Research Article

ORGANIZATIONAL AND MANAGERIAL FACTORS INFLUENCING ELECTRONIC HEALTH RECORDS IMPLEMENTATION IN PUBLIC HEALTH FACILITIES, MACHAKOS COUNTY, KENYA

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Abstract: *The adoption of Electronic Health Records (EHRs) in healthcare systems has the potential to improve patient care, reduce turnaround times, and leverage secondary data for enhanced decision-making. Information technologies are increasingly being embraced in healthcare to promote accountability, efficiency, and service delivery. This study aimed to identify managerial and organizational factors influencing the implementation of EHRs in public health facilities in Machakos County, Kenya. A cross-sectional descriptive design was adopted, as it allows for the collection of data at a single point in time across a diverse population, making it suitable for identifying prevalent factors influencing EHR adoption without requiring longitudinal follow-up. The target population consisted of 424 healthcare providers, including management officers, ICT officers, and healthcare workers. Purposive sampling was used to select key informants with specific knowledge on EHR implementation, ensuring depth and relevance in qualitative insights. Stratified random sampling was applied to the broader population of healthcare providers to ensure representation across different cadres and facility levels, which enhances the generalizability of the findings. The combination of these sampling techniques helps reduce selection bias by ensuring both inclusivity and relevance. A total of 411 respondents were reached. Additionally, qualitative data were collected through interviews with eight key informants. Quantitative data were analyzed using SPSS, while NVivo was used for qualitative analysis. Chi-square tests were applied to determine statistical significance. The results indicated that adequate hardware and software infrastructure, ICT literacy, resource availability, capacity building, and strong leadership commitment were significant factors influencing successful EHR adoption. The study concluded that both organizational and managerial factors must be addressed to ensure effective EHR implementation. It recommends investment in infrastructure, capacity building, and leadership commitment as essential for EHR systems to improve patient outcomes and enhance operational efficiency.*

Keywords*: E-health, Health leadership, Information System, Patient Safety, Service delivery.*

1. Introduction

The integration of modern information technology into healthcare offers opportunities to improve patient care quality, reduce clinical errors, and enhance care efficiency. Important for enhancing service delivery in health care is health management information systems (HMIS) which aid in data dissemination, collection, and storage, essential for making of decisions and monitoring performance in

health care [1] In Kenya, the Ministry of Health and other stakeholders use HMIS to monitor indicators of the Health Sector Strategic Plan (HSSP), particularly through integrated reporting systems that support planning and evaluation. The rise of digital tools, including electronic health (e-health), has introduced new opportunities to improve clinical and business processes, with electronic health records (EHR) becoming a central focus for enhancing accountability and service delivery. Several factors have been identified as barriers to EHR adoption, including the absence of comprehensive policies, inadequate leadership, and lack of awareness [2]

This study seeks to explore the determinants of EHR adoption in public health facilities in Machakos County, aiming to identify key organizational and managerial factors that influence the uptake of EHR systems.[3]. The study is expected to provide valuable insights that could inform policy and practice, improving the overall health information management system in the county [4]. Additionally, inefficiencies, enhancement of data collection, accuracy, and overall improvement of health services focusing on patient outcomes are elements to be addressed by the study findings.[5].

The study's findings offer a blueprint for EHR adoption in third-world economies and similar contexts, contributing to the Sustainable Development Goal (SDG) on health and well-being, while also shaping policy guidelines for the Kenyan healthcare system.

2. Materials and Methods

2.1. Study Design and Tools

A cross-sectional descriptive design was employed in this study, incorporating both qualitative and quantitative methods. This design was chosen because it is well-suited to examining the relationships between organizational and managerial factors and the adoption of Electronic Health Records (EHR) in a defined population at a specific point in time. The cross-sectional design allows for the collection of data from multiple participants in a single moment, making it cost-effective and time-efficient, especially when the goal is to identify associations between variables without the need for longitudinal tracking. While the study includes both quantitative (via semi-structured questionnaires) and qualitative (via key informant interviews) data, it is primarily cross-sectional in nature, not strictly a mixed-methods design. The term "mixed-methods" often refers to an integrated approach where qualitative and quantitative data are collected simultaneously, analyzed together, and used to provide a fuller picture of the research question. In this study, the qualitative data were collected after the quantitative data, and the two types of data are analyzed separately, making it more appropriate to describe the study as cross-sectional with both quantitative and qualitative components. A semi-structured questionnaire was used as the primary data collection tool, and it was pre-tested to ensure reliability and validity. Adjustments were made based on feedback from 10% of the study population at Matuu District Hospital

2.2. Study Area

The study was done in Machakos County, one of Kenya's 47 counties, located in the eastern part of the country. Machakos County is a peri-urban area located 100 kilometers from Nairobi, and is known for its poor performance in several health outcomes, including child malnutrition and low vaccination coverage. These indicators include child malnutrition rates and vaccination coverage, with 16% of children below five years being as stunted and 88% as per (Kenya DHS 2022) coverage of vaccination. The research was approved by Mount Kenya University Scientific and Ethical Review Committee (ISERC) hence there was human subject involvement in the study. Approval Number: 2655, dated 12th April 2024.

