ELECTRONIC MEDICAL RECORDS ADOPTION AND PATIENT HEALTH OUTCOME METRICS IN INTENATIONAL RESCUE COMMITTEE FACILITIES AT KAKUMA REFUGEE CAMP, KENYA

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June 25

DECLARATION

I declare that this document and the research that they describe are my original work and that they have not been presented in any other university for academic work.

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This research was carried out under our supervision and is submitted with our approval as University supervisors.

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DEDICATION

This research is dedicated to my parents, Adram Muloma and Alice Muloma, whose unwavering guidance and belief in my potential taught me the value of hard work and perseverance. I also dedicate this work to Gladys Muiga, whose motivation and support encouraged me to pursue my master's studies. Their collective faith in my abilities has been the cornerstone of this academic journey.

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DEFINITION OF TERMS

Electronic Medical Records (EMR)	Computer-based systems that store patients' health information, including medical history, diagnoses, medication, and treatment plans.
Drug Tracking Efficiency	The degree to which health facilities track drug inventories efficiently, reduce stockouts, and minimize wastage through EMR systems.
Patientcare Quality	Improvement in accuracy and speed of retrieval of patient information to support timely and accurate healthcare decisions.
Report Generation	Timely and appropriate reporting to health management, donors, and government bodies with the use of the EMR system.
Data security	Ensures personal health information of patients is kept from unauthorized access, maintaining data privacy through secure EMR systems.
Health Care Quality	Overall improvement in healthcare delivery, patient outcomes, efficiency, and satisfaction achieved by implementing EMRs.
Kakuma Refugee Camp	A refugee settlement in Kenya used in this study to evaluate the effect of EMR systems on healthcare delivery.
Stockouts	Situations where necessary drugs or medical supplies are unavailable, which EMR systems help avoid by improving inventory management.
Data Security	Protection against breaches or unauthorized electronic access to maintain patient information in EMR systems.
Patient health outcomes metrics	The results of healthcare delivery, such as the speed of patient recovery, are influenced by quality care through EMR systems.
International Rescue Committee (IRC)	A global humanitarian organization managing healthcare services in refugee camps, including Kakuma Refugee Camp.

ABBREVIATIONS AND ACRONYMS

EMR	Electronic Medical Records
IRC	International Rescue Committee
IT	Information Technology
WHO	World Health Organization
MOH	Ministry of Health
ICT	Information and Communication Technology
HIT	Health Information Technology
HIS	Health Information Systems
NGO	Non-Governmental Organization
USAID	United States Agency for International Development
HER	Electronic Health Records
GDP	Gross Domestic Product
UNHCR	United Nations High Commissioner for Refugees
BMC	BioMed Central

ABSTRACT

This study was conducted in Kakuma Refugee Camp, Kenya, where the adoption of Electronic Medical Records (EMRs) in humanitarian healthcare settings is increasingly recognized as a strategic intervention for improving clinical quality, operational efficiency, and system accountability. However, implementation in resource-limited environments like Kakuma remains challenged by infrastructural constraints, limited digital capacity, and workforce turnover. This study assessed the influence of EMR adoption on four core operational domains—drug inventory tracking, quality of patient care quality, data security, and report generation—and their impact on patient recovery outcomes within International Rescue Committee (IRC) health facilities. Anchored in the Diffusion of Innovations (DOI) Theory, the Technology-Organization-Environment (TOE) Framework, and Donabedian's Quality-of-Care Model, the study employed a quantitative explanatory research design, using structured questionnaires administered to 53 healthcare workers. Multiple linear regression was used to determine the predictive effect of each EMR functionality on self-reported clinical outcomes, including treatment adherence, diagnostic turnaround time, and overall recovery. Findings revealed that all four EMR functionalities had a statistically significant and positive impact on patient recovery outcomes. Patient care quality was the strongest predictor ($\beta = 0.881$, $p = 0.000$), followed by drug tracking efficiency ($\beta = 0.640$, $p = 0.000$), data security ($\beta = 0.625$, $p = 0.017$), and report generation ($\beta = 0.539$, $p = 0.001$). The model explained 62.1% of the variance in recovery outcomes ($R^2 = 0.621$), indicating a robust model fit. These results underscore that EMRs are most effective when fully integrated into clinical, pharmaceutical, administrative, and reporting workflows. Chapter Five concludes that while all functionalities contribute significantly, their collective value is maximized through alignment with day-to-day practices, policy support, and user-centered system design. The study contributes to theory by extending digital health adoption frameworks to fragile healthcare environments and to practice by identifying functionality-specific priorities for EMR implementation. Methodologically, it demonstrates the utility of frontline perception data in evaluating digital system performance where objective health indicators are limited. Policy recommendations include role-specific training, participatory system refinement, and public–private partnerships to ensure scalable and sustainable EMR deployment. Future research should incorporate objective clinical metrics, longitudinal designs, and a broader scope of system functionalities. Qualitative studies are also encouraged to explore user experiences and support EMR alignment with operational realities in complex humanitarian contexts.

CHAPTER ONE

INTRODUCTION

1.1. Introduction

This chapter provides an overview of the research in terms of background to the study, statement of the problem, research objectives, hypotheses, and significance of the study. It will also cover the scope, limitations, delimitations, and assumptions of the research. In addition, the theoretical framework upon which the study is based will be presented, followed by the conceptual framework illustrating the inter-relationship of the variables scrutinized.

1.2. Background of Study

Generally, EMRs have transformed health systems globally by increasing the quality, productivity, and accessibility of services. For example, high-income countries like the USA, Germany, and Australia have scored great strides in patient health outcomes metrics. In the US, hospitals that adopted EMRs documented large declines in rates of adverse drug events by 25% and readmissions by 20% (Hersh *et al.,* 2020). Still, with the use of EMRs, Germany has improved medication safety and communication by reducing errors through automated alerts (Silva *et al.,* 2021). With pandemics such as COVID-19, EMRs have been very critical in facilitating real-time surveillance of diseases and resource allocation (WHO, 2023). The above improvement falls under SDG 3 for promoting accurate data-driven health decisions. However, even in high-resource settings, interoperability and data privacy have been an issue that needs to be continued to be refined.

In Sub-Saharan Africa, the adoption of EMRs has been very slow because of infrastructural, financial, and technical barriers to implementation. A few countries like Rwanda and South Africa have pioneered EMR implementation with substantial success. In Rwanda, EMRs contributed to a 15% decrease in maternal mortality and a 10% improvement in infant patient health outcomes metrics by enhancing care coordination in district hospitals (Mukherjee *et al.,* 2020). The integration of EMRs in public hospitals in South Africa improved drug inventory management by 20%, reducing stock-outs and waste (Booth *et al.,* 2021). Pilot EMR programs in Ethiopia have increased the reliability of patient data by 25%, improving follow-up care (Booth *et al.,* 2021). However, poor or no internet connectivity, erratic power supplies, and inadequate training of the staff under which most of the facilities work greatly hinder scaling

up. Investment in infrastructure and capacity building is critical to overcoming these barriers and realizing the potential of EMR for SDG 9 on resilient health innovations.

In East Africa, progress toward EMR adoption has been slow, with wide disparities across countries. For instance, Uganda's pilot EMR projects increased the efficiency of drug tracking by 20%, reducing stockouts significantly (Maina *et al.,* 2022). However, manual recording remains a norm in most, delaying quality care delivery. Refugee camps in East Africa, especially those in Uganda, Ethiopia, and Kenya, represent some of the most underserved healthcare environments. These settings have some of the greatest patient turnover rates, resource scarcity, and infrastructural gaps, making the deployment of EMRs challenging. However, in settings where they have been implemented, EMRs have improved the rate of patient recovery by preventing medication errors from occurring (Mukherjee *et al.,* 2020). Consequently, this is in line with SDG 10 in respect of health inequity among the displaced population.

In Kenya, EMR adoption has been accelerated by government policies, international support, and NGO initiatives. Urban hospitals reported a 15% reduction in clinical errors and great improvement in patient outcomes after the implementation of EMRs (Kamau & Mwangi, 2021). Progress is slower in rural and refugee settings, such as Kakuma Refugee Camp, where infrastructure is weaker, and resources are more constrained. The 2021 implementation of EMRs by the IRC, as undertaken by Kakuma, has revealed preliminary successes in reducing drug stock-outs by 30% and improving the speed of patient record retrieval (Maina *et al.,* 2022). Such developments have enhanced clinical decision-making and contributed to an increase in the number of recoveries. However, challenges such as unreliable electricity, poor internet connectivity, and high staff turnover continue to impede full optimization of EMRs and delay continuity of care. Strengthening EMR systems in Kakuma may provide scalable solutions for similar resource-limited settings across Kenya.

The study concentrates on four operational domains of EMRs—drug tracking efficiency, Patient care quality, data security, and report generation—as key levers influencing patient health outcomes metrics in Kakuma's IRC clinics. This shall seek to examine the short- and long-term implications of EMR implementation on patient health outcomes metrics against the backdrop of challenges facing infrastructure, training, and cybersecurity. In so doing, the research responds to SDG 3, SDG 9, and SDG 10 through the proposal of scalable and sustainable solutions for resource-constrained settings within healthcare.

1.2.1. Electronic Medical Records Adoption

Adoption of electronic medical records characterizes one of the enormous revolutions in modern healthcare, improving safety and clinical decision-making, together with operational efficiency in the health systems of high-income countries. For instance, in such countries as the United States, Canada, and the United Kingdom, EMRs have integrated into the health system to the extent that they currently enable health caregivers to access patient records with unparalleled speed and greatly reduce medication errors. In Canada, hospitals that adopted electronic medical records experienced a remarkable 25% reduction in adverse drug events, coupled with a 30% improvement in the management of preventive care (Hersh *et al.,* 2020; Silva *et al.,* 2021). Such progress illustrates the potential of EMRs to revolutionize healthcare globally, provided there is adequate infrastructural and technical support.

