



Research Paper

Organizational Factors Influencing EMR Diffusion in Nyeri, Thika, And Mbagathi Hospitals in Kenya

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ABSTRACT : *The adoption of Electronic Medical Records (EMR) in Kenya's public healthcare facilities has been slow, despite the widespread use of EMR. This study aimed to evaluate the extent of EMR adoption in Nyeri County Referral Hospital, Thika Sub County Hospital, and Mbagathi Sub County Hospital. The target population included health records officers, physicians, nurses, administrators, and other personnel involved in EMR use. Data collection involved a questionnaire and Key Informant Interviews. A majority at 140 (49.1%) reported that their experience on the use of computer applications in clinical practice was moderate. A significant number 11 (3.9%) of the respondents indicated that their knowledge was low, 250 (88%) reported that they were using the application while a minority at 35 (12%) indicated that they did not utilize the application in their work operations. The study analyzed organizational factors affecting the diffusion of electronic medical records (EMR). Factors such as inadequate infrastructure, insufficient funding, lack of technical personnel, inconsistent internet connection, and ongoing costs of acquiring resources and facilities impacted EMR sustainability. The level of understanding about EMR systems and lack of policies and guidelines also impacted EMR diffusion. However, the adoption and long-term viability of EMR systems were not significantly influenced.*

KEYWORDS: *Electronic Medical Records, Healthcare Workers, EMR Diffusion, Routine Data*

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I. INTRODUCTION

Electronic Medical Records (EMR) are digital systems that store patient information, enabling easy retrieval and dissemination among healthcare providers, insurance providers, and organizations. They have the potential to improve patient care, safety, and reduce costs while improving workplace efficiency [1]. The adoption of EMR technology has been accelerated by advancements in medicine and ICT, with rates typically increasing when 10-20% of the population adopts it. In the United States, the integration of information technology has led to improvements in patient safety, efficacy, timeliness, efficiency, and equity. However, barriers such as cost implications, time constraints, inadequate training, security concerns, and lack of standardized protocols hinder their adoption [2]. Canada has implemented EMR since 2001, resulting in decreased waiting times, improved access to healthcare services in remote areas, and improved chronic disease management practices. However, challenges such as insufficient funding, limited resources, and fragile healthcare infrastructure persist in Sub-Saharan African countries. Health Information Systems (HISs), including EMRs, are often used for upward reporting rather than aiding clinicians in patient monitoring and disease management [3].

In their 2014 study, Mugo and Nzuki examined the numerous challenges associated with the delivery and management of healthcare services in the majority of Sub-Saharan African countries. Implementers of healthcare information technology-based solutions in numerous countries encounter a multitude of intricate challenges, including insufficient funding, limited resources, and a fragile healthcare infrastructure [4]. Research conducted in multiple developing nations, such as Mozambique, South Africa, and Mongolia, indicates that the utilization of accessible health information is constrained. According to health workers stationed at health centers in these nations, it is observed that Health Information Systems (HISs), including Electronic Medical Records (EMRs), are primarily utilized as instruments for upward reporting, specifically for the purpose of reporting to

governmental authorities [5], [6]. According to Abimbola [7], the tools do not serve the purpose of aiding clinicians, specifically physicians and nurses, in their decision-making processes pertaining to patient monitoring and disease management.

The first electronic medical record (EMR) system used for the comprehensive and clinical care of HIV-infected patients in sub-Saharan Africa was the Academic Model for the Prevention and Treatment of HIV (AMPATH) Medical Record System (AMRS) in Kenya [8]. According to Mugo and Nzuki [9], the utilization of electronic medical records (EMR) offers the potential for expedited retrieval of health information, resulting in enhanced healthcare outcomes and optimized resource allocation. According to Mboro [10], the health systems of developing nations are insufficient to meet the demands placed upon them. Despite extensive research conducted in the field of information technology, the rate of diffusion has shown limited progress.

