8%)	7(9.2%)	
	Nutrition officer	9(90.0%)	1(10.0%)	
	Pharmaceutical technologist	28(90.3%)	3(9.7%)	
	Public health officer	8(100.0%)	0(0.0%)	
Experience in years	1-4 years	152(87.9%)	21(12.1%)	p=0.645*
	5-9 years	96(88.1%)	13(11.9%)	
	10-14 years	42(85.7%)	7(14.3%)	
	15-19 years	13(92.9%)	1(7.1%)	
	20-24 years	2(66.7%)	1(33.3%)	
	25 years and above	11(100.0%)	0(0.0%)	

### Technological Factors Influencing Uptake of EMRs

The participants who indicated that the speed in retrieving patient’s information was very good were three times likely to utilize EMR system compared to those who indicated the speed to be very poor (OR=2.513; 95% CI 1.033-6.111; p=0.012). Thus, having high speed in retrieving patient’s information had influence on uptake of EMRS by health workers. Besides, health workers who indicated that the speed in retrieving patient’s information was good and acceptable were 1.9 and 2.1 likely to utilize electronic medical record system. Thus, having good and acceptable speed of information retrieval influenced the uptake of EMRS at p=0.021 and 0.047 respectively.

Respondents who agreed that the facility has a power backup up system set up were 2.4 times likely to utilize EMRS although this was not significantly associated with uptake of EMRS (OR=2.406; 95% CI 0.422-5.248; p=0.232). Additionally, healthcare workers who agreed that the installed EMR system is easy to use were four times likely to utilize EMRS and this was significantly associated with uptake of EMRS (OR=3.802; 95% CI 2.314-9.965; p=0.014). The findings also indicated that have patients’ information always available (p = 0.053) and experiences of hacking (P > 0.05) did not statically influence uptake of EMRS.

**Table 4: Technological factors influencing uptake of EMRs**

Variables		EMRS	Manual	OR (95% CI)	p-value
Speed in retrieving patient’s information	Very good	84(95.5%)	4(4.5%)	2.5(1.033-6.111)	0.012
	Good	143(89.9%)	16(10.1%)	1.9(0.783-4.900)	0.021
	Acceptable	72(82.8%)	15(17.2%)	2.1(0.892-5.405)	0.047
	Poor	13(72.2%)	5(27.8%)	1.8(0.742-4.451)	0.191
	Very poor	3(50.0%)	3(50.0%)	Ref	
Power backup up system set up	Disagree	282(87.9%)	39(12.1%)	Ref	
	Neutral	33(91.7%)	3(8.3%)	1.0(0.201-0.999)	0.154
	Agree	1(50.0%)	1(50.0%)	2.4(0.422-5.248)	0.232
Enough gadgets	Disagree	224(89.6%)	25(10.4%)	Ref	
	Neutral	91(84.3%)	17(15.7%)	1.9(0.393-2.701)	0.803
	Agree	1(50.0%)	1(50.0%)	0.8(0.635-1.865)	0.308

Variables		EMRS	Manual	OR (95% CI)	p-value
Installed EMRs system is easy to use	Disagree	248(90.5%)	26(9.5%)	Ref	
	Neutral	66(81.5%)	15(18.5%)	1.1(0.656-1.862)	0.068
	Agree	2(50.0%)	2(50.0%)	3.8(2.314-9.965)	0.014
Patients' information always available	Disagree	275(89.9%)	31(10.1%)	Ref	
	Neutral	41(77.4%)	12(22.6%)	1.7(0.415-1.195)	0.053
Experienced hacking	Some of the time	30(93.8%)	2(6.3%)	0.6(0.777-3.701)	0.633
	Seldom	55(85.9%)	9(14.1%)	0.1(0.528-2.335)	0.184
	Never	231(87.8%)	32(12.2%)	Ref	

**Organizational Factors Influencing EMRS Uptake**

Majority of the respondent, 89.6%, utilizing EMRS disagreed that they had adequate knowledge and skills on EMRS operation. However, this was not significantly associated with uptake of EMRS ( $\chi^2=1.790$ ;  $df=1$ ;  $p=0.181$ ). The findings also showed that at least 89.0% of healthcare workers utilizing EMRS had never had a continuous medical education on EMRS. Similarly, 89.0% of healthcare workers sometimes had CMEs on EMRS. However, having continuous medical education was not significantly associated with uptake of EMRS ( $\chi^2=0.053$ ;  $df=2$ ;  $p=0.0974$ ).

Majority of the respondents, 90.9% (n = 159), indicated that maintenance of computers used for EMRS happened sometimes. Maintenance of computers was statistically associated with uptake of EMRS ( $\chi^2=9.422$ ;  $df=3$ ;  $p=0.024$ ). Moreover, 91.5% of those who indicated that maintenance of computers was often, and 75.0% indicating never had maintenance of computers in the facility were utilizing EMRS. Further, 89.9% (n = 151) of the healthcare workers who reported that they were not aware of the funds that are set aside for the maintenance of the electronic medical record system utilized EMRS. However, there was no significant association between uptake of EMRS and setting funds aside for maintenance of the EMRS system ( $\chi^2=1.421$ ;  $df=3$ ;  $p=0.701$ ).