Institutions in the Sub-Saharan region have shown slow adoption of EMRs in health due to financial, infrastructural, and technical constraints. Regardless of the challenges, several countries have been able to attain critical successes. South Africa serves as an example of successful EMR integration into its health management and healthcare delivery system according to Oriaregbete (2019). The implementation of Electronic Medical Records in Rwanda produced better health outcomes for mothers and children and led to a 15% reduction in maternal deaths over five years (Alotaibi *et al.,* 2022). This success points out the big potential of EMRs to bring transformational change even in settings that are resource constrained.

Whereas Kenya has realized notable progress in EMR adoption, driven by supportive government policies and international partnerships, improvements have been most visible in urban hospitals. These facilities have reported measurable gains, such as a 15% reduction in clinical errors and improvements in key aspects of Patient care quality (Kamau & Mwangi, 2021). In contrast, healthcare workers in resource-constrained environments like Kakuma Refugee Camp continue to grapple with systemic challenges, including high patient volumes, fragmented health records, and delayed clinical decision-making. In response, the International Rescue Committee (IRC) introduced electronic medical records (EMRs) in Kakuma's health facilities in 2021 as a means to enhance operational efficiency and improve care delivery.

This study investigates the adoption of EMRs by examining four critical dimensions of system performance that influence Patient care quality: drug tracking efficiency, Patient care quality, data security, and report generation. Drug tracking efficiency is conceptualized as the EMR

system's capacity to streamline inventory management and reduce stockouts, and is operationalized by measuring reductions in stockout frequency and wastage of medications. Patient care quality is conceptualized as the effectiveness, accuracy, and timeliness of clinical decision-making, and is operationalized using indicators such as diagnostic turnaround time, treatment adherence, and reduced delays in patient service delivery. Data security refers to the system's ability to protect patient records from unauthorized access; this is operationalized through reported instances of data breaches, implementation of access control protocols, and user compliance with data protection standards. Report generation, the fourth dimension, is conceptualized as the EMR's ability to support timely and accurate health reporting for administrative and clinical use. It is operationalized by tracking improvements in reporting accuracy, completeness, and turnaround time for health management submissions.

Preliminary findings in Kakuma indicate a 30% reduction in drug stockouts and significantly faster retrieval of patient information, resulting in enhanced pharmaceutical management and more streamlined healthcare services (Maina *et al.,* 2022). However, several persistent barriers continue to impede the full potential of EMRs in this setting, including intermittent electricity supply, poor internet connectivity, and limited technical training among staff. While EMR implementation has demonstrated early success in addressing these operational challenges, realizing its full benefits will require further investment in infrastructure, human resource capacity, and system optimization tailored to the realities of humanitarian healthcare environments.

1.2.2. Patient health outcomes metrics

Patient health outcomes metrics are a critical measure for assessing the effectiveness and quality of healthcare delivery, especially in environments marked by limited resources and heightened health vulnerabilities such as refugee camps. The adoption of Electronic Medical Records (EMRs) has attracted considerable attention in recent years due to its potential to improve various dimensions of care. These include enhancing diagnostic accuracy, enabling timely clinical decision-making, strengthening continuity of care, and ultimately reducing preventable morbidity and mortality (Hersh *et al.,* 2020). By digitizing and centralizing patient information, EMRs facilitate data-driven interventions that improve both the immediate and long-term efficiency of clinical services.

In this study, patient health outcomes metrics are operationalized through three specific clinical performance indicators. The first is treatment adherence, defined as the proportion of patients

who complete their prescribed treatment regimens as documented in the EMR system. The second is diagnostic turnaround time, measured by the average duration between a patient's initial consultation and the confirmation of diagnosis. The third is the patient recovery rate, which refers to the percentage of patients who are recorded as having clinically recovered within the expected period of care (Xu *et al.,* 2023).

These indicators were selected to reflect core aspects of clinical quality that EMRs are designed to enhance. Data for each of these variables are extracted from EMR-generated reports and corroborated through patient records and staff inputs. Together, they provide a structured and quantifiable framework for evaluating how EMR adoption influences the actual delivery of care in high-volume, low-resource humanitarian settings like Kakuma. The use of these operational definitions ensures that the study maintains both methodological rigor and contextual relevance while grounding abstract concepts in practical, measurable outcomes.

1.2.2.1. EMR Adoption and Drug Tracking Efficiency

EMRs have significantly improved pharmaceutical logistics by enabling real-time visibility of medicine stock levels and automating reorder processes. Globally, countries like Germany and Australia have reported reductions in drug wastage by up to 35% and lowered stockouts by 25% through EMR systems (Omotosho *et al.,* 2021; Silva *et al.,* 2021). In Sub-Saharan Africa, EMRs have contributed to drug availability improvements in Uganda and inventory accuracy gains in Rwanda (WHO, 2021; Silva *et al.,* 2021).

In Kakuma Refugee Camp, EMRs were introduced to overcome inefficiencies in paper-based stock management systems that often resulted in drug stockouts and misallocation. Within the first year of implementation, stockout events were reduced by 30% and drug wastage by 20% (Maina *et al.,* 2022). These improvements were demonstrated during high-demand episodes such as malaria outbreaks, where EMRs enabled early alerts and redistribution of medication (Titi *et al.,* 2021). Nonetheless, full realization of these benefits is hindered by gaps in electricity, connectivity, and staff training. Addressing these through solar backup systems and targeted capacity building has been recommended to strengthen the pharmaceutical value chain (Mulemi *et al.,* 2023).

1.2.2.2. Adoption of EMRs and Patient Quality of Care

EMRs enhance Patient care quality by improving diagnostic accuracy, reducing clinical errors, and supporting continuity of care. In high-resource settings like the U.S. and Canada, EMRs

have reduced readmissions and improved chronic disease monitoring (Hersh *et al.,* 2020; Hawkins *et al.,* 2021). Similar trends are observed in Sub-Saharan Africa, where EMRs have reduced waiting times and improved care compliance (Silva *et al.,* 2021; Ministry of Health, Kenya, 2022).

At Kakuma, where high patient volume and limited resources challenge care delivery, the implementation of EMRs has led to notable improvements. Follow-up compliance improved by 20%, and diagnostic errors decreased by 15% (Maina *et al.,* 2022). The system enabled real-time monitoring of treatment during disease outbreaks, such as tuberculosis, supporting more effective intervention (Titi *et al.,* 2021). However, barriers such as user resistance and inconsistent connectivity continue to limit the system's potential. These can be addressed through sustained training and EMR platforms designed for offline use.

1.2.2.3. EMR Adoption and Confidentiality of Data

Data security and confidentiality are vital in building trust in digital health systems. EMRs help enforce security through encryption, access controls, and audit logs, as demonstrated in countries like South Africa and Canada (Alotaibi *et al.,* 2022; Hawkins *et al.,* 2021). In East Africa, improvements in data protection have been documented in Rwanda and Uganda (Mukherjee *et al.,* 2020; Silva *et al.,* 2021).

Kakuma has also benefited from EMR-induced improvements in data confidentiality. Since 2021, IRC facilities in the camp have reported a 20% reduction in data breaches (Maina *et al.,* 2022). Nonetheless, challenges remain. About 35% of staff lack adequate training in information security, which affects system reliability (Titi *et al.,* 2021). Power outages and connectivity issues also pose risks. Solutions implemented include solar-powered backups, offline-capable EMRs, and cybersecurity training initiatives. Looking ahead, integrating biometric authentication and linking EMRs with Kenya's national health information systems could strengthen interoperability and privacy safeguards.

1.2.2.4. EMR Adoption and Report Generation

Timely and accurate reporting is critical for effective health system governance and emergency response. In developed settings, EMRs have streamlined reporting workflows, reduced reporting delays, and improved data use in planning (Hersh *et al.,* 2020; Hawkins *et al.,* 2021). In Sub-Saharan Africa, EMRs have improved the completeness and timeliness of health reports, as evidenced in Uganda and Rwanda (Silva *et al.,* 2021).

Kakuma facilities have experienced similar benefits. After transitioning from paper to electronic reporting, IRC centers achieved a 20% reduction in reporting errors and a 25% decrease in report generation time (Maina *et al.,* 2022). Stakeholders, including donors and government partners, cited improved data quality and timeliness as strengthening accountability and investment confidence (Titi *et al.,* 2021). Persistent obstacles, however, include unreliable power and limited staff capacity. IRC has responded by implementing offline databases, training programs, and infrastructure upgrades. These efforts aim to align EMR-supported reporting with evidence-based decision-making and Sustainable Development Goal 17 on data-driven development (Maina *et al.,* 2022).

1.2.3. Electronic Medical Record Adoption and Patient health outcomes metrics

A significant reason for EMR adoption is expectation of augmented patient health outcomes metrics, facilitated through maximized workflows and augmented accuracy in information. In high-resource nations, EMRs lowered prescription errors by 20% and consolidated chronic disease management, 15%, over two years of use (Hersh *et al.,* 2020). Real-time tracking of patients with EMRs in Canada saved 25% in terms of reduced rehospitalization (Hawkins *et al.,* 2021). Recent European studies in hospitals even indicate that routine use of EMRs over 36 months is accompanied with a 10–12% boost in patient overall satisfaction (van Oosterhout & Silvers, 2023).

In Sub-Saharan Africa, EMRs have proven no less transformational, fixing long-standing inefficiencies in care delivery. Tanzanian work attributed EMRs with a 10% fall in maternal deaths and a 15% rise in recovery, through largely medication and timely decision improvement (Mukherjee *et al.,* 2020). In Rwanda, integration of EMRs facilitated immunization programs, with a 20% boost in vaccinating kids (Silva *et al.,* 2021).