2.3. Sampling Procedure

Purposive and stratified random sampling techniques were employed in this study. The target population was stratified based on health facility levels, which included Level 5 Machakos Hospital and Level 4 Kangundo Hospital. Within each stratum, random sampling was used to select healthcare workers for participation. Fisher's formula was applied to determine the sample size, resulting in 424 respondents. For the key informant interviews, purposive sampling was used to select eight key informants, specifically facility in-charges and medical superintendents, based on their expertise and involvement in the implementation and management of healthcare services within their facilities. The selection criteria for these key informants included their managerial or administrative role in the healthcare facilities and their direct involvement in decision-making regarding healthcare delivery and technology adoption. The key informants did not answer the quantitative semi-structured questionnaires. Instead, they participated in separate qualitative interviews, which were conducted after the completion of the survey process with the general healthcare workers. The interviews with the key informants provided additional insights into the managerial and organizational factors influencing Electronic Health Records (EHR) adoption

2.4. Data Collection

The primary data collection tool used in this study was semi-structured questionnaires, designed to collect quantitative data from the healthcare workers. Key informant interviews were conducted to gather qualitative data from a selected group of facility in-charges and medical superintendents. The data collection process was conducted by three trained research assistants who were knowledgeable in health-related fields. These assistants were not co-authors of the study but were selected based on their familiarity with healthcare settings and their ability to effectively administer the questionnaires and conduct interviews. All research assistants received training on ethical standards, data collection procedures, and how to obtain informed consent from participants. Study participants were selected based on inclusion criteria, which included healthcare workers from Machakos and Kangundo hospitals, with a focus on those involved in healthcare delivery and EHR implementation. The inclusion criteria ensured that participants had relevant experience in healthcare practices and technology usage, and that they were directly or indirectly affected by the adoption of EHRs. Participants were reached through direct contact at their respective health facilities, specifically Machakos Level 5 Hospital and Kangundo Level 4 Hospital. The County Health Directorate provided authorization and support in accessing the facilities and coordinating with department heads to facilitate data collection during convenient times that did not disrupt healthcare service delivery. No financial or material incentives were offered to participants. Participation was entirely voluntary, and all respondents were briefed on the purpose of the study, assured of confidentiality, and provided written informed consent before proceeding. Participants were provided with information about the study's objectives, procedures, and their rights. Consent was obtained from all participants before their involvement in the study, ensuring voluntary participation and confidentiality of responses. The key informant interviews were conducted separately after the survey process with the general healthcare workers. The interviews were carried out to gather deeper insights into the managerial and organizational factors affecting EHR adoption.

2.5. Data Analysis

Quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) version 27. Descriptive statistics such as means and standard deviations were used to summarize data, while Chi-square tests were employed to examine associations between categorical variables. The assumptions for Chi-square analysis, namely, independence of observations, mutually exclusive categories, and adequate expected cell counts (no more than 20% of cells with expected frequencies below 5), were

checked and met before conducting the analysis. Chi-square was chosen because the primary aim was to explore associations between categorical variables (e.g., ICT literacy levels, availability of infrastructure, leadership support) and EHR adoption status. Regression analysis was considered but not used in this study, as the objective was not to predict outcomes but to identify statistically significant relationships and patterns among discrete variables. Future studies may build on this work using regression to model predictive relationships more deeply. For qualitative data, NVIVO v12 software was used for organizing, coding, and verifying themes from key informant interviews. A deductive thematic analysis approach was applied to identify patterns related to the study's objectives. While NVIVO facilitated systematic coding and theme retrieval, initial coding and theme development were conducted manually by the principal investigator. NVIVO was then used to verify consistency and refine categories. Given the small number of interviews (n=8), NVIVO was primarily used to enhance rigor and transparency in the thematic coding process and ensure traceability of coded content to raw data. This dual approach ensured both human insight and software-supported reliability in qualitative analysis

Ethical statement

This study received ethical approval from the Mount Kenya University Institutional Scientific and Ethical Review Committee (ISERC), under Approval Number: 2655, dated 12th April 2024. In line with ethical guidelines for research involving human subjects, informed consent was obtained from all participants. Before participation, each participant was fully briefed on the study's objectives, procedures, and potential risks, ensuring they understood their rights, including the voluntary nature of their involvement and their right to withdraw at any time without penalty. The consent process was documented, with participants signing consent forms before any data collection commenced. To ensure confidentiality, all personal information and responses were anonymized. Identifiable data were securely stored and only accessible to authorized research personnel. In compliance with ethical standards, data was handled with the utmost care, using encryption and secure systems to protect participant privacy. Furthermore, the study adhered to the ethical principles of beneficence, non-maleficence, and respect for autonomy. Efforts were made to minimize any potential harm to participants, and the findings aim to contribute positively to the field of study while maintaining the highest standards of integrity and transparency