II. STATEMENT OF THE PROBLEM

The adoption rate of Electronic Medical Record (EMR) technology is significantly slower in comparison to other information technology (IT) advancements across diverse industries [11]. The concept of Electronic Medical Record can be elucidated through the lens of contemporary diffusion theory, which is particularly relevant to intricate and extensively interconnected information technology products. The rate of diffusion in physicians' offices ranges from 10 to 16 percent, depending on the specific measures used [9]. In order to expedite the diffusion of Electronic Medical Records (EMR), it is imperative to establish suitable incentives that facilitate their effective utilization. The acceleration of the diffusion of electronic medical records (EMR) can potentially yield advantages, contingent upon the existence of additional factors such as competitive advantage and regulatory frameworks [12]. The Electronic Medical Record (EMR) serves as a catalyst for transforming the manner in which tasks are executed. According to a scholarly study conducted in the United States, the implementation and utilization of Electronic Health Records (EHRs) have encountered challenges, as healthcare professionals, including doctors and caregivers, have exhibited a reluctance to fully embrace these systems [5]. The adoption and diffusion of electronic medical records (EMR) in Kenya is facing challenges due to low utilization in hospitals. Despite government subsidies, the diffusion of EMR remains slow. The utilization of information technology in the healthcare sector has not increased over the past six years, and the failure rate of EMR implementations can reach 80%. Despite existing EMR systems in Nyeri CRH, Mbagathi SCH, and Thika SCH, challenges persist in all departments, including communication issues between outpatient and pharmacy departments. This study aims to inform decisions to accelerate EMR adoption and diffusion in selected facilities.

III. METHODS

This was an analytical cross-sectional design using both quantitative methods (issuing self-administered questionnaires to the health records and information officers, administrators, doctors, nurses, and other staff working directly with EMR, e.g., pharmacy, laboratory, etc. in the selected hospitals) and qualitative methods (use of Key Informant Interviews from medical superintendent, head of the departments, and people in charge of EMR in the healthcare facilities) of data collection that was carried out between November 2022 to February 2023. Systematic random sampling method was used among 285 healthcare workers from Nyeri county referral hospital, Mbagathi County hospital, and Thika Level 5 hospital in Nyeri, Nairobi and Kiambu Counties respectively. The study included respondents with work experience of 6 or more months, who were available during data collection period, and respondents who were willing to participate and consented for the study. Further, it excluded respondents on leave such as annual leave, study leave, maternity leave, paternity leave, sick leave etc. and healthcare workers who failed to consent for the study. Self-administered structured questionnaires were used to collect quantitative data while Key Informant Guide was used to collect qualitative. Quantitative data was analyzed using statistical package for social science (SPSS) version 26.0. Descriptive data was presented using frequencies, percentages, means and standard deviation while inferential statistics used chi-square test to measure association between independent and dependent variables. P values less than 0.05 were considered statistically significant

IV. RESULTS

4.1 Socio- Demographics Characteristics of the Respondents

The respondents were required to indicate their age in respective categories which ranged from 23-56 years. A majority of the respondents ranged between 31 to 35 years at 103 (36.1%) while the least age category was 20-25 years at 24 (8.4%). On the marital status of the respondents, a majority indicated that they were single at 140 (49.1%) while a minority at 1 (0.4%) reported that they were widowed. The study participants were required to indicate their religious affiliations. The respondents reported different religious affiliations. A majority of the respondents at 176 (61.8%) suggested that they were Christians while 88 (30.9%) were Muslims. The data is as summarized in table 1.

Table 1: Socio-demographics of the Respondents

Characteristics	Frequency	Percentage	
Age	20-25 years	24	8.4
	26-30 years	48	16.8
	31-35 years	103	36.1
	36-40 years	79	27.7
	41 and above	31	10.9
Gender	Male	136	47.7
	Female	149	52.3
Marital Status	Single	140	49.1
	Married	131	46.0
	Separated	10	3.5
	Divorced	3	1.1
	Widowed	1	0.4
Religion	Christian	176	61.8
	Muslim	88	30.9
	Traditional beliefs	21	7.4

4.2 Professional Characteristics

The study participants had varied profession. The majority 95 (33.3%) were nurses while the least were information and technology experts at 9 (3.2%). There was also a significant number of clinical officers at 71 (24.9%). The sampled healthcare workers had varied qualifications. A majority of the respondents were diploma holders at 128 (44.9%) while a minority were certificate holders at 18 (6.40%). The respondents had worked in the hospital over a varied duration of time. A majority at 115 (40.4%) had worked in the respective health facilities for a period of more than 8 years. On the other hand, the least number 21 (7.4%) of healthcare workers had worked in the respective hospitals for a duration of less than 3 years. The respondents were required to capture their professional experience. A high number 126 (44.2%) of the healthcare workers had a work experience ranging of more than 10 years while the least number 12 (4.2%) indicated that they had a work experience of less than 3 years.