Within Kakuma Refugee Camp, the EMRs rollout by the IRC strengthened a range of indicators. Incomplete documentation and persistent delays discolored care delivery in the past. Delayed interventions a year postimplementation reduced by 25%, and patient healing increased 20% (Maina *et al.,* 2022). In measles epidemics, unvaccinated children were quickly identified through EMRs, and subsequently, preventive interventions accelerated (Titi *et al.,* 2021). Trends in disease cases, mother statistics, and healing times in a 12-month review monitored these improvements. Questionnaires completed by health workers also documented 80% increased confidence in clinical decision-making, with EMRs providing in-depth patient background (Silva *et al.,* 2021).

Despite such improvements, infrastructure vulnerabilities—ineffective electrification and connectivity—hobble full use of EMRs in Kakuma. High patient-to-medicine and patient-to-personnel ratios also hinder effective use of EMRs. Solar-powered alternatives, full training sets, and supplementary recruitment of medical practitioners present key interventions for unlocking EMR effectiveness in such challenging environments (Maina *et al.,* 2022). Overall, Kakuma's EMR case confirms information innovation potential for enhancing patient performance in low-resource environments, in supporting accomplishment of SDG 3 for worldwide wellness (Hersh *et al.,* 2020).

1.2.4. Refugee Camps in Kenya

Kenya hosts two key refugee camps, Kakuma and Dadaab, with over 500,000 displaced individuals from neighboring countries in a state of tension (United Nations High Commissioner for Refugees [UNHCR], 2021). Overcrowding disease epidemics and poor medical care form persistent public wellness concerns in these camps. Over 200,000-person population in Kakuma experiences high malnutrition, tuberculosis, and HIV/AIDS infection (UNHCR, 2021). Poor sanitation, low vaccination, and high patient-provider imbalances exacerbate epidemics such as cholera and measles

Historically, the camps have supported information systems for health in terms of paper, developing fractured information and delayed and delayed interventions in care. EMRs of the future represent an opportunity through centralized patient files and rapid interventions in care. In Dadaab, pilot EMRs, for example, reduced drug errors by 30% and increased tracking of such long-term illnesses such as diabetes (Titi *et al.,* 2021). In Kakuma, IRC's use of EMRs in 2021 facilitated a 20% drop in diagnosing errors and 15% in one year's improvement in compliance with care (Maina *et al.,* 2022). EMRs facilitated, in a case of cholera outbreak, tracking of cases and of interventions, and reduced case fatality by 10% (Silva *et al.,* 2021).

Rollout of EMRs in Kenya's camps continues to encounter difficulty, with gaps in infrastructure and technical impediments (UNHCR, 2021). Unstable electricity and no connectivity in terms of internet plug gaps in system operations, and high turnover in personnel necessitates constant retraining. Supplementing solar backup, supporting training, and connecting EMRs with Kenya's National Health Information System represent important actions to facilitate constant, high-quality care for displaced persons (UNHCR, 2021). In addition, a ministry of Health, Kenya (2022) policy brief lists developing country-specific digital frameworks for refugee camps, leveraging multi-stakeholder collaboration for sustained

EMR use, as key to rollout success. Successful rollout of EMRs in refugee settings directly assists in achieving SDG 3 and SDG 10 through improvement in access in terms of care and inequality reduction (Maina *et al.,* 2022).

1.2.5. IRC Health Facilities in Kakuma

The International Rescue Committee (IRC) provides an integrated range of care to approximately 200,000 refugees in Kakuma, a key function in safeguarding public health (Maina *et al.,* 2022). With paper documents long defining IRC's care centers, disorganized patient information and delayed care long characterized them (Maina *et al.,* 2022). In 2021, EMRs were initiated at the IRC to mitigate inefficiencies, a quantum leap in providing care (Maina *et al.,* 2022).

Early indications reveal considerable improvement in controlling long-term disease, namely for hypertension, diabetes, and HIV/AIDS. Twelve months post-implement, EMRs experienced a 20% increase in compliance with care for endemic disease (Silva *et al.,* 2021). In a suspected measles outbreak, gaps in vaccination uncovered via EMRs boosted vaccination campaigns and lowered disease transmission by 15% (Titi *et al.,* 2021). EMRs have, moreover, halted medication wastage at 15%, with drugs regularly in store (Silva *et al.,* 2021).

Notwithstanding, many obstacles remain, including infrastructure and high attrition of personnel. Many medical professionals require training in utilizing EMRs to full potential, and connectivity continues to take a bite (Maina *et al.,* 2022). To mitigate, the IRC started focused capacity development programs and embraced offline-first EMR platforms to mitigate connectivity concerns (Maina *et al.,* 2022). By improving Patient care quality, controlling epidemic disease, and enhancing intervention in emergencies, IRC-managed EMRs in Kakuma contribute towards SDG 3 and provide valuable information for rolling out EMRs in further poor-resource settings (UNHCR, 2021).

1.3. Statement of the Problem

Despite growing adoption of Electronic Medical Records (EMRs) in low-resource settings, evidence linking EMRs to measurable improvements in patient health outcomes—such as treatment adherence, recovery rates, and diagnostic accuracy—remains limited. According to the WHO (2022), only 28% of health facilities in Sub-Saharan Africa using EMRs systematically monitor clinical outcomes, while over 70% focus on administrative metrics like stock management and reporting. In Kenya, Malanda et al. (2022) found that fewer than 35%

of facilities with EMRs reported any improvement in diagnostic accuracy or treatment adherence. At Kakuma Refugee Camp, although EMRs have reduced stockouts by 20% and improved report timeliness by 25% (Maina et al., 2022), their effect on actual patient recovery remains undocumented. This gap highlights a critical issue: EMRs are widely implemented for efficiency, yet their clinical value in improving health outcomes is still poorly quantified, especially in fragile humanitarian contexts.

Despite the expanding presence of Electronic Medical Records (EMRs) in healthcare systems globally, a critical shortfall persists in understanding their clinical utility beyond administrative efficiency. Much of the existing literature tends to focus on EMRs as tools for data management—highlighting their role in improving reporting accuracy, inventory tracking, and documentation speed—while paying insufficient attention to how these systems directly shape Patient care quality outcomes. For instance, Booth et al. (2021) observe that EMRs are frequently evaluated as static data repositories rather than as dynamic clinical tools that support diagnostic accuracy, treatment adherence, or continuity of care. The failure to engage theoretical models such as the Technology Acceptance Model (TAM) or the Health Information System Success Model further deepens this conceptual vacuum. Titi et al. (2021) argue that this theoretical neglect inhibits understanding of how user behavior and system integration interact to influence clinical performance.

Moreover, the contextual realities of humanitarian settings like Kakuma Refugee Camp remain largely absent from dominant EMR literature. Infrastructural fragility, high staff attrition, unreliable connectivity, and limited digital training create conditions that differ significantly from the urban or rural health facilities where most EMR research has been conducted. As Rodriguez and Martinez (2022) emphasize, applying findings from stable health systems to emergency contexts risks oversimplification. Maina et al. (2022) reinforce this by showing that even after EMR implementation in Kakuma, infrastructural constraints and workforce instability significantly undermined system performance—highlighting a major ecological gap in the literature.

Equally limiting is the overreliance on descriptive and qualitative research, which—while valuable for exploratory insights—offers little causal explanation. Stock and Watson (2019) and Wooldridge (2020) advocate for explanatory, regression-based designs to uncover statistically significant relationships between interventions like EMR adoption and clinical outcomes. This study responds to that methodological shortfall by employing a quantitative

explanatory design, using multiple linear regression to rigorously assess how EMR functionalities—specifically drug tracking, Patient care quality, data security, and reporting—affect measurable patient outcomes such as diagnostic turnaround, recovery rates, and treatment adherence. By incorporating key control variables like infrastructure reliability and staff availability, the study provides a more nuanced and statistically grounded understanding of EMR effectiveness in fragile health ecosystems.

In summary, the problem lies in the lack of empirically grounded, theoretically informed, and contextually appropriate evidence that demonstrates whether EMR systems genuinely improve clinical outcomes in complex humanitarian settings. This study aims to fill that gap by evaluating the real-world performance of EMRs within IRC-operated health facilities at Kakuma Refugee Camp, thereby guiding future policy, system design, and investments in digital health in crisis-affected regions.

1.4. Objectives of the Study

The study was guided by the following general and specific objectives.

1.4.1. General Objective

The study established the effect of electronic medical records adoption on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya.

1.4.2. Specific Objectives

The specific objectives of this study were sought to address are the following:

i. To determine the effect of drug tracking efficiency on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya
ii. To determine the effect of improvement in quality on Patient care quality patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya
iii. To determine the effect of report generation on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya
iv. To determine the effect of data security on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya

1.5. Study Hypotheses

Hypotheses tested in the study are stated below, corresponding to the specific objectives stated earlier:

H_{O1}: Drug tracking efficiency has no significant effect on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya

H_{O2}: Improvement in quality patientcare has no significant effect on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya

H_{O3}: Report generation has no significant effect on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya

H_{O4}: Data security has no significant effect on patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya

1.6. Significance of the Study

This study has provided meaningful insights for the Government of Kenya, the Ministry of Health (MOH), and humanitarian health actors seeking to enhance clinical performance in underserved populations through the adoption of Electronic Medical Records (EMRs). For the MOH and other government agencies, the research offered evidence-based conclusions on how EMR systems can improve key dimensions of healthcare delivery in fragile contexts, such as drug stock management, diagnostic efficiency, and patient recovery. These findings support informed decision-making on resource allocation, policy development, and national strategies for scaling digital health systems across both urban and marginalized populations, including refugee settlements.