3. Results

In line with the study objectives, results were reported using tables, figures, and charts to present analyzed data. A total of 411 participants completed the quantitative questionnaire out of a target of 424, yielding a response rate of 96.9% (see Figure 1). This high response rate was achieved due to strong institutional support from facility leadership, active follow-up by trained research assistants, and the scheduling of interviews during less busy hours in clinical departments. According to Werner (2004), a survey response rate above 80% is generally considered reliable and robust for drawing study conclusions. All eight key informants (facility in-charges and medical superintendents) identified for the qualitative component were successfully interviewed. Their responses provided critical insights into the organizational and managerial dynamics influencing EHR implementation
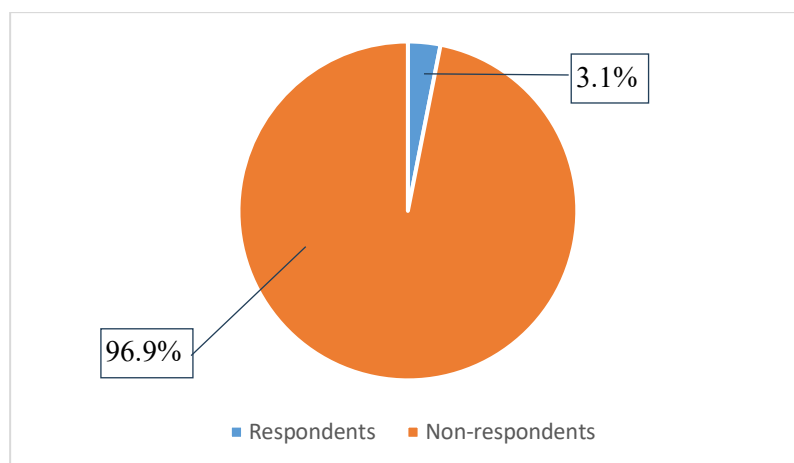
Figure 1. The response rate of the study respondents.

3.1. Data Analysis

Socio-demographic characteristics of the respondents were determined, and the results were presented in Table 1.

Table 1. Respondents' socio-demographic characteristics

Variable	Category	Frequency (n)	Percent (%)
Sex	Male	131	31.9
	Female	280	68.1
	Total	411	100
Age	Below 20 years	4	1.0
	20-29 years	154	37.5
	30-39 years	119	28.9
	40-49 years	93	22.6
	50 and above years	41	10.0
	Total	411	100
Highest Level of Education	Certificate	12	2.9
	Diploma	156	38.0
	Bachelors	204	49.6
	Post-graduate	39	9.5
	Total	411	100
Years of experience	Less than 1 year	41	10.0
	1-5 years	182	44.3
	6-10 years	81	19.7
	Over 10 years	107	26.0
	Total	411	100
If the facility has any form of EHR system	Yes	297	72.3
	No	114	27.7
	Total	411	100

Female respondents were a significant number, as the results show with 280 (68.1%), male respondents were 131 (31.9%). Participants' age was mainly presented by 20-29 years, 154 (37.5%), 119 (28.9%) aged between 30-39 years, 93 (22.6%) aged 40-49 years, and 50 and above were 41 (10.0%) (Table 1).

Participants' level of education was, with Certificate level of education at 12 (2.9%), diploma level of education at 156 (38.0%), bachelor's level at 204 (49.6%), and postgraduate level at 39 (9.5%). On the years of experience, those with less than 1 year were 41 (10.0%), 1-5 years were 182 (44.3%), 6-10 years of experience were 81 (19.7%), and those with over 10 years of experience were 107 (26.0%). 297 (72.3%) were respondents with electronic medical records systems in their medical facility, as shown in Table 1.

3.2. Socio-demographic characteristics and implementation of electronic health records

A Chi-square test of independence was conducted to determine the group differences between socio-demographic groups in the implementation of electronic health records. Two key informant interview guides had indicated that 'A health care worker who has undergone a higher level of education (bachelor's and post graduate), understand the need EHR to agree with the findings of the study, which is adopted easier by the young generation, or the youths as illustrated in Table 2.

Table 2. Socio-demographic characteristics and implementation of electronic health records

	Health facilities having any form of electronic medical records system		χ^2	p
	No n (%)	Yes n (%)		
Age				
Below 20 years	0 (0.0)	4 (45.0)	6.12	0.001**
20-29 years	5 (3.2)	149 (96.8)	12.45	0.025*
30-39 years	23 (19.3)	96 (80.7)	4.17	0.053
40-49 years	51 (54.8)	42 (45.2)	1.01	0.835
50 and above years	35 (85.4)	6 (14.6)	6.33	0.804
Highest level of education				
Certificate	11 (91.7)	1 (8.3)	8.52	0.064
Diploma	95 (60.9)	7 (39.1)	5.21	0.267
Bachelors	2 (1.0)	202 (99.0)	18.4	0.002**
Post-graduate	6 (15.4)	33 (84.6)	4.08	0.027*
Years of experience				
Less than 1 year	29 (70.7)	12 (29.3)	6.51	0.659
1-5 years	37 (20.3)	145 (79.7)	4.71	0.835
6-10 years	15 (18.5)	66 (81.5)	3.32	0.406
Over 10 years	33 (30.8)	74 (69.2)	0.79	0.582

