

TECHNOLOGY INTEGRATION AND OPERATIONAL EFFICIENCY OF HEALTH CARE SERVICE DELIVERY: A CASE OF KAJIADO COUNTY

BY

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Abstract

Technology integration in healthcare is important because it helps in improving the delivery of healthcare services through reducing delays, improving access to patients' information, supporting better decision-making, and enabling better use of resources. This study assessed the impact of technology integration, specifically Electronic Health Records, in the delivery of healthcare services on operational efficiency in Kajiado County. Despite investment in digital health, healthcare facilities in Kajiado County still experience long patient waiting times, inefficient use of resources, fragmented information systems, and low satisfaction of patients. A descriptive research design was used in this study. Yamane's formula was used in coming up with a sample size of 214, where respondents were selected using stratified random sampling. For the study, primary data was collected using a structured questionnaire. It was then analyzed using SPSS Version 23 through descriptive statistics and inferential statistics. The findings showed that Electronic Health Records had positive and statistically significant effect ($B = 0.351$, $\beta = 0.348$, $p = 0.001$) on operational efficiency. The study concluded that the integration of digital health technologies played a significant role in improving operational efficiency of healthcare services in Kajiado County. The study recommends investment in digital infrastructure, staff training, technical support, and integration of Electronic Health Records across public healthcare facilities.

Keywords: Technology Integration, Electronic Health Records, Operational Efficiency, and Healthcare Service Delivery

Introduction

Globally, countries are experiencing health system-related problems that vary from one country to another. According to Oleribe et al. (2023), these challenges are experienced more in countries that have a high Human Development Index. In Africa, healthcare systems have, for a long time, experienced man-made issues which cut across institutional, human resources, financial, technical and political developments. Melnychenko and Ovcharova (2024) explain that in 2007, the World Health Organization (WHO) proposed a framework describing six core components, or "building blocks," of an effective healthcare system. These components are service delivery, healthcare workforce, healthcare information systems, medicines and technologies, financing, and leadership/governance.

According to Siegel et al. (2025), realizing these six components proposed by WHO has been challenging

across both developed and developing countries. Despite major investments in healthcare reforms, many countries continue to face inefficiencies due to inadequate infrastructure, shortages of healthcare workers, poor information management systems, and unequal access to healthcare services. Oleribe et al. (2023) note that integrating technology into healthcare delivery has been an important approach in addressing these challenges and improving important functions of health systems. Alqaysi et al. (2024) further explain that digital health technologies can improve service delivery, enhance the coordination of care, strengthen data management, and support evidence-based decision-making. As a result, the use of technology has become an effective and practical way of improving the performance and operational efficiency of healthcare systems (Ebo et al., 2025).

Despite the integration of technology in delivering healthcare services, Tareh et al. (2023) explain that

there are still disparities which persist between rural and urban regions. Kimathi et al. (2025) add that counties such as Kajiado and Homa Bay face challenges such as poor infrastructure, limited electricity, cultural reluctance toward modern medical treatment, and low digital literacy. Oloo et al. (2020) added that health facilities such as Level 4 and 5 hospitals often lack the resources which should enable the operationalization of Electronic Health Records (EHRs) leading to inefficiencies in healthcare service delivery.

Statement of Problem

Even though the potential of digital health technologies is widely acknowledged globally, Kajiado County continues to experience significant inefficiencies in healthcare service delivery. Healthcare facilities should provide timely, effective, and patient-centred services characterized by minimal waiting times, optimal resource utilization, high diagnostic accuracy, and strong patient satisfaction. However, this ideal remains elusive in the county.

Kajiado County persistently struggles to effectively make maximum use of reliable technologies such as Electronic Health Records (Tareh et al., 2023). These challenges originate from inadequate infrastructure, inconsistent data management, missing records, and non-standardized patient information systems. Other challenges include low levels of digital literacy, cultural resistance among the Maasai community, reliance on indigenous healing practices, and limited technical skills and equipment (Howland, 2021). As a result, operational efficiency continues to deteriorate across many healthcare facilities in the county.

According to Wanjeri et al. (2025), in Kenya, the average waiting time for patients is 3-4 hours, which is consistently high despite digital transformation efforts, leading to high instances of dissatisfaction with healthcare services. The long waiting times have led to delays, resulting in approximately 40% inefficiency in patient flow management. This has also led to inefficient use of resources despite advancements in healthcare-related technologies. Moses et al. (2021) also reported that county public healthcare systems in Kenya recorded a median technical efficiency level of only 84%, indicating that nearly 16% of available resources are lost through operational inefficiencies.