At the operational level, the study generated practical lessons for the International Rescue Committee (IRC) and other non-governmental organizations implementing health programs in Kakuma Refugee Camp and similar environments. By evaluating the real-world effects of EMR use on treatment adherence, diagnostic turnaround time, and recovery rates, the study identified the specific system functionalities that contribute most to improved patient outcomes. These results provide actionable guidance for health facility managers, system developers, and donors on where to prioritize training, infrastructure investment, and technical support.

The research also made a theoretical contribution by applying established models—namely, the Diffusion of Innovations (DOI) Theory and the Technology–Organization–Environment (TOE) Framework—to a humanitarian health setting. In doing so, it demonstrated how EMRs can transition from being seen as administrative tools to becoming integral components of

clinical decision-making and service continuity in high-pressure, resource-constrained environments.

In the academic and research domain, this study added to the limited but growing body of literature on digital health implementation in displaced populations. By using multiple linear regression to assess causal relationships between EMR use and clinical outcome indicators, the study established a rigorous methodological precedent for future inquiries. It further laid the groundwork for subsequent research into EMR sustainability, user experience, and system scalability, particularly within the public health frameworks overseen by national authorities such as the MOH.

1.7. Scope of the Study

This study investigated the impact of Electronic Medical Records (EMRs) on clinical performance outcomes within International Rescue Committee (IRC) health facilities at Kakuma Refugee Camp in Kenya. Specifically, it assessed how EMR adoption influenced four key operational domains: drug tracking efficiency, quality of patient care quality, data security, and the generation of healthcare reports. These areas were selected due to their direct relevance to service delivery performance and their alignment with the informational needs of key stakeholders, including the IRC, donors, and the Ministry of Health (MOH).

The study focused exclusively on the Kakuma Refugee Camp, a context that is markedly different from typical health service environments due to its constrained infrastructure, high patient turnover, limited staffing, and frequent public health emergencies. Kakuma was purposefully selected as the study site because it represents a high-need, high-risk setting where the implementation of EMRs by IRC in 2021 offered a unique opportunity to evaluate the system's effectiveness under humanitarian conditions.

The period under investigation covered the years 2021 to 2023, which corresponded to the early stages of EMR implementation and integration into routine clinical operations. This timeframe allowed for the analysis of health performance indicators both before and after EMR deployment, enabling an assessment of changes in patient recovery rates, treatment adherence, diagnostic turnaround time, and report generation.

A quantitative research design was employed to ensure objectivity and statistical validity. Data were drawn from structured IRC records, including patient service logs, inventory reports, and EMR system-generated outputs. These data were analyzed to determine the extent to which

EMR functionalities contributed to measurable improvements in healthcare delivery outcomes within the refugee camp context.

1.8. Limitation and Delimitation of the Study

One of the major limitations encountered in this study was the availability and completeness of EMR data from IRC-operated health facilities in Kakuma Refugee Camp. Although the EMR system was implemented in 2021, inconsistencies in data entry and gaps in historical records affected the depth and reliability of the quantitative analysis. To mitigate this, the researcher collaborated closely with IRC administrative and clinical personnel to verify data availability, validate critical records, and cross-check missing entries wherever possible.

Another limitation was the relatively short duration of EMR implementation at the time of study, covering the period from May 2021 to early 2023. This restricted the ability to assess long-term trends or delayed clinical impacts that may only become evident over an extended period of system use. In response to this constraint, the study adopted a pre-and post-implementation comparative approach and cautiously projected future implications based on observable short-term patterns.

The study was delimited to IRC health facilities within Kakuma Refugee Camp. While EMR systems are increasingly being adopted in other refugee camps and health institutions, this research intentionally focused on a single, well-defined setting to maintain contextual relevance and analytical precision. This delimitation ensured that findings were rooted in the operational and infrastructural realities specific to Kakuma.

Furthermore, the study was restricted to four core EMR operational domains—drug tracking efficiency, quality of patient care quality, data security, and report generation—as independent variables. These were examined in relation to clinical outcome indicators such as treatment adherence, diagnostic turnaround time, and recovery rates. Although EMRs may also impact areas such as staff productivity, financial reporting, or broader institutional efficiency, these dimensions were beyond the scope of the present analysis to maintain focus on patient-centered clinical performance. The study also did not attempt to generalize findings to national-level EMR implementations or broader international contexts, but instead concentrated on localized evidence from a humanitarian health environment.

1.9. Assumptions of the Study

This study was based on several key assumptions that underpinned its methodology and interpretation of results. First, it was assumed that the data captured in the EMR system across IRC health facilities in Kakuma Refugee Camp was accurate, reliable, and sufficiently complete to reflect actual healthcare delivery processes. This included assumptions about the integrity of patient records, drug inventory logs, and clinical outcome metrics used for the analysis.

The study further assumed that healthcare professionals consistently utilized the EMR system in accordance with operational guidelines and standards, ensuring uniformity in data entry, retrieval, and reporting practices. It was also assumed that respondents—both clinical staff and other stakeholders—provided honest and accurate information during data collection through structured questionnaires and survey tools.

Additionally, the study relied on the assumption that the necessary infrastructural support—such as stable electricity supply, functional network connectivity, and timely technical maintenance—was adequately available during the study period. These conditions were considered essential for the EMR system to function effectively and for the study to accurately assess its impact on clinical performance indicators.

Collectively, these assumptions provided the foundation for evaluating the relationship between EMR adoption and patient health outcome metrics in the unique operational context of Kakuma Refugee Camp.

1.10. Theoretical Framework

The adoption of Electronic Medical Records (EMRs) is central to enhancing healthcare service delivery by improving drug tracking efficiency, Patient care quality, data security, and reporting accuracy. These operational improvements, which serve as the independent variables in this study, are expected to influence patient health outcomes metrics (dependent variable), such as treatment adherence, recovery rates, and mortality reduction. However, in resource-constrained settings like the International Rescue Committee (IRC) facilities in Kakuma Refugee Camp, the effectiveness of EMRs is influenced by several factors, including technological infrastructure, organizational capacity, and regulatory support.

Understanding the relationships mentioned above is furthered by integrating three theoretical frames in this study: Diffusion of Innovations (DOI) Theory, Technology–Organization–

Environment (TOE) Framework, and Donabedian Model for Quality of Care. The DOI tracks healthcare provider adoption of EMRs through perceived benefits and usability. The TOE perspective, on the other hand, assesses the technological readiness, organizational capacity, and environmental factors influencing EMR implementation from an institutional point of view. This means that the Donabedian Model defines the effect that EMR adoption has on healthcare processes and, eventually, for patient health outcomes metrics. In short, this study integrates theories to offer a holistic view of the factors driving EMR adoption, problems limiting implementation, and expected impacts on healthcare outcomes as one country's refugee camp, Kakuma Refuge.

1.10.1. Diffusion of Innovations (DOI) Theory

The Diffusion of Innovations (DOI) Theory, developed by Rogers (2003), explains how new technologies are adopted and spread across individuals and institutions. The theory identifies five attributes that influence adoption decisions: relative advantage, compatibility, complexity, trialability, and observability. Innovations are more readily adopted when they are perceived to offer a clear benefit over previous systems, align with existing values and workflows, are simple to use, allow for trial use, and produce visible results.

In this study, the DOI Theory anchored the investigation into the adoption and use of Electronic Medical Records (EMRs) in IRC-operated health facilities at Kakuma Refugee Camp. Each of the study's four focal EMR operational domains—drug tracking efficiency, Patient care quality, data security, and report generation—aligns with one or more DOI constructs. For example, healthcare workers in Kakuma were more likely to adopt EMRs when they observed a relative advantage, such as improved inventory management and reduced drug stockouts (Mukherjee *et al.,* 2020). Compatibility with existing practices, like the reduction of prescription errors or delays in care, also supported adoption (Greenhalgh *et al.,* 2021). Additionally, where EMRs demonstrated observability—such as improved report timeliness or patient monitoring—staff confidence in the system increased (Maina *et al.,* 2022).

This theoretical framework also guided the construction of survey instruments used to gather data, ensuring that questions reflected healthcare workers' perceptions of EMR functionality, usability, and overall value. DOI provided a structured foundation for interpreting behavior related to technology use and allowed the study to assess how perceived benefits shape implementation outcomes in fragile health systems.

However, the study also recognized limitations of the DOI Theory in fully capturing the complexity of EMR adoption in humanitarian contexts. In environments like Kakuma, adoption may be shaped more by external institutional factors—such as donor funding conditions, national health mandates, and infrastructure limitations—than by individual provider preferences (Rodriguez & Martinez, 2022). For this reason, the study complemented the DOI framework with the Technology–Organization–Environment (TOE) Framework to capture broader systemic influences.

In conclusion, the DOI Theory grounded the study's conceptual model, guided variable selection, and helped explain how frontline health professionals in refugee settings interact with health technology innovations.

1.10.2. Technology–Organization–Environment (TOE) Framework

The Technology–Organization–Environment (TOE) Framework provides a comprehensive model for understanding the factors that influence the adoption of innovations such as Electronic Medical Records (EMRs) in complex systems. Originally proposed by Tornatzky and Fleischer, the TOE framework highlights three core dimensions that drive technology implementation: technological readiness, organizational capacity, and the external environment.

In this study, the TOE Framework complemented the Diffusion of Innovations (DOI) Theory by anchoring the analysis of institutional and contextual enablers and barriers to EMR adoption in Kakuma Refugee Camp. Unlike DOI, which emphasizes individual-level perceptions, TOE incorporates structural and systemic variables that are especially relevant in humanitarian settings where adoption may be mandated by donors or national policy, and constrained by infrastructural deficits.