**Table 5: Organizational factors influencing EMRs uptake**

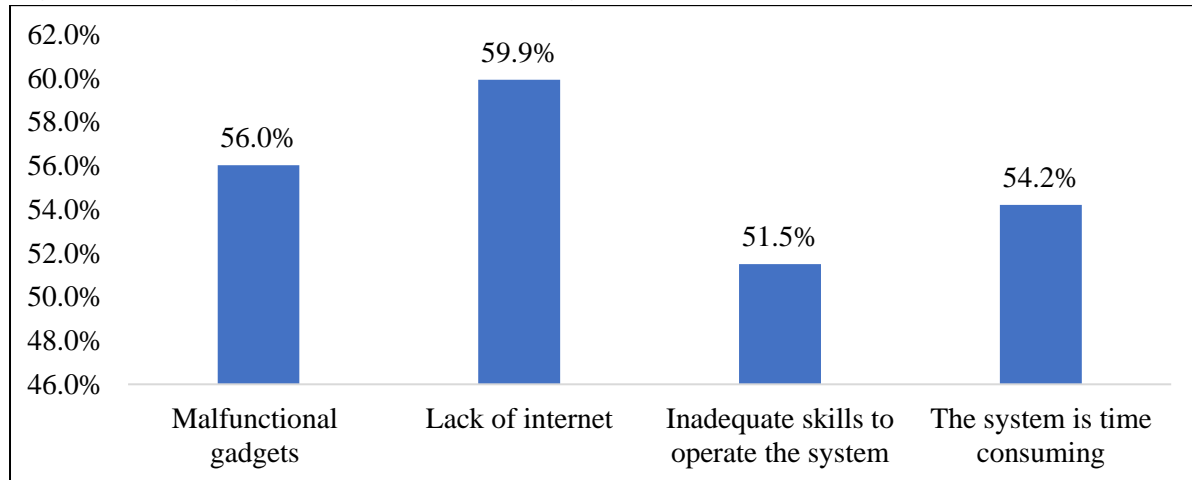
Variables		EMRS	Manual system	Significance
Adequate knowledge and skills on EMRS operation	Disagree	216(89.6%)	25(10.4%)	$\chi^2=1.790$ ; $df=1$ ; $p=0.181$
	Neutral	100(84.7%)	18(15.3%)	
Training on EMRS	Disagree	129(87.8%)	18(12.2%)	$\chi^2=0.053$ ; $df=2$ ; $p=0.974$
	Undecided	49(87.5%)	7(12.5%)	
	Agree	138(88.5%)	18(11.5%)	
CMEs on EMRS	Often	29(80.6%)	7(19.4%)	$\chi^2=2.129$ ; $df=3$ ; $p=0.546$
	Sometimes	97(89.0%)	12(11.0%)	
	Seldom	85(88.5%)	11(11.5%)	
	Never	105(89.0%)	13(11.0%)	
Maintenance of computers	Often	75(91.5%)	7(8.5%)	$\chi^2=9.422$ ; $df=3$ ; $p=0.024$
	Sometimes	159(90.9%)	16(9.1%)	
	Seldom	55(83.3%)	11(16.7%)	
	Never	27(75.0%)	9(25.0%)	
Funds are set aside	Disagree	43(84.3%)	8(15.7%)	$\chi^2=1.421$ ; $df=3$ ; $p=0.701$
	Neutral	59(88.1%)	8(11.9%)	
	Agree	63(86.3%)	10(13.7%)	
	Don't know	151(89.9%)	17(10.1%)	

### Challenges Encountered While Using Electronic Medical Record System

Respondents highlighted challenges encountered while using EMRs that fell under the following themes; lack of internet (59.9%), malfunctioned

gadgets such as office desktop, laptops or hand-held devices (56.0%) time consumption in operating EMRs (54.2%) as well as the respondents lacking the right skills to operate EMRs (51.5%) as captured in **Figure 2**.

**Figure 2: Challenges encountered while using EMRs**



### Improving EMRS Utilization

Respondents gave several suggestion on how uptake of EMRs within public hospitals can be improved that fell under the following 7 key themes; staff training on use of EMRs,

maintenance of existing computers utilized on EMRs, improve internet connection within the hospitals, increasing the number of staffs, adding more computers provisions of power backups and encouraging all staff to embrace EMRs as summarized in **Table 6**.

**Table 6: Suggestions on how EMRs Uptake can be Improved**

Theme	Percentage of Responses
Healthcare workers embracing EMRS	56.0%
Staff training on use of EMRs	58.5%
Maintenance of existing computers	48.2%
Improve internet connectivity with hospital	60.7%
Increasing the number of staff shortage	46.8%
Adding more computers	38.4%
Provision of power backups	17.8%

### DISCUSSION

The study found that majority of respondents were using EMRs during the time of the study. EMR uptake among doctors, clinical officers, nurses, pharmacists, laboratory technologists and other health care workers is crucial to successfully implement it. According to Mohd and Mohamad (2005) the uptake of EMR is the measure of acceptance of the digitalized health information technology. The study revealed that most respondents with internet connectivity utilized the EMRs. Further analysis showed that internet

connectivity was 5.3 times more likely to utilize EMRS. This finding agrees with Ruiz, Mintzer and Leipzig, (2006) who found that internet connectivity provides a platform where key e-health stakeholders achieve various goals and objectives. A lot of digital information can be shared by medical learners from various digital libraries on the Internet, hence patients take charge of their health.