*: p<0.05; **: p<0.01; χ^2 :Chi-square test

Table 2 presents the association between socio demographic characteristics and implementation of electronic health records age groups below 20 and 21–29 years showed statistically significant

associations with EHR utilization (χ^2 = 6.12, p = 0.001) and (χ^2 = 12.45, p = 0.025, respectively, On the other hand, years of work experience had no significant association with EHR use (χ^2 = 6.51, p = 0.659). The level of education for bachelor's and postgraduate was significantly associated with the implementation of electronic health records with p values of (χ^2=18.4, p=0.002) and (χ^2=4.08, p=0.027) respectively. There was no association between years of work experience and implementation of electronic health records with p p-value of (χ^2=6.51, p=0.659).

3.3. Organizational Factors: Facilities that have the structures and legal processes needed for implementing an EMR system

The study findings indicated that 101 (24.6%) of the respondents agreed that structures and legal processes were in place, whereas 284 (69.1%) indicated No, and 26 (6.3%) did not know, as shown in Figure 2.
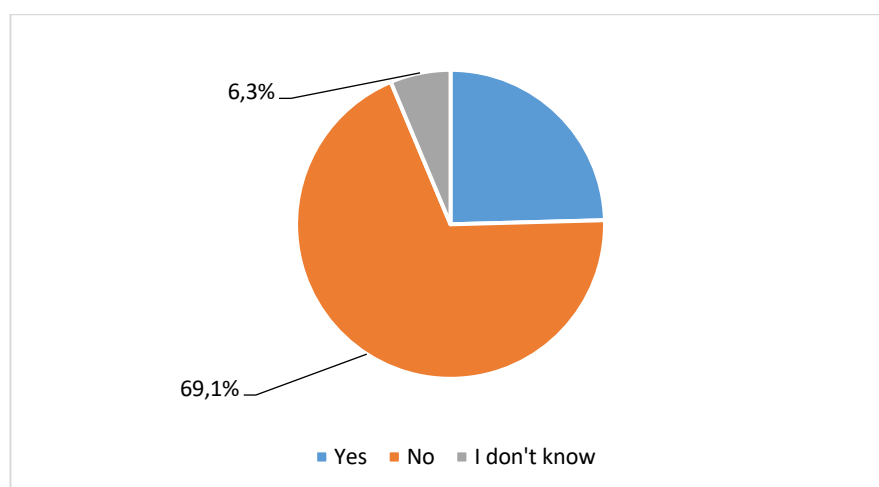

Figure 2. Facilities that have the structures and legal processes needed for implementing an EMR system

3.4. Analysis of Organizational Factors Influencing Electronic Health Records Implementation

An interval scale is what the five-point Likert scale is known as. It denotes no extent at all between 1 and 1.8. 1.81 to 2.60 denotes a modest degree. It indicates neutrality from 2.61 to 3.40, a big extent from 3.41 to 4.20, and a very large extent from 4.21 to 5.

The first statement on sufficient financial resources needed for procurement and implementing an EMR system had a mean of 4.303, and the interoperability and compatibility problems that arise during system operations and are promptly fixed had a mean of 4.501 indicating to no extent at all. To a small extent, with a mean of 3.465, the facilities have sufficient mechanisms to build capacity for a new EMR system. Many respondents were neutral on the existence of technical expertise to run an EMR system (mean=2.064) and that the electronic health records system is being implemented in accordance with an institutional policy (mean=3.905). On the electronic health records system promoting institutional quality and data accountability, it had a mean of 3.871 as indicated in Table 3.

To meet the assumptions of the Chi-square test, it was confirmed that all cells in the contingency table had expected frequencies of at least 5 prior to analysis. This is a key assumption for the test's validity. If any expected frequency was found to be below 5, researcher would have to consider alternative strategies, such as collapsing categories, or used a different test (like Fisher's Exact Test). Independence of Observations: The assumption that observations in the table are independent was also checked. This was done by ensuring that each participant contributed to only one cell in the table, avoiding repeated measures.

Table 3. Analysis of the Level of Organizational Factors Influencing Electronic Health Records Implementation

Statement	Very large extent	Large extent	Neutral	Small extent	No extent at all	Mean	SD
There are sufficient financial resources needed for procurement and implementing an EMR system	0.0%	1.0%	2.7%	35.3%	61.1%	4.303	2.174
The facility has sufficient mechanisms to build capacity for a new EMR system	1.5%	13.6%	21.4%	47.9%	15.6%	3.465	2.407
There exists technical expertise to run an EMR system	4.4%	8.0%	43.6%	35.5%	8.5%	2.064	1.095
The electronic health records system is being implemented in accordance with an institutional policy.	11.2%	16.3%	51.8%	11.9%	8.8%	3.905	2.315
The electronic health records system has promoted institutional quality and data accountability	24.1%	51.3%	13.6%	8.3%	2.7%	3.871	2.302
Interoperability and compatibility problems arise during system operations and are promptly fixed	1.0%	3.2%	8.8%	21.2%	65.9%	4.501	2.419

Table 3 show that most respondents rated interoperability and compatibility issues (M = 4.501±2.419) and financial resources for procurement (M = 4.303±2.174) as factors to a very large extent.