The technological context in Kakuma was assessed in terms of the availability, reliability, and perceived adequacy of the EMR system. This included system accessibility, data entry functionalities, and user interface challenges as reported by IRC staff. The organizational dimension was examined through the lens of internal readiness—including staff training, administrative support, leadership engagement, and workflow integration—all of which determine how effectively technology is embedded into clinical processes. The environmental context considered external pressures such as donor priorities, Ministry of Health policies, and infrastructural limitations like electricity and internet stability. These dimensions are especially pertinent in low-resource settings, where institutional adoption decisions are often influenced

more by external mandates and survival priorities than by internal enthusiasm (Assaye *et al.,* 2024).

This study found that successful EMR implementation in Kakuma was heavily influenced by organizational adaptability and external support networks, consistent with recent research applying TOE in similar low-resource health systems (Bin Naeem *et al.,* 2024). For instance, while technological potential existed, infrastructural fragility and intermittent support services limited optimal system utilization. This anchoring theory was essential for interpreting not only adoption behaviors but also the performance and sustainability of EMR use in the face of resource and policy constraints.

By employing the TOE Framework, this study was able to assess EMR adoption through a multi-layered lens that contextualized implementation challenges beyond user preferences, offering a grounded view of what conditions enable or hinder digital health innovation in humanitarian environments.

1.10.3. Donabedian's Model for Quality of Care

The Donabedian Framework remains a widely used model for assessing healthcare quality through its three interrelated components: structure, process, and outcomes. Structure encompasses the physical, technical, and organizational infrastructure in which care is delivered. Process refers to the interactions between patients and healthcare providers, including clinical practices, information use, and communication. Outcomes are the results of care—typically reflected in changes to patient health status, recovery, satisfaction, or mortality.

In this study, the Donabedian model was used to evaluate the quality of care delivered through the Electronic Medical Records (EMR) system introduced in IRC facilities at Kakuma Refugee Camp. The implementation of EMRs was conceptualized as a structural input—a digital infrastructure that enables improved data entry, storage, and access. The use of EMRs in drug tracking, clinical documentation, and reporting was analyzed as part of the process domain, while indicators such as treatment adherence, diagnostic turnaround time, and recovery rates were positioned within the outcomes domain.

Recent studies have reaffirmed the utility of the Donabedian model in evaluating digital health interventions, especially in low-resource and humanitarian settings. Saheb (2024) applied the framework to assess national digital health strategies, arguing that mapping structure-process-outcome relationships is essential for policy-level decision-making. Similarly, Jones-Esan,

Somasiri, and Lorne (2024) used the model in their systematic review of mobile health and telemedicine applications in low- and middle-income countries, showing how digital tools contributed to improved care processes and patient outcomes when embedded within a well-defined structure.

By aligning this study's design with the Donabedian model, a clear analytical pathway was established to trace how EMR adoption at the structural level influences both care processes and measurable health outcomes. This allowed the evaluation to remain rooted in a validated, evidence-based model of healthcare quality, tailored to the unique demands of refugee health systems.

1.11. Conceptual Framework

This conceptual framework focuses on how the EMR adoption in the IRC hospitals in Kakuma Refugee Camp affects the patient health outcomes metrics by improving the efficiency of tracking drugs, quality of Patient care quality, data security and privacy, and generating reports within four independent operation dimensions. These independent variables have correlations with clinical outcomes as defined by the drop in mortality, an improvement in recovery, increased adherence to treatment, and outbreak control, as illustrated in Figure 1.

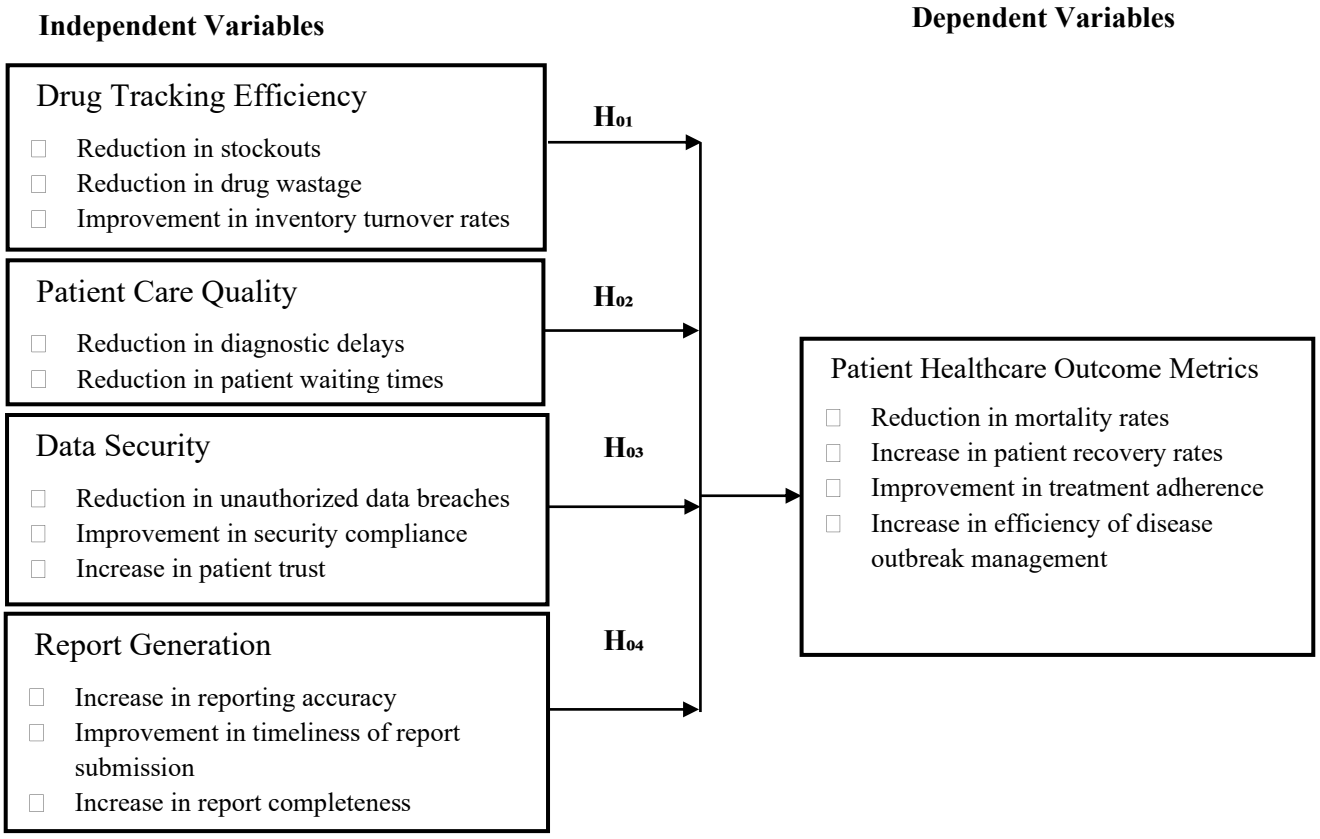


Figure 1: Conceptual Framework

Source: Researcher (2025)

The conceptual framework presented in Figure 1 illustrates the hypothesized relationships between the operational components of the Electronic Medical Records (EMR) system and measurable patient healthcare outcome metrics within IRC health facilities in Kakuma Refugee Camp. It is structured around four independent variables—drug tracking efficiency, Patient care quality, data security, and report generation—each theorized to influence a set of clinical performance outcomes.

Drug tracking efficiency is defined through indicators such as reductions in stockouts and drug wastage, as well as improvements in inventory turnover rates. The assumption is that more reliable and timely pharmaceutical tracking will contribute to better treatment continuity and reduced morbidity. Patient care quality, as another independent variable, is reflected by reductions in diagnostic delays and patient waiting times, signaling increased clinical responsiveness and procedural streamlining enabled by EMRs.

Data security is captured through the reduction in unauthorized breaches, improved compliance with security protocols, and increased patient trust. These elements are critical in building confidence in the EMR system and ensuring data integrity in environments characterized by high vulnerability and population movement. Similarly, report generation includes improvements in reporting accuracy, timeliness of submissions, and the completeness of health records. These enhancements are expected to strengthen administrative and clinical decision-making processes.

Each of these four EMR operational domains is linked through testable hypotheses (H_{01} through H_{04}) to a common dependent variable—Patient Health Outcome Metrics. These metrics encompass reductions in mortality rates, increases in patient recovery rates, improvements in treatment adherence, and enhanced efficiency in disease outbreak management. The framework assumes that improvements in EMR-related processes will lead to tangible enhancements in the overall quality of care provided in the refugee camp setting.

Overall, the conceptual framework provides a clear structure for the study's empirical analysis by aligning each operational domain with specific outcome measures. It also establishes the theoretical foundation for applying multiple linear regression to examine the significance and strength of these relationships, thereby allowing for a robust evaluation of EMR effectiveness in a complex humanitarian environment.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter reviews current literature on the use of Electronic Medical Records (EMRs) in healthcare, focusing on drug tracking efficiency, Patient care quality, data security, and reporting. It highlights empirical findings on EMR benefits and limitations, particularly in low-resource settings. The chapter also identifies gaps in evidence concerning EMR implementation in refugee contexts such as Kakuma Refugee Camp and underscores the limited theoretical grounding in existing studies. By examining these gaps, the chapter justifies the need for this study and positions EMR optimization as a critical intervention for improving healthcare outcomes in humanitarian environments.

2.2. Empirical Literature Review

This section presents a critical review of empirical studies assessing the impact of Electronic Medical Records (EMRs) on healthcare delivery across four key domains: drug tracking efficiency, Patient care quality, data security, and report generation. Each study is examined based on its objectives, methodology, key findings, limitations, and relevance to the present research. Particular emphasis is placed on studies conducted in resource-constrained environments, especially in Sub-Saharan Africa and refugee settings, to provide a contextual foundation for understanding EMR implementation and effectiveness in Kakuma Refugee Camp.