Table 2: Profession, Qualifications, and Experience of the Respondents

Professional characteristics	Frequency	Percentage	
Cadre	Doctor	33	11.6
	Clinical officer	71	24.9
	Nurse	95	33.3
	Administration staff	13	4.6
	Health records	16	5.6
	Laboratory	20	7.0
	Physiotherapy	10	3.5
	Pharmacy	18	6.3
	Information Technology	9	3.2
Level of Education	Postgraduate	19	6.7
	Degree	120	42.1
	Diploma	128	44.9
	Certificate	18	6.3
Years of working	Less than 3 years	21	7.4
	3-5 years	56	19.6
	6-8 years	93	32.6
	More than 8 years	115	40.4
Experience	Less than 3 years	12	4.2

3-5 years	27	9.5
5-8 years	56	19.6
8-10 years	64	22.5
More than 10 years	126	44.2

4.3 Level of Knowledge on Computer Application in Clinical Practice

The respondents were asked to rank their level of knowledge on computer applications in clinical practice. A majority at 140 (49.1%) reported that their experience on the use of computer applications in clinical practice was moderate. A significant number 11 (3.9%) of the respondents indicated that their knowledge was low.

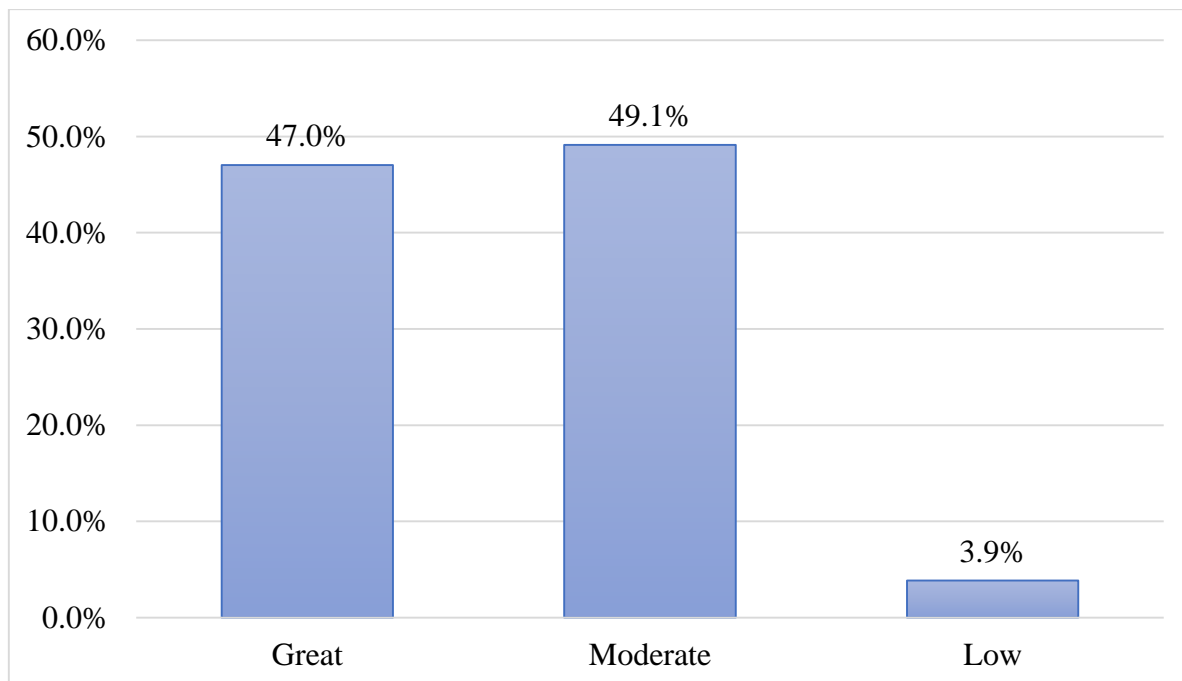


Figure 1: Level of Knowledge on Computer Application in Clinical Practice

4.4 Uses EMR

The study participants were required to answer whether they were using EMR during the period of the study. A majority at 250 (88%) reported that they were using the application while a minority at 35 (12%) indicated that they did not utilize the application in their work operations.