3.5. Organizational factors and implementation of electronic health records

Using the Chi-square test of independence, the analysis revealed significant differences between EHR implementation and organizational factors such as availability of funds for acquisition (χ^2=12.71, p=0.023), sufficiency of mechanisms to build capacity (χ^2=6.38, p=0.041), and existence of technical expertise (χ^2=3.84, p=0.050). However, there was no statistically significant association with institutional policy (χ^2=3.07, p=0.079).

A key informant interview guide had indicated, 'Availability of financial resources, human capacity, and the expertise at the health facilities is critical to see the successful implementation of the medical records system which agreed with the study findings. These investments need to be put in when a system is to be installed and used. These are illustrated in Table 4.

**Table 4.** Organizational factors and implementation of electronic health records

	Health facilities that have any form of electronic medical records system		χ^2	p
	No n (%)	Yes n (%)		
Organizational factors				
There are sufficient financial resources needed for procurement and implementing an EMR system	407 (99.0)	4 (1.0)	12.71	0.023*
The facility has sufficient mechanisms to build capacity for a new EMR system	349 (84.9)	62 (15.1)	6.38	0.041*
There exists technical expertise to run an EMR system	360 (87.6)	51 (12.4)	3.84	0.050
The electronic health records system is being implemented in accordance with an institutional policy.	298 (72.5)	113 (27.5)	3.07	0.079
The electronic health records system has promoted institutional quality and data accountability	101 (24.6)	310 (75.4)	5.93	0.015*
Interoperability and compatibility problems arise during system operations and are promptly fixed	394 (95.9)	17 (4.1)	4.81	0.093

*: $p < 0.05$; χ^2 :Chi-square test

Table 4 shows that availability of funds, capacity-building mechanisms, and technical expertise were significantly associated with EHR implementation, while institutional policy was not

3.6. Managerial Factors: The facility has a core management team

The study found that 291 (70.8%) of the health facilities had a core management team, while 77 (18.7%) said they did not have and 43 (10.5%) did not know, as indicated in Figure 3
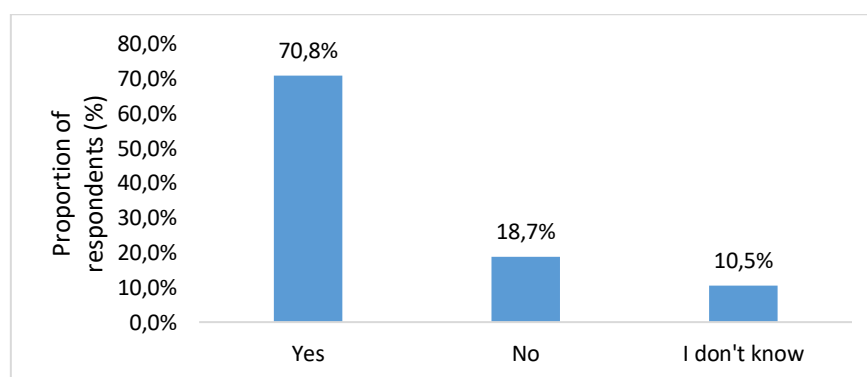
Figure 3. The facility has a core management team

3.7. Analysis of Managerial Factors Influencing Electronic Health Records Implementation

An interval scale is what the five-point Likert scale is known as. It denotes no extent at all between 1 and 1.8. 1.81 to 2.60 denotes a modest degree. It indicates neutrality from 2.61 to 3.40, big extent from 3.41 to 4.20, and very large extent from 4.21 to 5 it means very large extent that the electronic health records systems are guided by an appropriate strategic framework (mean=4.303), that the system is implementation is supported by all department heads (mean=3.465) and the department heads are informed about all system functions and actively participate in them (mean=3.905). To a small extent,

the respondents indicated that the departmental in-charges efficiently divide up the work of keeping an eye on system functioning (M=2.064±1.095) and they were neutral on the guarantee of an efficient procedure. Department heads and employees are in continual communication with a mean of 3.465±2.407 as indicated in Table 5.

Table 5. Analysis of the Level of Managerial Factors Influencing Electronic Health Records Implementation

Statement	Very large extent	Large extent	Neutral	Small extent	No extent at all	Mean	SD
The electronic health records systems are guided by an appropriate strategic framework.	22.4%	51.3%	14.6%	9.0%	2.7%	4.303	2.174
The electronic health records system's implementation is supported by all department heads.	12.4%	43.1%	20.2%	16.8%	7.5%	3.465	2.407
The departmental in-charges efficiently divide up the work of keeping an eye on system functioning.	7.8%	18.5%	23.6%	36.3%	13.9%	2.064	1.095
Department heads are informed about all system functions and actively participate in them.	6.6%	33.8%	26.3%	18.7%	14.6%	3.905	2.315
To guarantee an efficient procedure, department heads and employees are in continual communication.	7.5%	18.5%	45.5%	13.6%	14.8%	3.871	2.302

Table 5 indicates that electronic health record systems are largely guided by a strategic framework (M=4.303±2.174), moderately supported by department heads (M=3.465±2.407), with neutral views on communication and procedures, and low effectiveness reported in system monitoring (M=2.064±1.095).