2.2.1. Efficiency in Drug Tracking and Patient Health Outcomes Metrics

Maina *et al.* (2022) assessed how EMRs improve pharmaceutical supply chains in Ugandan health facilities. This mixed-methods study, which analyzed quantitative inventory data and qualitative interview data with supply chain managers, concluded that the use of EMRs reduced inventory checking time by 30%, freeing up health workers to pay more attention to actual Patient care quality. The only limitation present herein is that it lacks an analysis in drug tracking regarding improvements in patient health outcomes metrics such as adherence to prescribed treatments or real cure rates of diseases. It will seek to ascertain what role improved drug tracking in Kakuma has played in improving patient health outcomes metrics among patient populations, particularly better adherence to prescribed treatments and lowered mortality rates from preventable causes of death.

Omotosho *et al.* (2021) studied the status of EMR adoption in healthcare facilities within Nigeria and the consequences for pharmaceutical inventory management. The study used a case study approach through document analysis and key informant interviews, reporting that because of the EMR adoption, there was an overall improvement in the availability of medicines and a remarkable reduction of expired medicines by 18%. However, the obstacles include resistance to adopting technologies, lack of training, and underfunding, which limit successful implementation. It also did not analyze how socio-economic and cultural issues impinge on the adoption of EMR in a highly mobile population. The current research extends these studies by examining specific barriers to EMR-based drug tracking in Kakuma and locating solutions appropriate to its refugee context.

Awoke *et al.* (2020) investigated the impact of EMRs on the accuracy of medicine inventory and adherence to treatment in district hospitals of Ethiopia. The longitudinal study evaluated changes in the management of inventory pre- and post-EMR implementation for two years. It was found that the level of inventory accuracy had increased by 30%, where the rate of error from manual tracking had been significantly reduced. The infrastructural challenges of non-reliability in access to electricity and the internet in refugee contexts were issues that this study had not explored. Therefore, this study builds upon previous studies by examining the implementation of EMRs in Kakuma refugee camp amidst the breakdown in electricity supply and technical constraints that hinder its application to track inventories of drugs.

Mukherjee *et al.* (2020) explored the effects of EMRs on the management of drug stock in rural Tanzania. In this mixed-methods study, which combined quantitative surveys with in-depth interviews with health professionals, the authors asserted that the EMR reduced stockouts by 25% and minimized drug wastage by 15%. These findings underlined how real-time inventory tracking could reduce stockouts and thereby enhance access to lifesaving medicines. This study, however, was conducted in a stable rural setting and did not cover landscapes of change, such as refugee camps, where the sudden arrival of populations and fragile supply chains may shave off even more of the benefits.

Levesque *et al.* (2019) investigated the role of EMRs in medication forecasting and the prevention of drug wastage in Rwandan clinics. This was a cross-sectional survey in which regression analysis was used to illustrate that the use of EMRs increases the efficiency of medication forecasting by 20%, hence cutting down on unnecessary procurements and reconciling medication wastages. However, this study has not addressed the flexibility of the

EMR in adapting patient populations and dynamic supply chain logistics when it comes to refugee camps. This paper, therefore, addresses such gaps by establishing how Kakuma health facilities have exploited the use of EMRs in the tracking of medicines during logistic challenges.

2.2.2. Quality of Patient Care Quality and Patient Health Outcomes Metrics

Maina *et al.* (2022) discussed the role of EMRs in reducing medical errors and improving clinical decision-making in hospitals in Uganda. Using a combination of retrospective patient record analysis and clinician focus groups, the study showed that EMRs reduced prescription errors by 25% and improved real-time decision-making through clinical alerts and automated drug interaction checks. A limitation of this study was that it looked only at issues of operational efficiency and did not attempt to measure the direct impact of such improvements on patient recovery rates. The present research develops an analysis of how EMR-driven reductions in medical errors translate into lower mortality rates and faster recoveries among patients in Kakuma.

Silva *et al.* (2021) assessed the contribution of EMRs to diagnostic efficiency and treatment quality within South African hospitals. Quasi-experimental design comparison of pre- and post-implementation of EMRs for patient outcomes showed that there was a 20% reduction in time spent on diagnostic delays and an increase in the accuracy of prescription by 15%. These gains were explained by how the EMRs—with real-time access to the patient's records—reduced errors arising from incomplete medical history. The setting for the research was, however, relatively well-endowed urban healthcare facilities that clearly exclude low-income urban settings with poor infrastructure, erratic internet access, and high patient throughput. The present study further explores the extent to which EMRs support diagnostic efficiency within Kakuma health facilities, overwhelmed by recurring diseases and resource constraints.

Nyongesa *et al.* (2021) investigated how EMRs decrease patient waiting time and increase adherence to clinical guidelines in rural Kenyan health facilities. This study conducted structured interviews and observational studies via an embedded mixed-methods design. The findings revealed a 30% reduction in patient waiting time when using EMRs and an increased percentage in practitioner treatment guideline adherence. It was understood from this study that automated patient records enhance workflow and reduce administrative bottlenecks. Yet, the study did not look at whether such gains translated to increased patient recovery rates or decreased mortality. The current paper builds on the work done by Nyongesa *et al.* in that it

ties Kakuma's EMR-driven operational gains to measurable patient health outcomes metrics —increased treatment adherence and recovery rates.

Booth *et al.* (2021) in their study tested the effect of EMRs on continuity of care across a sample of South African and Nigerian healthcare settings. The results of the longitudinal study, which entailed auditing patient records and interviewing clinicians, indicated that EMRs increased continuity of care by 40%. Clinicians were able to track patient history more accurately; hence, misdiagnosis and multiple testing of patients were reduced. However, this study only focused on the benefits of EMR for patient records and excluded the infrastructural constraints such as unstable power supplies and inadequate technical support, which are common in refugee settings. This research closes the gap by investigating how Kakuma's healthcare providers surmount these challenges to continuously sustain Patient care quality with the help of EMRs.

Titi *et al.* (2021) in their study investigated the impact of adopting EMR on treatment adherence among patients with chronic illnesses attending health facilities in Nigeria. Based on their cross-sectional survey involving more than 1,000 patients, they established that the utilization of EMRs led to an increase in adherence to prescribed treatments by 18%, where automated medicine reminders and full patient records contributed to minimizing missed dosages. This study did not consider socio-cultural factors such as mistrust among patients towards the adoption of digital records, which affects utilization of health services. The present study extends this previous work by exploring, for the first time in Kakuma, whether use of EMRs is associated with treatment adherence, when cultural perceptions of technology and trust in institutions are considered some of the most significant drivers of healthcare utilization.

2.2.3. Data Security and Patient Health Outcomes Metrics

Alotaibi *et al.* (2022) discussed vulnerabilities of EMRs in resource-constrained environments, focusing on data breaches in health institutions across Sub-Saharan Africa. In the said study, they used a quantitative approach to analyze cybersecurity incidents within a five-year period. Through this, they found that 65% of data breaches were due to poor authentication protocols, untrained staff, and software that was not up to date. They recommended increased investment in cybersecurity infrastructure and continuous staff training as measures to mitigate security risks. The infrastructural constraints of unreliable electricity and internet connectivity contributing to security vulnerability were not discussed in that paper. Considering these, this

current study investigates how health facilities in Kakuma overcome infrastructural hurdles while maintaining secured EMR systems.

Maina *et al.* (2022) investigated the roles of EMRs in deterring unauthorized access to patient data at health facilities in Uganda. This mixed-methods study undertook security audits and interviews with healthcare providers; results showed that in health facilities where the records were implemented, the incidence of unauthorized access decreased by 50%. Nevertheless, the shortage of technical staff led to inconsistency in security protocol implementation, while some healthcare workers bypassed the security features to speed up access for patients seeking care. The study recommended regular training in cybersecurity for healthcare workers to 26ncreasee their compliance level. The current study extends the foregoing by investigating how Kakuma health care providers balance security compliance against the need for urgency in ensuring access in cases of emergencies to ensure that the security features are not a source of delay for timely care.

Booth *et al.* (2021) investigated how EMR adoption impacts data security in a South African hospital. The incidence of unauthorized data access before and after EMR implementation was measured by conducting a case study method through in-depth interviews among information technology specialists and an audit of the EMR security log events. These results indicated that unauthorized data breach incidents decreased by 40% after the implementation of role-based access controls and multi-factor authentication. Although this study verified that EMRs improve data security, the setting in which this study was conducted had good infrastructural resources, including stable internet access and a good amount of technical expertise, conditions that are not achievable in refugee settings. The present study extends this work through an evaluation of how EMRs improve data confidentiality in Kakuma, where weaker infrastructure and high staff turnover impede the use of stringent security measures.

Titi *et al.* (2021) investigated the relation between EMR adoption and patient confidence in the security of their data in Nigerian health facilities. Through a cross-sectional survey of 1,000 patients, this study established that 80% of the respondents showed more confidence in the confidentiality of their medical records after the hospitals had adopted EMRs. This added confidence may reflect benefits such as secure patient portals and encrypted communication by practitioners, as well as audit logs to detect any unauthorized changes in records. Still, this article fails to consider any socio-cultural causes for decreased patient trust due to experiences of state surveillance or risk of state or institutional data misuse. These findings are advanced

by the current research, examining the extent to which patients trust and have a willingness to disclose their health information based on how secure EMR records are managed, particularly where the Kakuma refugee context makes populations increasingly privacy-conscious and possibly distrustful of institutions.