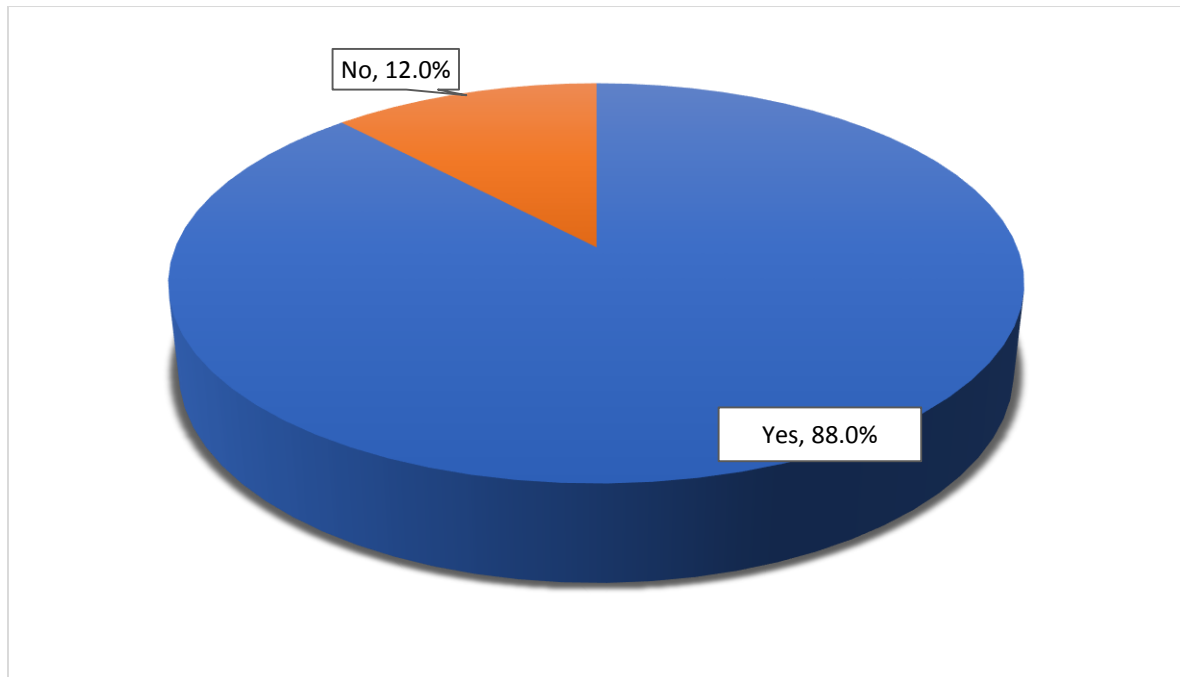


Figure 2: Respondent uses EMR

During the qualitative interview respondents said the departments are linked to EMT

"We have about 12 departments which are connected. All the major departments and wards have EMR systems" (KII 2).

4.5 Degree of EMR System Diffusion

The respondents were asked whether the EMR system was diffused between various departments. A majority at 160 (56.1%) indicated that the system was partially electronic and partially paper between different departments. Further, 49 (17.2%) of the respondents reported that the system as not diffused between various departments