3.8. Managerial factors and implementation of electronic health records

The relationship of management factors and electronic health records adoption revealed a significant effect on the system's direction and the suitability of the strategic framework (p=0.039), and the systems being implemented in supported by all department heads (p=0.047). No significant association between departmental in-charges efficiently dividing up the work of keeping an eye on system functioning (p=0. 268) and the department heads being informed about all system functions and actively participating in them (p=0.041).

Key informant interview guide indicated 'In all instances, a system that has been installed for use has to have a guiding framework and under one department for ease of monitoring, and it does not need so many managers for managing it, which concurred with the study findings. A system administrator is sufficient. These are illustrated in Table 6.

Table 6. Managerial factors and Implementation of electronic health records

	Health facility have any form of electronic medical records system		χ^2	p
	No n (%)	Yes n (%)		
Managerial factors				
The electronic health records systems are guided by an appropriate strategic framework.	108 (26.3)	303 (73.7)	9.64	0.039*
The electronic health records system's implementation is supported by all department heads.	183 (44.5)	228 (55.5)	3.94	0.047*
The departmental in-charges efficiently divide up the work of keeping an eye on system functioning.	303 (73.7)	108 (26.3)	3.29	0.069
Department heads are informed about all system functions and actively participate in them.	245 (59.6)	166 (40.4)	1.23	0.268
To guarantee an efficient procedure, department heads and employees are in continual communication.	304 74.0)	107 (26.0)	4.51	0.087

*p<0.05; χ^2 :Chi-square test

Table 6 shows a significant association between the system's direction and the suitability of the strategic framework (χ^2 = 9.64, p = 0.039), as well as support from department heads (χ^2 = 3.94, p = 0.047). However, no significant association was observed for work delegation (χ^2 = 3.29, p = 0.069) and department heads' involvement (χ^2 = 1.23, p = 0.268)

4. Discussion

The findings are aligned with [6] who suggest the need for EHR adoption in health care settings to improve patient outcomes, [7].The study highlights critical organizational and managerial factors influencing Electronic Health Records (EHR) systems adoption and implementation in healthcare facilities. These factors offer valuable insights into challenges and opportunities for enhancing EHR adoption in Kenya, [8] other third-world countries, and globally [9]. This study highlights key factors influencing the adoption of Electronic Health Records (EHRs) in Machakos County, Kenya, but alternative explanations and confounders should also be considered. Digital literacy plays a significant role, as healthcare workers with higher digital skills are more likely to successfully adopt EHRs, while those with lower literacy may face challenges [5]. The location of healthcare facilities also impacts adoption, with urban facilities benefiting from better infrastructure and resources compared to rural ones, which may face barriers such as inconsistent electricity [8]. Supporting policies, such as government incentives and technical support, are crucial for the success of EHR systems, and their role should be further explored [3]. High turnover rates among healthcare workers could disrupt EHR implementation, particularly in rural areas, affecting the system's sustainability [4]. Lastly, organizational culture and change management strategies are vital, as resistance to change and lack of staff engagement can hinder the adoption process [2]. Future research should address these factors to improve strategies for EHR implementation and long-term success.

4.1. Organizational Factors

The findings of this study regarding the organizational factors influencing EHR adoption in Machakos County resonate with existing literature, though they also provide unique insights into the challenges faced in this context. One of the most critical issues identified was the lack of legal

frameworks and administrative structures for supporting EHR implementation, with 69.1% of respondents indicating that their facilities lacked the necessary structures and legal processes. This finding aligns with research by Rohwer et al. (2016), who noted that the absence of national health IT policies and regulatory frameworks significantly hampers the implementation of health technologies in low-resource settings. In their study, the lack of institutional and regulatory backing was found to result in fragmented and unsustainable health IT projects. This study's results further underscore the need for the establishment of clear legal frameworks and standardized policies at both the national and institutional levels to support EHR deployment [5].

Financial constraints were another major barrier identified in this study, with respondents overwhelmingly acknowledging the importance of adequate funding for successful EHR adoption (p = 0.023). This resonates with findings from Ayatollahi et al. (2020), who found that financial limitations in Iran's healthcare system were a significant obstacle to the implementation of health information technologies, with competing priorities delaying technological progress. The emphasis placed by this study on public-private partnerships (PPPs) as a potential solution aligns with the literature on successful models for funding digital health projects. For example, Rwanda's OpenMRS initiative and Kenya's Afya Care pilot program has demonstrated how PPPs can combine government policy support, private sector investment, and international development contributions to overcome financial barriers [7]. The findings of this study further suggest that such collaborative funding models are essential for addressing the financial challenges faced by health facilities in Machakos County and similar contexts.