Nevertheless, existing studies show that there are cases of deterioration in service delivery, which is a major indicator of operational efficiency. A study by the Kenya National Patient Experience Survey (2024) showed that only 54% of patients were satisfied with healthcare services, which was a decline from 67% reported in 2021, showing a growing concern concerning the quality, accessibility, and responsiveness of healthcare delivery in Kenya. This was mainly due to delays in treatment and fragmented service processes. This existing literature shows that operational efficiency, which is determined using patient waiting time, resource utilization, and level of satisfaction of patients, continues to be erratic despite technological advancements in healthcare systems.

Despite the increasing adoption of digital health technologies and continued investments in healthcare digital transformation in Kenya, in rural areas such as Kajiado County, operational inefficiencies in healthcare service delivery remain persistent. Existing studies have mainly assessed health technologies in isolation, with limited attention given to their integrated influence on operational efficiency outcomes such as patient waiting time, resource utilization, and patient satisfaction. Therefore, this study seeks to address this gap by examining the effect of EHRs on operational efficiency in healthcare service delivery in Kajiado County, Kenya.

LITERATURE REVIEW

This study was guided by the Technology Acceptance Model (TAM). This theory was developed by Fred Davis in 1989, and it draws its perspectives from the Theory of Reasoned Action (TRA). According to Lee et al. (2025), this theory helps in predicting how people accept and use information systems and technologies, while also showing the factors that influence the acceptance of technology. Agarwal and Karahanna (2000) argue that the model emerged from the need to understand why individuals accept or reject technologies in different organizational settings. According to Davis (1989), the adoption of any new technology depends on the beliefs of the users and attitudes toward the system. According to Zoccarato et al. (2024), TAM states that people are more likely to accept technology when they see it useful and easy to use. This positive view increases their intention to use the system, leading to the actual usage.

This theory is founded on two metrics, which are perceived usefulness (PU) and perceived ease of use (PEOU). Zoccarato et al. (2024) explain that PEOU looks at how simple a system is to understand and operate, while PU is based on how helpful and practical the system is. Davis (1989) stated that individuals evaluate the advantages of using a technology against the efforts needed to use it. When users feel that a system is both useful and easy to use, they are more likely to accept and use it. Kamal et al. (2020) note that TAM also considers external factors such as the design of the system, user training, and technical support, which shape these perceptions and influence attitudes, intentions, and actual technology use. Over time, the model has been expanded through versions such as TAM2 and TAM3, adding factors such as social influence, cognitive processes, and facilitating conditions. These improvements have made the model to be more useful in explaining the use of technology in areas such as healthcare, education, banking, and public administration (Davis, 1989; Venkatesh & Davis, 2000).

There are different studies which have assessed the relationship between Electronic Health Records and the operational efficiency of healthcare service delivery. For instance, Hossain et al. (2019) investigated the determinants of EHR adoption based on PLS-SEM model. Social Influence ($\beta = 0.19$, $P < 0.05$), Facilitating Conditions ($\beta = 0.19$, $P < 0.05$), and Personal Innovativeness in Information Technology ($\beta = 0.19$, $P < 0.05$) were significant predictors of EHR adoption according to their findings. On the other hand, none of the following were significant predictors: Performance Expectancy ($\beta = 0.08$, $p > 0.05$), Effort Expectancy ($\beta = -0.02$, $p > 0.05$), and Resistance to Change ($\beta = 0.03$, $p > 0.05$). These results highlight that increasing social interaction, maintain adequate technical support as well as stimulating risk taking among physicians are essential in order to spread EHR use. However, the study did not consider specific constructs of EHR such as accessibility of data, accuracy of records, usability of system, speed of documentation, and the impact of these on indicators of operational efficiency, such as patient waiting time and speed of service delivery.

Alalwan et al. (2018) carried out a study to assess the factors that affect the use of Electronic Health Records in healthcare institutions. The study looked at how

facilitating conditions, such as access to adequate infrastructure, technical support, and staff training, help in the successful use of EHR systems. This study used a quantitative research design, where data was collected from healthcare professionals using structured questionnaires. The data was then later analysed using SPSS software. The results from this study showed that facilitating conditions had a strong positive relationship with the use of EHR ($\beta = 0.412$, $p = 0.001$). The study also found that system reliability had a major effect on the trust of the user, and continued use of EHR systems ($r = 0.768$, $p = 0.003$). The study also explained that healthcare facilities need to invest in infrastructure, regular training of staff, and IT support systems to improve the use of digital health technologies. However, the study did not evaluate the specific EHR constructs such as record accuracy, data accessibility, system usability, and speed of documentation. Empirically, the study did not show the direct effect of the use of EHR on operational efficiency indicators such as patient waiting time, service delivery speed, and resource utilization. In terms of context, the study was carried out in a generalized healthcare environment and did not focus on rural county hospitals such as those in Kajiado County, where infrastructural challenges are more serious.