Hawkins *et al.* (2021) investigated how EMRs influence compliance with legislations on data protection in Canadian hospitals. Based on analysis of compliance reports in the hospitals and interviews with data protection officers, this study concluded that the EMR systems facilitated compliance with the privacy regulations by up to 60%. This, the study argued, was because of automated checks on compliance and real-time alerts over potential breaches of privacy. Although this previous study had established the regulatory benefits of EMRs, it was conducted in a high-income setting with effective means of enforcement. This study investigates how the EMRs facilitate compliance with the data protection standards in Kakuma, where regulatory oversight is generally limited and informal health practices may pose extra security risks.

2.2.4. Report Generation and Patient Health Outcome Metrics

Maina *et al.* (2022) examined the impact of EMRs on reporting timeliness and accuracy at Ugandan healthcare facilities. The study conducted a mixed methods approach through structured interviews with a quantitative analysis of medical reports and found that EMRs improved accuracy in reporting by 50%, and report submission delays dropped by 40%. These were attributed to inherent capabilities in EMRs—automated data entry, real-time updates, and linking with inventory and patient record systems. The study did not explore how such improved reporting translates into better healthcare outcomes, including more timely responses to disease outbreaks and optimization of resource utilization. The current study complements this by analyzing how improved reporting in Kakuma enables better disease surveillance and management of healthcare resources, especially at times of public health emergencies.

Omotosho *et al.* (2021) investigated the impact that EMRs have had on donor reporting in healthcare facilities within Nigeria. Qualitative case studies among hospitals that shifted to digital reporting demonstrated an increased compliance to donor requirements with the utilization of EMRs by 35%. This reduced funding delays and provided increased financial transparency. It was reported that due to automated reporting, discrepancies in data were minimized; hence, funding organizations restored their confidence in healthcare institutions. However, the study did not discuss how such efficiencies impact actual improvement in Patient

care quality. This study enhances this research by investigating the ways in which EMRs support donor reporting in Kakuma, enabling the continued funding of key healthcare services, and linking such efficiencies with improved patient health outcomes metrics.

Hawkins *et al.* (2021) estimated the contribution of EMRs to the administrative efficiency of diverse hospitals in Canada, regarding timeliness and comprehensiveness of reports. In this study, which estimated the time taken to compile reports before and after the implementation of EMRs, it was observed that EMRs decreased reporting time by 40%, freeing health personnel for direct care. Furthermore, the study found that reporting using automated tools decreased documentation errors while complying with regulatory requirements. However, this study did not investigate how such benefits are transformed into real life in resource-constrained contexts where power and internet instability could hinder real-time reporting. The current study bridges the gap by examining the ways in which Kakuma's healthcare facilities maintain the continuity of EMRs functional for reporting despite infrastructural challenges.

Mukherjee *et al.* (2020) investigated the contribution of EMRs to resource allocation in Tanzanian hospitals. By combining financial data analysis with key informant interviews, the study reported an increased tracking of budgets and a reduction in the misallocation of resources by 20%. The ability of EMRs to perform detailed reporting on drug consumption, staffing levels, and numbers of patient visits assisted in the efficient distribution of medical supplies and workforce distribution. However, the study did not report a direct connection between improved reporting regarding patient health outcomes metrics, such as reduced mortality rates or better recovery rates. The present study addresses the identified knowledge gap on how better reporting by Kakuma leads to better decision-making by the healthcare professional to improve patient health outcomes metrics.

Levesque *et al.* (2019) assessed how the EMR streamlined disease surveillance with timely outbreak detections in health facility settings within Rwanda. Time series data on diseases reported were followed before and after the implementation of the EMR. There was a recorded decrease in responding to disease breakouts by as much as 30% and, therefore, it was possible to contain infectious outbreaks. This article was conducted at a relatively stabilized environment; indeed, it excluded just how exactly EMRs work towards places with unstable populations, mainly refugee camps, where people continually come and leave. This review will expand beyond the previous data to evaluate what real-time reporting creates in terms of

epidemic preparedness and response and in the face of diseases within Kakuma regarding cholera, for instance and malaria.

2.3. Summary and Research Gaps

This chapter reviews the literature that illustrates the transformative potential of the EMRs in improving healthcare delivery, and more precisely, in enhancing the efficiency of tracking drugs, providing quality Patient care quality, data security, and reporting. Empirical studies have documented that EMRs reduce stockouts of medication, enhance diagnosis accuracy, improve adherence to treatments, increase the strength of data security, and further enable timely and accurate reporting. Despite these identified benefits, critical research gaps remain, particularly regarding how EMR systems are implemented in resource-constrained contexts such as refugee camps.

Therefore, based on the effectiveness of tracking drugs, the literature, including Mukherjee *et al.* (2020) and Awoke *et al.* (2020), has found that EMRs drastically reduce medication stockouts through the reduction of wastages by way of real-time tracking of inventories. Most of these studies have been conducted in relatively stable healthcare settings characterized by predictable patient populations and supply chains and have failed to address the challenges brought forth in very dynamic environments like Kakuma, where fluctuating refugee populations and irregular supply chains introduce other levels of complexity in managing inventories. Most of the literature also does not connect improved drug tracking with direct measures of patient health outcomes metrics such as treatment adherence and patient recovery rates. This research bridges the gap in previous literature by assessing how EMRs perform in an unpredictable healthcare environment and relates the improvement in inventory management to patient health outcomes metrics.

Studies such as those by Silva *et al.* (2021) and Nyongesa *et al.* (2021) attest to the fact that EMRs ensure fewer diagnostic delays, enhance clinical decision-making, and make adherence to certain treatment guidelines more probable. This was mostly carried out in urban hospitals or well-funded rural clinics where the healthcare provider is introduced to state-of-the-art technologies, and they also have regular training in using those technologies. That these studies failed to show how EMRs work in refugee camps for other challenges like a scarcity of resources, a high patient load, and frequent staff turnover does not bring the operational efficiencies described to their logical conclusion regarding the patient outcomes expected-reduced mortality and enhanced recovery rates. This present study goes on to assess the impact

of EMRs on improving the outcomes for patients despite infrastructural and human resource challenges in Kakuma.

On data security and confidentiality, the likes of Booth *et al.* (2021) and Titi *et al.* (2021) demonstrate that EMRs enhance data security through data encryption, authentication controls, and audit trails; such improvement in data security engenders patient trust and hence enhances continuity of care. These studies are biased toward high-resource environments with strong IT support and enforcement of regulations. They do not consider how data security could be effectively implemented in refugee settings where power disparities, limited internet access, and high staff turnover compromise the integrity of digital systems. Further, while these studies affirm that EMRs enhance patient trust, they do not explore whether increased patient trust would lead to improved patient health outcomes metrics, such as improved treatment adherence. The present study responds to this gap by establishing how the EMRs maintain data security in Kakuma amid infrastructural challenges and assessing the effect of data confidentiality on patient engagement and treatment adherence.

Report generation: In this line, Maina *et al.* (2022) and Hawkins *et al.* (2021) indicated that EMRs enhance reporting accuracy, reduce documentation errors, and enable timely submission of reports required to manage healthcare and ensure accountability for donors. While they addressed improvements in reporting, they failed to assess the degree to which such enhancement of reporting makes a difference in disease surveillance and outbreak responses within refugee settings-places where informed, data-driven decisions on public health interventions have to be arrived at expeditiously. Again, although the said research hints at the realization of efficiencies, they fall short of establishing an evidence link between reporting improvement and tangible patient health outcomes metrics -say, improved resource utilization or reduction in mortality. This study fills that gap in understanding how EMRs improve healthcare reporting in Kakuma and further explores the way data management leads to better healthcare interventions.

Another related methodological gap in the literature is that most of the available studies adopt cross-sectional research designs and therefore assess the implementation of EMRs mostly with regard to operational benefits in the short term. These studies have been very helpful in demonstrating immediate operational benefits but are less likely to demonstrate long-term effects of EMRs on health care delivery and results for the patient. Moreover, most are conducted quantitatively, which underlines the aspects of efficiency metrics without any

qualitative insight into the experiences of health professionals and patients about EMRs. This paper adopted a sequential, mixed-method design that combined quantitative analysis of health performance metrics and qualitative interviews to comprehensively analyze Kakuma's effectiveness.

Moreover, the socio-cultural barriers to the adoption of EMR in refugee contexts are not well documented. Although most studies indicate that technical and infrastructural impediments do exist, they rarely explore how cultural perceptions of digital healthcare systems impede or inhibit adoption rates and patient engagement. In refugee populations, factors such as mistrust of institutional record-keeping, linguistic barriers, and varying levels of digital literacy may become major impediments toward successful EMR implementations. The present research fills this knowledge gap by identifying socio-cultural factors that impact EMR adoption in Kakuma and by developing strategies aimed at enhancing acceptance and utilization.

While there are studies that re-affirm the efficacy of the EMR system in healthcare settings, they fall short of appreciating how unique the challenges in refugee camps render the adoption of such systems through infrastructure limitation, high patient flow, and socio-cultural barriers. Most of them have not been able to link operational efficiencies to patient health outcomes metrics; a gap this study intends to fill through an assessment of the effectiveness of EMR systems in improving healthcare delivery in Kakuma, linking operational efficiencies to patient health outcomes metrics, and providing insights into ways of optimizing the adoption of EMR in resource-limited settings.