The study also highlighted the limited technical expertise within health facilities, with respondents expressing doubt about their ability to effectively manage EHR systems (mean score = 2.064). This finding supports previous research, such as that by Kabanda and Brown (2019), which identified the lack of skilled personnel as a barrier to health IT adoption, particularly in rural areas. The statistically significant relationship found between technical expertise and EHR adoption success (p = 0.050) indicates that the availability of skilled personnel is crucial for successful implementation. As emphasized by Bada et al. (2018), strategic investment in human resources, such as recruiting skilled ICT staff and integrating digital health literacy into healthcare workforce training programs, is essential for overcoming this barrier. This study's findings call for the strengthening of in-service training and capacity-building initiatives to ensure that healthcare staff are equipped with the necessary skills to manage and sustain EHR systems [6].

Interoperability was another key challenge identified in this study, with respondents expressing widespread concern about the difficulty of integrating diverse health information systems (mean score = 4.501). This issue mirrors findings from Thirukumar et al. (2017), who highlighted that interoperability is one of the most significant barriers to the effective use of EHRs, as health systems that cannot communicate with each other result in fragmented care and inefficiencies. The call for universal data standards and platform compatibility guidelines in this study is consistent with recommendations from Oladapo et al. (2019), who stressed that the adoption of interoperable systems is critical for improving the effectiveness of health IT initiatives. The study's findings further reinforce the importance of establishing common data standards and ensuring that EHR platforms are compatible across different facilities and regions to facilitate seamless data exchange and improve care continuity [8]. In conclusion, this study's findings contribute to the existing body of literature on EHR adoption by identifying key organizational and managerial factors that influence implementation success. The challenges of legal frameworks, financial resources, technical capacity, and interoperability are consistent with those observed in other studies, particularly in low- and middle-income countries. The study offers a unique perspective on these issues in the context of Machakos County, providing actionable recommendations for overcoming these barriers. The need for national and institutional policy development, innovative funding models, capacity-building initiatives, and interoperability

standards are crucial for the successful implementation of EHR systems, as highlighted by both the current study and the broader literature on digital health adoption [2].

4.2. Managerial Factors

The study's findings on the necessity of strategic frameworks in facilitating Electronic Health Records (EHR) implementation resonate strongly with broader global evidence. A well-articulated strategic framework was found to be significantly associated with EHR success (mean = 4.303; $p = 0.039$), reinforcing earlier research that emphasizes the value of tailored digital health strategies in achieving effective system integration and institutional alignment with health IT goals (10). The role of these frameworks is not merely in providing direction but also in fostering inter-departmental coherence, efficient resource utilization, and standardization across health facilities [13].

Support from departmental leadership also emerged as an influential factor (mean = 3.465; $p = 0.047$). This aligns with evidence showing that departmental heads play a pivotal role in change management, acting as catalysts who translate strategic priorities into operational practice [12]. However, reported inefficiencies in work delegation (mean = 2.064) and communication (mean = 3.465) underscore persistent managerial weaknesses that echo findings from other resource-constrained contexts where leadership gaps hinder health information systems rollout [14]. These inefficiencies suggest the need for structured leadership training and workflow redesign to streamline roles and enhance organizational cohesion during EHR implementation [15].

Consistent with literature from other developing regions, the study identified enduring structural challenges including inadequate infrastructure, financial constraints, and limited technical capacity. These issues are also highlighted in studies examining the implementation of digital health systems across sub-Saharan Africa and Southeast Asia, where underfunding and fragmented health systems remain key deterrents to EHR success [11]. A multi-pronged strategy—blending government commitment, donor engagement, and public-private partnerships—has been proposed as a viable remedy. Models like Kenya's Afya Care and Rwanda's OpenMRS exemplify how such collaborations can mitigate fiscal and technical constraints while fostering sustainable innovation [16].

Finally, global experience provides critical insights applicable to the Machakos context. Research from high-income countries consistently shows that early stakeholder engagement, adherence to interoperability standards, and sustained funding underpin successful EHR adoption [10]. Moreover, the user-centered design of systems, continuous feedback loops, and technical support are essential to ensuring long-term usability and scalability. Adapting these approaches—albeit in simpler, cost-effective formats—can address the unique needs of resource-limited environments and accelerate progress toward efficient, data-driven healthcare delivery [13].

5. Conclusion

The study concludes that both organizational and managerial factors play a pivotal role in the successful implementation of Electronic Health Record (EHR) systems in Kenya and comparable settings globally. The findings highlight that overcoming financial, technical, and structural barriers—such as inadequate infrastructure, limited technical expertise, and the absence of enabling legal frameworks—is essential for effective EHR adoption. Furthermore, the presence of guiding strategic frameworks, strong departmental leadership, and coordinated communication structures significantly contribute to system sustainability and long-term success. Addressing these interconnected challenges through capacity building, targeted investments, and multi-stakeholder collaboration is crucial to realizing the full potential of EHRs in improving healthcare delivery and operational efficiency.