RESEARCH METHODOLOGY

This study used a descriptive-correlational research design. The target population for this study was made up of frontline healthcare professionals working in the five public health facilities in Kajiado County, with an estimated total population of 2,200 healthcare workers (County Government of Kajiado, 2025). These five public hospitals are Kajiado County Referral Hospital, Ngong Sub County hospital, Oloitoktok Sub County hospital, Kitengela Sub County hospital and Ongata Rongai Sub-County Hospital. The sample frame included special medical consultants, medical officers, dentists, clinical officers, nurses, nutritionists, laboratory officers, public health officers, physiotherapists, health administrative officers, health records and information management officers, medical engineers, morticians and mortuary attendants, community health assistants, and community health volunteers. The study determined the sample size using Yamane's (1967) formula for finite populations,

where a 6.5% margin of error was adopted, leading to a sample size of approximately 214 respondents. The research instrument used to collect primary data was a structured questionnaire that used closed-ended questions. The questionnaire was then shared electronically in form of a Google Form to the respondents. Data analysis was done using descriptive and inferential statistics. A multiple linear regression analysis as part of inferential statistics was used to analyze the relationship between the EHR systems and the operational efficiency of healthcare service delivery in Kajiado County. The regression model used in the data analysis was: $Y = \beta_0 + \beta X + \varepsilon$

Where: Y = Operational Efficiency (patient waiting time, resource utilization rate, and service delivery speed)

X = EHRs systems

β_0 = Constant

β = Regression coefficients

ε = Error term

RESULTS AND DISCUSSION

The response rate was first presented to establish the reliability and adequacy of the collected data for analysis. The demographic characteristics of respondents were then described based on their education level, professional specialty, health facility, and years of service. Diagnostic tests were also done to make sure that the data met the assumptions required for regression analysis. The results showed that the research instrument was reliable, with Cronbach's Alpha values above 0.7 for the study variables. The variable (Electronic Health Records) recorded a Cronbach's Alpha value of 0.82, showing high internal consistency and showing that the questionnaire items used to measure EHR were reliable.

The findings showed that respondents agreed that Electronic Health Records had a positive relationship with the operational efficiency of healthcare services in Kajiado County ($M = 3.91$, $SD = 0.644$). The results showed that EHRs are important drivers of better efficiency in operations during healthcare service delivery because they improve access to patient information, reduce duplication of records, improve the accuracy of medical information, and support coordination among healthcare providers and the patients. Before carrying out regression analysis, diagnostic tests were done to ensure that the data was

suitable to inferential statistics and analysis. The linearity test showed that there was a positive linear relationship between Electronic Health Records and operational efficiency. The Ramsey RESET test also confirmed that there were no specification errors in the model ($p > 0.05$). The normality test showed that residuals were normally distributed, while the Breusch-Pagan test confirmed homoscedasticity, showing that the variance of residuals was constant and the regression results were reliable.

Results from the descriptive analysis showed that accessibility of patient information was rated highest ($M = 4.37$, $SD = 0.586$), followed by reduction of duplication of patient records ($M = 3.91$, $SD = 0.552$), improvement of medical record accuracy ($M = 3.86$, $SD = 0.708$), coordination among healthcare providers ($M = 3.77$, $SD = 0.686$), and speed of clinical documentation ($M = 3.62$, $SD = 0.665$). These findings show that respondents appreciated the role played by EHRs in improving the management of healthcare-related information and healthcare workflow. The results agreed with Darwish et al. (2021), who argued that EHR systems improve access to patient information, reduce paperwork, minimize errors, and enhance workflow efficiency. Nevertheless, Anusi (2026) noted that EHRs enable faster clinical decision-making by enabling healthcare providers to access accurate patient records. The findings also agree with Alalwan et al. (2018), who added that reliable systems, technical support, and proper infrastructure facilitate the use of EHRs in healthcare facilities. Therefore, the findings show that Electronic Health Records have a positive influence on operational efficiency since they improve the accessibility of healthcare information, reduce delay in looking for medical records, and enhance healthcare service delivery in Kajiado County.