Although Simon et al. (2007) observed that health workers are more concerned about the issue than their clients when deciding whether to use EMRs



or not, the study did not find significant association between uptake of EMRS and fear of job termination among health workers due to over-staffing, outsourcing tasks or a changing role. While loss of jobs in most organizations is often caused by desire for eliminating redundant tasks in the interest of efficiency, this may be unique in the healthcare setting where cutting health workers could or could not be related to cutting the cost and has an impact that spans beyond just a department (Simon et al., 2007).

The study found that most respondents aged between 40-44 years were utilizing EMRS followed by 30-34 years and 20-24 years indicating no statistically significant association between healthcare workers age and utilization of EMRS. This contradicted Bennett and Glasgow, (2009), who asserted that younger health care workers may be more likely to use EMR compared to older ones. Similarly, Morriss et al. (2005) assert that ICT is more likely to be adopted in a country where the work force is young, homogenous and is specifically in the 31-40 years.

Although more male healthcare workers were utilizing EMRS than their female counterparts, there was no significant association with uptake of EMRS ( $\chi^2=2.290$ ;  $df=1$ ;  $p=0.130$ ). Additionally, there was also no statistically significant association between cadre ( $p=0.647$ ), working experience ( $p=0.645$ ). According to Johnson et al. (2011), neither gender, career nor work experience influence perceived stress, satisfaction and usability, determining whether a person will adopt EMRs. The study revealed that respondents who narrated the speed of retrieving patient's information was very good were three times more likely to utilize EMR. According to Yoon et al. (1998), service quality of technological system as measured by information availability, fairness, responsiveness, its ease of understanding, ease of use including support staff's skills, their experiences, and their capabilities plays a big role employees embrace the system.

The study revealed that at least 89.6% of the healthcare workers utilizing EMRS disagreed that they had adequate knowledge and skills on EMRS

operation, this was not significantly associated with uptake of EMRS ( $\chi^2=1.790$ ;  $df=1$ ;  $p=0.181$ ). This finding is similar to finding of a study by Houser and Johnson (2008) conducted in an Alabama hospital that revealed there's impaired implementation and adoption of EMRs because health workers have inadequate skills and knowledge about EMRs and there could be no room to train them. Efficient training is an important part of EMR uptake and adoption and different training efforts could be given to different job roles (Studer, 2005; Terry et al., 2008). According to Adder (2007) vendors can help come up with different styles of training and a day that is busy is not the best day to start using the EMR, he says it is better done on a day which is not quite busy. Training usually helps users of the system adjust to the new system to bring a positive attitude towards this system (Aladwani, 2001).

The study further found that 151(89.9%) of the healthcare workers utilizing EMRS reported that they were unaware of the funds set aside to maintain the electronic medical record system. However, there was no significant association ( $\chi^2=1.421$ ;  $df=3$ ;  $p=0.701$ ) with uptake of EMRS. This finding did not confirm findings of Houser and Johnson,

(2008) which revealed that insufficient finances and other limited resources are contributing to delays in implementation and adoption of EMR, hence low uptake by the health workers.

## CONCLUSION AND RECOMMENDATION

EMRS adoption within the health sector is a worldwide priority during this digital era and Kiambu county is not an exception. Use of EMRs within the healthcare setting not only aids decision making but also help in effectively detecting challenges, defining priorities, managing day to day programs as well as streamlining resource allocation for improving outcomes of health. This study established that EMRs is widely used in public hospitals within Kiambu County. The study also established no statistically significant association between, cadre, gender and working

experience of healthcare workers when it comes to utilization of EMRs within these public hospitals. The basis of decisions of the management in the area of study is based on the available information and also directives from superiors. The speed in retrieving patient's information and ease of use of installed EMRs were major determinants that influenced adoption of EMRS. Some of the challenges affecting EMRs utilization includes; unstable internet/network system, intermittent power outages/interruptions, inadequate training, difficult to operate without ICT skills, costliness, inadequate ICT equipment, diminishes confidence/self-esteem, negligence, lack of confidentiality and interoperability, and slow pace of work and creation of duplicity.

Based on the study findings, the following recommendation will address identified gaps. Firstly, the government should harness adequacy of ICT resources that includes efficient network system within public hospitals in the county. Secondly, the relevant authorities to organize continuous training to healthcare workers with specific focus on use of EMRs. This can be done by also strengthening the curriculum in health training institutions by integrating HMIS module in the training of all cadres of health. Thirdly, the health sector should leverage highly educated professionals as evidenced in the socio-economic background of respondents to relax the constraints impeding e-Health use and adoption.

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