6. Recommendations

The study concludes that the successful implementation of Electronic Health Records (EHR) systems is significantly shaped by both organizational and managerial factors. Addressing financial constraints, limited technical capacity, and the absence of supportive legal and policy frameworks is vital for enhancing EHR adoption in Kenya and similar contexts. Furthermore, the presence of well-articulated strategic plans, supportive departmental leadership, and coherent communication structures are indispensable for long-term sustainability and system effectiveness. These insights provide a strong foundation for practical, evidence-based recommendations that policymakers can adopt to facilitate robust, scalable EHR systems.

To operationalize these findings, policy development must be prioritized by formulating and enforcing comprehensive regulations that address data privacy, security, patient consent, and ownership. These policies should align with international benchmarks such as the GDPR and HIPAA, while also promoting national interoperability protocols. Policymakers should adopt a participatory approach, engaging frontline healthcare workers, administrators, and patients to ensure policies are both contextually relevant and widely accepted.

Capacity building should be institutionalized through continuous professional development tailored to various skill levels. This includes technical training in system usage, data management, and digital literacy. Structured mentorship programs for departmental leaders and ICT specialists can strengthen institutional leadership and promote a culture of innovation. To sustain motivation and skill retention, healthcare workers should be incentivized through certifications, recognition schemes, and clear career progression paths tied to EHR competencies.

In terms of financial support, national and county governments must increase dedicated funding for EHR systems, positioning them as long-term investments with significant returns in efficiency and patient care. Policymakers can supplement public funds by engaging international donors and leveraging public-private partnerships. Innovative financing models—such as outcome-based financing or health bonds—should be explored to ensure sustainable implementation.

To overcome structural limitations, infrastructure and interoperability need urgent attention. Governments should invest in scalable, user-friendly systems that accommodate low bandwidth environments, diverse languages, and low digital literacy. Strengthening core ICT infrastructure—including reliable power and internet—is essential. Vendor-neutral procurement practices should be promoted to ensure open standards and future system integration, while advanced data security measures like encryption and multi-factor authentication must be mandated.

Monitoring and evaluation mechanisms should be embedded in national health strategies. Real-time dashboards and key performance indicators (KPIs) can help track system adoption and performance, while periodic impact evaluations can assess influence on patient outcomes and cost-efficiency. Feedback mechanisms involving both healthcare workers and patients will promote accountability and continuous system improvement.

Finally, global collaboration can fast-track progress by enabling Kenya and similar countries to learn from mature EHR ecosystems. Policymakers should support cross-border forums, collaborative research, and knowledge exchange platforms to adapt global best practices to local challenges. Strategic partnerships with international academic institutions, tech companies, and health bodies can foster innovation, reduce costs, and build a globally informed but locally grounded EHR infrastructure.

By integrating these recommendations into national policy agendas, Kenya can build a resilient digital health ecosystem that not only supports efficient service delivery but also aligns with global health standards and future technological demands.

Limitations of the study

Potential Biases in Sampling Approach:
Issue: The study used purposive sampling for key informants and stratified random sampling for healthcare providers. While these methods ensure the inclusion of relevant participants, they might introduce selection bias.
Solution: Future studies should explore random sampling or consider using a mixed-methods approach that includes longitudinal sampling to capture diverse perspectives over time, helping to mitigate selection bias.

Response Bias:
Issue: Healthcare workers may have provided socially desirable answers, particularly when discussing organizational aspects like leadership and infrastructure.
Solution: To minimize response bias, future research could include anonymous surveys and emphasize confidentiality in interviews. Additionally, integrating observational data alongside self-reported data could provide a more objective view of the situation.

Limited Causality in Cross-Sectional Design:
Issue: The cross-sectional design limits the ability to draw causal conclusions, as it captures data at a single point in time.
Solution: A longitudinal study design could allow for the tracking of changes in EHR adoption over time, providing a clearer understanding of cause-and-effect relationships between organizational factors and EHR success.

Generalizability of Findings:
Issue: The study was conducted in Machakos County, Kenya, which may limit the applicability of the results to other regions or countries with different healthcare infrastructures and resources.
Solution: To improve generalizability, future research could conduct similar studies in other countries or regions within Kenya or even compare findings across countries with varying healthcare systems and EHR adoption rates.

Lack of Discussion on Future Research Directions:
Issue: The abstract does not mention potential areas for future research that could build on the findings.
Solution: Future studies could explore the impact of EHR implementation on patient outcomes and efficiency in different health sectors (e.g., private vs. public hospitals). It could also investigate barriers to EHR adoption in smaller or rural health facilities or examine the role of specific software and hardware solutions in successful adoption.

Authors' Contributions:

The research is a contribution by all the authors. J.N: came up with the concept and methodology, carried out the research work, including data collection, analysis, and writing, V.M: data analysis, interpretation, and guidance through the process of the research work. M.W: development of research objectives, questionnaire, conceptual framework, guidance in the process of the study, as well as assisting in manuscript writing and revisions. The final manuscript was read and approved by all the authors.

Generative AI statement

The author J.N. declares that no generative AI tools were used in the preparation, writing, editing, data analysis, or creation of any part of this manuscript. This was a joint effort by the three authors: J.N., V.M., and M.W. All content is original and the result of the authors' independent work.

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