Results from Regression Analysis

The objective of this study was to assess the impact of Electronic Health Records on the operational efficiency of healthcare services in Kajiado County. Regression analysis was carried out to determine the effect EHRs on the efficiency of operations in Kajiado County. Operational efficiency of healthcare service delivery was the dependent variable, while Electronic Health Records was the independent variable. Five statements were used to examine whether EHR systems improved access to patient information,

reduced duplicate records, increased record accuracy, coordination among healthcare providers, accelerated clinical documentation, and enhanced

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.672	0.452	0.438	0.521

The regression model shows that EHRs had a strong positive relationship with operational efficiency in healthcare facilities in Kajiado County. This is evident from the recorded correlation coefficient ($R = 0.672$). The coefficient of determination ($R \text{ Square} = 0.452$) shows that approximately 45.2% of the variation in operational efficiency can be explained by the integration of EHRs included in the model. After adjusting for the number of predictors, the Adjusted $R \text{ Square} = 0.438$, meaning that the model still explains 43.8% of the variation in operational efficiency after controlling for possible inflation arising from the inclusion of several predictors. The standard error of the estimate (0.521) is relatively low, showing that the predicted operational efficiency values are reasonably close to the observed values and that the regression model provides a good fit to the data used in the study. In conclusion, the results show that integration of technology has a significant impact on the efficiency of operations in the healthcare system, while the remaining 54.8% of the variation can be due to other organizational, infrastructural, environmental, and operational factors not included in the model.

FINDINGS

Correlation analysis showed that there was a positive and statistically significant relationship between EHRs and operational efficiency in healthcare facilities in Kajiado County, with a correlation coefficient ($r = 0.651$, $p < 0.01$), and regression coefficient ($B = 0.351$, $\beta = 0.348$, $p < 0.001$). This shows that the use of electronic patient records, improved accessibility of information, accurate records, and faster documentation are associated with improved operational efficiency. Based on this strong statistical association, it is clear that EHRs in terms of improving access to patient information, reducing duplication of records, increasing accuracy of records, accelerating clinical documentation, and enhancing coordination among healthcare providers, impact the operational efficiency of healthcare service delivery. The findings

are in agreement with recent empirical evidence, which shows that digital health technologies have a positive influence on the efficiency of operations in healthcare facilities. Rahman et al. (2022) argued that electronic health information systems improve administrative processes by enabling easy access to data, reducing documentation delays and misplacement of health records, hence enabling coordinated decision-making. Al-Husban et al. (2023) explained further that effective use of digital systems enables the integration of workflow and responsiveness to services.

Conclusion

This study is important because it highlights the need for effective use of Electronic Health Records in improving the operational efficiency of healthcare services in Kajiado County. Healthcare facilities operate in an environment where timely access to patient information, proper management of records, and efficient coordination of services are very important in improving the quality of healthcare service delivery. Poor management of patient records can lead to delays, duplication of information, medical errors, poor decision-making, and inefficient use of healthcare resources. Therefore, understanding the role of Electronic Health Records is important because these systems provide a better way of storing, accessing, and sharing patient information, which enables faster service delivery and better management of healthcare activities. Without effective EHR systems, healthcare facilities may continue to experience challenges that are related to missing records, delays in accessing patient information, and reduced efficiency in patient care processes.

The focus on Electronic Health Records as a technology that influences operational efficiency enables this study to provide evidence on how the integration of technology in the delivery of healthcare services leads to better healthcare service delivery. Although previous studies have examined the adoption

and use of EHRs in different healthcare settings, limited attention has been given to their specific contribution to operational efficiency in public healthcare facilities within rural counties such as Kajiado. The findings of this study show that healthcare workers recognize the importance of EHRs in improving healthcare operations. This shows that improved use of Electronic Health Records leads to better access to patient information, improved accuracy of records, reduced duplication of patient information, and faster healthcare service delivery.

The study is also practically important to healthcare managers, county health officials, policymakers, healthcare workers, and other stakeholders involved in digital health transformation. The findings provide a basis for strengthening the implementation and use of Electronic Health Records in healthcare facilities in Kajiado County. Healthcare managers should ensure that EHR systems are properly integrated into daily healthcare activities, supported with adequate infrastructure, and accompanied by continuous training for healthcare workers. Staff training should focus on improving digital skills, proper documentation practices, and effective use of electronic systems in patient care. In addition, healthcare facilities should provide regular technical support to address system challenges and improve user confidence. Effective use of EHRs can help in reducing patient waiting time, improve clinical decision-making, minimize errors, and ensure better utilization of available healthcare resources. However, EHRs should not be viewed as a standalone solution but should be supported by strong leadership, reliable internet connectivity, adequate funding, and supportive policies to achieve maximum benefits.

Future research should examine how specific components of Electronic Health Records, such as system usability, data security, interoperability, and user satisfaction, influence healthcare operational efficiency. Further studies should also compare the effectiveness of EHR implementation across different counties and healthcare facility levels in Kenya to identify factors that promote successful digital health transformation. Such studies would provide more knowledge on how Electronic Health Records can continue supporting improved healthcare delivery, better resource management, and sustainable health system performance.

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