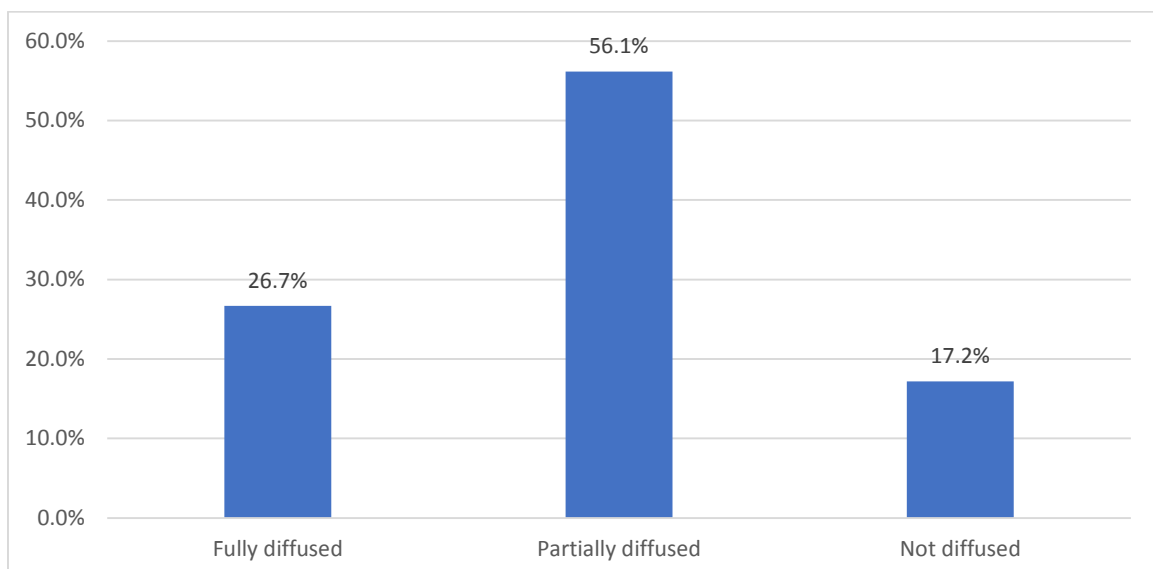


Figure 3: Degree of EMR System Diffusion

Some facilities have done assessment about the diffusion of EMR

..... Yes, sometimes we check on the usage of the system within the departments. However, the checks are performed once in a while" (KII 2).

On key informant interview, one informant said there are effects of EMR on service delivery

“.....I think EMR has changed the time that is taken in service delivery. It also makes documentation and record keeping easy. It also takes care of the storage. The access to medical records through EMR is easier as compared to paper records” (KII 4).

4.6 Organizational Factors Influencing EMR Diffusion

The organizational factors were analyzed to determine influence of diffusion of EMR. The findings revealed that lack of adequate infrastructure affects the EMR sustainability ($\chi^2=7.879$; df 2; $p=0.046$), Insufficient sources of funding pose a hindrance to the long-term viability of EMR technology within our organization ($\chi^2=9.186$; df 2; $p=0.017$). Additionally, the absence of technical personnel to handle the installation and operation of EMR technology resources acts as a barrier to its sustainability ($\chi^2=8.615$; df 2; $p=0.042$). and the consistency rate of internet connection (bandwidth) at your hospital inhibit EMR technology sustainability ($\chi^2=14.882$; df 2; $p=0.005$) were factors affecting the diffusion of EMR (Table 3). Additional examination revealed that the primary obstacle to the adoption and long-term viability of electronic medical record (EMR) systems is the expense associated with acquiring the necessary resources and facilities ($\chi^2=1.575$; df 2; $p=0.813$). Furthermore, the ongoing costs of maintaining EMR technology facilities impede their sustainability and utilization within our institution ($\chi^2=1.895$; df 2; $p=0.755$). Additionally, the level of comprehension regarding the functioning of EMR systems has an impact on the diffusion and sustainability of these systems ($\chi^2=2.910$; df 2; $p=0.573$), and lack of policies and guidelines affect the diffusion of EMR ($\chi^2=2.324$; df 2; $p=0.676$) were not affecting the diffusion of EMR (Table 3).

Table 3: Organizational Factors Influencing EMR Diffusion

Variables		Fully diffused	Partially diffused	Not diffused	Statistics
Lack of adequate infrastructure affects the use of EMR	Agree	22(18.3%)	74(61.7%)	24(20.0%)	$\chi^2=7.879$ df 4 $p=0.046$
	Uncertain	18(30.0%)	33(55.0%)	9(15.0%)	
	Disagree	36(34.3%)	53(50.5%)	16(15.2%)	
Cost of EMR resources is a barrier to its adoption	Agree	29(26.1%)	61(55%)	21(18.9%)	$\chi^2=1.575$ df 4 $p=0.813$
	Uncertain	21(31.3%)	35(52.2%)	11(16.4%)	
	Disagree	26(24.3%)	64(59.8%)	17(15.9%)	
Lack of technical personnel for EMR affects its adoption	Agree	23(19.5%)	76(64.4%)	19(16.1%)	$\chi^2=8.615$ df 4 $p=0.042$
	Uncertain	16(32.7%)	25(51.0%)	8(16.3%)	
	Disagree	37(31.4%)	59(50%)	22(18.6%)	
Maintenance costs of EMR affects its sustainability and use	Agree	32(25.6%)	69(55.2%)	24(19.2%)	$\chi^2=1.895$ df 4 $p=0.755$
	Uncertain	16(28.6%)	29(51.8%)	11(19.6%)	
	Disagree	28(26.9%)	62(59.6%)	14(13.5%)	
Inadequate sources of funding inhibit EMR technology	Agree	29(27.9%)	61(58.7%)	14(13.5%)	$\chi^2=9.186$ df 4 $p=0.017$
	Uncertain	11(17.7%)	33(53.2%)	18(29.0%)	
	Disagree	36(30.3%)	66(55.5%)	17(14.3%)	
The consistency rate of internet connection affects the diffusion of EMR	Agree	19(17.0%)	74(66.1%)	19(17.0%)	$\chi^2=14.882$ df 4 $p=0.005$
	Uncertain	22(40.7%)	20(37.0%)	12(22.2%)	
	Disagree	35(29.4%)	66(55.5%)	18(15.1%)	
Level of understanding how EMR work affects its diffusion	Agree	30(26.8%)	64(57.1%)	18(16.1%)	$\chi^2=2.910$ df 4 $p=0.573$
	Uncertain	13(19.7%)	41(62.1%)	12(18.2%)	
	Disagree	33(30.8%)	55(51.4%)	19(17.8%)	
	Agree	21(22.6%)	56(60.2%)	16(17.2%)	$\chi^2=2.324$

Lack of EMR policies and guidelines affects its diffusion	Uncertain	19(25.3%)	44(58.7%)	12(16.0%)	df 4 p=0.676
	Disagree	36(30.8%)	60(51.3%)	21(17.9%)	

V. DISCUSSION

The study found that the diffusion of EMR from the department was partial since most of the functions were partly electronic and partially paper. The use of the system in most of the operations was high. However, the use of EMR varied depending on the nature of services. The use of the system was high on registration of patients, storage of the patients' information, and billing and payments. Other functions such as scheduling of appointments of clinics, writing of pharmacy prescriptions, recording consultations, writing patient summaries, decision and support, and making insurance claims relied on the system on a moderate and low extent. The study findings are in line with Witker [13] noted that the adoption of EMR in hospitals is improving. The study also concurs with Ochieng and Hosoi [14], who articulate that the adoption and the uptake of EMR in hospitals are high. The improvement of the EMR uptake and adoption can be attributed to the fact that more people are now embracing technology. The ICT is taking a centre-stage in most of the operations in both the private and public sector and, therefore, the hospitals have not been left behind.

Various organizational factors were found to influence the diffusion of EMR. Lack of training was one of the organizational factors that influence the uptake and adoption of EMR with health facilities. The study also noted that the low understanding of how EMR works, cost of the systems and its related resources, and inadequate sources of funding were some of the significant factors that influence its adoption. The study findings are supported by Caine & Hanania [15] who posit that despite the calls to adopt technology in many government agencies, there is still a shortage of resources to train and support the infrastructure. Abimbola [7] argues that despite the introduction of the EMR system, much of the operations remain with the vendors and the ICT experts. As a result, most of the users are not very familiar with the operation of the system and thus prefer using paper-based documentation and communication between departments. Akinyele *et al.*, [16] noted that resources are unique organizational factors which must be provided to support EMR as well as its maintenance. Adequate technical personnel were also found to be among the organizational factors that influence the uptake of EMR. The findings are not in consisted of a study by Blaya *et al.*, [17] who noted that the ICT experts were enough for the task and did not hinder the adoption of the technology. The inconsistency can be attributed by the fact the latter undertook their study in a developed country and, therefore, there was no shortage of human resources.

VI. CONCLUSION

The study found out that the level of understanding of the EMR was high among the respondents in the three sampled health facilities. However, the level of diffusion of EMR from one department to another was moderate since operations were partially electronic and partly paper. The understanding of the system was high, but there was still a significant number of respondents who reported moderate and low knowledge of the operations of EMR. The use of the system varied depending on the type of the function with registration of patients, storage of patients' information, and billing and payments reporting high usage. Working experience was associated with diffusion of EMR. The study also found out that the major organizational factors that affect diffusion are lack of adequate infrastructure, inadequate sources of funding in our organization, lack of technical personnel to install and operate EMR technology resources, and the consistency rate of internet connection (bandwidth). Thus, there is a requirement for the establishment of a comprehensive guideline aimed at assisting healthcare workers in effectively utilizing electronic medical records (EMR). Consequently, it is imperative to prioritize additional training initiatives to ensure that all healthcare providers possess the requisite knowledge and skills pertaining to the implementation and utilization of EMR systems.

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DECLARATION

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Conflict of interest: None declared

Ethical approval: The study was approved by the Kenyatta University- Ethical Review Committee and a permission by National Commission for Science, Technology and Innovation, Kenya. Written consent was obtained from the participants

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