2.4. Summary of Findings and Key Gaps Table

Authors and Year	**Focus of Study**	**Major Findings**	**Gaps in Research**	**How this study addresses the gaps identified**
Mukherjee *et al.* (2020)	EMRs and drug tracking efficiency in rural Tanzania	EMRs reduced medication stockouts by 25% and drug wastage by 15%, improving inventory management.	Conducted in a stable rural setting with predictable supply chains, it did not link inventory improvements to	Highlights the need to assess how EMRs sustain drug tracking in dynamic settings like Kakuma and connect inventory efficiencies to patient recovery rates.

			patient health outcomes metrics.	
Awoke *et al.* (2020)	EMRs and medication inventory accuracy in Ethiopian district hospitals	EMRs improved medication inventory accuracy by 30% and reduced human errors in tracking medications.	Did not account for infrastructural challenges such as unreliable electricity and internet connectivity prevalent in refugee settings.	Underlines the importance of evaluating how infrastructural constraints in Kakuma affect EMR-driven inventory accuracy and subsequent patient outcomes.
Omotosho *et al.* (2021)	EMRs and drug wastage reduction in Nigerian hospitals	EMRs minimized drug wastage and improved drug availability; however, staff resistance due to inadequate training was noted.	Did not explore external factors like funding variability and logistical challenges that affect drug availability in low-resource settings.	Provides insights into how EMRs might overcome similar challenges in Kakuma, ensuring stable medication supply despite resistance and logistical barriers.
Maina *et al.* (2022)	EMRs and inventory check times in Ugandan health facilities	Inventory check times decreased by 30%, freeing up time for patient care quality.	Did not investigate how these operational efficiency gains translate into broader patient health outcomes metrics such as reduced mortality or improved	Illustrates the potential to correlate improved inventory management in Kakuma with reduced treatment delays and enhanced patient recovery.

			treatment adherence.	
Levesque *et al.* (2019)	EMRs and medication forecasting in Rwandan clinics	EMRs improved medication forecasting accuracy by 20%, reducing stockouts and wastage.	Did not consider the adaptability of EMRs in transient settings such as refugee camps.	Supports examining how EMR forecasting in Kakuma ensures continuous medication availability despite fluctuating patient numbers and supply challenges.
Silva *et al.* (2021)	EMRs and quality of patient care quality in South African hospitals	EMRs reduced diagnostic delays by 20% and improved treatment accuracy by 15%.	Focused on urban, well-resourced hospitals, it did not directly connect operational improvements to patient health outcomes metrics in under-resourced settings.	Informs the investigation into how EMRs in Kakuma may improve diagnostic accuracy and treatment adherence, contributing to better patient recovery.
Nyongesa *et al.* (2021)	EMRs and patient waiting times in rural Kenyan health centers	EMRs reduced patient waiting times by 30% and enhanced adherence to clinical protocols.	Did not assess the impact of reduced waiting times on long-term patient outcomes such as recovery rates and mortality reduction.	Encourages exploration of how decreased waiting times in Kakuma contribute to improved Patient care quality and recovery.

Booth *et al.* (2021)	EMRs and data confidentiality in South African hospitals	Unauthorized data access decreased by 40%, resulting in increased patient trust in digital record systems.	Conducted in high-resource settings; limited insights into how EMRs perform in environments with unstable infrastructure.	Highlights the need to evaluate how improved data security in Kakuma influences patient trust and treatment adherence.
Titi *et al.* (2021)	EMRs and patient trust in Nigerian healthcare facilities	80% of patients reported increased trust following improvements in EMR data security.	Did not consider socio-cultural factors affecting trust, such as concerns over data misuse in refugee settings.	Informs evaluation of how secure EMR systems in Kakuma impact patient trust and healthcare utilization.
Alotaibi *et al.* (2022)	Cybersecurity vulnerabilities in EMRs across Sub-Saharan Africa	65% of data breaches were attributed to weak authentication, staff errors, and outdated software.	Overlooked infrastructural challenges like unreliable electricity and internet connectivity in refugee settings.	Guides analysis of cybersecurity measures in Kakuma and their impact on maintaining patient data integrity.
Hawkins *et al.* (2021)	EMRs and administrative efficiency in Canadian hospitals	Reporting times decreased by 40%, allowing healthcare workers to focus more on patient care quality.	Conducted in a high-resource environment, limiting its generalizability to refugee settings with unstable infrastructure.	Provides a benchmark for evaluating EMR report generation in Kakuma, emphasizing the need for sustained system functionality despite infrastructural challenges.

Levesque *et al.* (2019)	EMRs and disease surveillance in Rwandan healthcare facilities	Automated reporting reduced response times to disease outbreaks by 30%.	Did not explore EMR functionality in highly transient populations, such as refugee camps.	Emphasizes the importance of rapid disease surveillance and outbreak management in Kakuma through effective EMR reporting.

Table 1: Summary of Findings and Key Gaps

Source: Research 2025 compilation based on Mukherjee *et al.* (2020); Awoke *et al.* (2020); Omotosho *et al.* (2021); Maina *et al.* (2022); Levesque *et al.* (2019); Silva *et al.* (2021); Nyongesa *et al.* (2021); Booth *et al.* (2021); Titi *et al.* (2021); Alotaibi *et al.* (2022); Hawkins *et al.* (2021).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This study employed an explanatory research design to examine the causal relationship between EMR functional domains—drug tracking, Patient care quality, data security, and report generation—and patient health outcomes. Primary data were collected using structured questionnaires administered to healthcare staff using EMRs. Multiple Linear Regression (MLR) was used to estimate the individual and combined effects of the independent variables on outcomes such as treatment adherence, diagnostic turnaround time, and recovery. Diagnostic tests, including VIF, Durbin-Watson, and Condition Index, were applied to ensure model validity and robustness.

3.2. Research Design

An explanatory research design will study the supposed causal relationship between key functionalities of Electronic Medical Records (EMR) and patient health outcomes metrics in a humanitarian healthcare context. Explanatory designs are suitable when the focus is on measuring how alteration in certain independent variables, such as drug tracking, Patient care quality, data security, and report generation, may affect dependent variables like treatment adherence, diagnostic efficiency, and recovery outcomes (Saunders, Lewis & Thornhill, 2020).

The design allows the detection of statistically significant patterns and relationships based on end-user experience. It is especially suitable for research conducted in dynamic and resource-limited contexts such as the Kakuma Refugee Camp, where a formal evaluation through randomized trials would often be impractical. Thus, the explanatory design forms a bridge between the visible changes in the system and the perceived impact at user level, allowing for credible and context-sensitive policy recommendations (Bell, Bryman & Harley, 2022).

3.3. Research Site

This study was conducted in health facilities operated by the International Rescue Committee (IRC) within Kakuma Refugee Camp, located in Turkana County, northwestern Kenya. Established in 1992, Kakuma currently hosts over 200,000 refugees and asylum seekers from more than ten nationalities, making it one of the largest and most protracted refugee settlements in Sub-Saharan Africa (UNHCR, 2023). The IRC provides a range of essential health services

in the camp, including maternal and child health, chronic disease management, communicable disease control, and public health surveillance.

In 2021, IRC facilities began implementing Electronic Medical Records (EMRs), providing a relevant and timely setting to study EMR adoption under conditions of high patient volume, limited infrastructure, and workforce shortages. The research setting offered a real-world humanitarian environment to examine how digital health tools function under pressure. Additionally, the structured rollout of EMRs across various clinics enabled consistency in user experiences and facilitated reliable data collection from frontline healthcare workers (Kimani & Maina, 2022).

3.4. Target Population

The target population for this study comprised healthcare professionals working in IRC-operated health facilities within Kakuma Refugee Camp who directly engage with the Electronic Medical Records (EMR) system. This included both clinical and non-clinical staff such as medical doctors, clinical officers, nurses, records clerks, facility managers, EMR officers, and IT personnel. These individuals are routinely involved in EMR-related tasks such as patient registration, diagnosis entry, treatment documentation, inventory management, and digital reporting.

To ensure reliability of responses, only staff members with at least six months of uninterrupted experience using the EMR system were eligible for inclusion. This criterion guaranteed that participants had sufficient exposure to the system to offer informed perspectives. Focusing exclusively on these EMR end-users ensured the study captured grounded, practice-based insights on the operational and clinical impacts of digital records in a high-demand, resource-constrained humanitarian setting.

Table 2 presents the distribution of the target population by role and percentage share:

Table 2: Breakdown of Target Population in IRC Clinics at Kakuma

Category	**Number**	**Percentage (%)**
Medical Doctors	5	9.4%
Clinical Officers	8	15.1%
Nurses	15	28.3%
Records Clerks	15	28.3%
Management Staff	3	5.7%
IT Personnel	2	3.8%
EMR Officers	5	9.4%
Total	**53**	**100%**

Source: IRC Health Services – Kakuma Camp Staffing Roster, 2025.

3.5. Sampling Design and Procedure

This study applied stratified random sampling to ensure balanced representation across different categories of health workers involved in the use of Electronic Medical Records (EMRs) in IRC-operated health facilities at Kakuma Refugee Camp. The stratification was based on job roles to reflect the diversity of interaction with the EMR system. The main strata included medical doctors, clinical officers, nurses, records clerks, EMR officers, IT personnel, and management staff. This method allowed for proportional representation of each group and ensured that insights were gathered from all functional levels directly engaging with EMRs.

A sampling frame of 500 eligible healthcare workers was established based on IRC staff rosters. To determine the required sample size, Yamane's formula (1967) for finite populations was used:

$$n = \frac{N}{1 + N(e)^2}$$

where:

- n is the sample size,
- N is the total population (500), and
- e is the desired level of precision (e.g., 0.05 for a 95% confidence level).

$$n = \frac{500}{1 + 500(0.05)^2} = \frac{500}{1 + 1.25} = \frac{500}{2.25} \approx 222$$

The resulting sample of 222 respondents was then proportionally allocated across the seven strata. Random selection was conducted within each group using staff lists to minimize bias and ensure statistical reliability.

Table 3: Stratified Sample Distribution by Staff Category

Staff Category	Estimated Population Proportion (%)	Sample Size (n = 222)
Medical Doctors	1%	2
Clinical Officers	2%	4
Nurses	15%	33
Records Clerks	20%	44
Management Staff	5%	11
IT Personnel	2%	4
EMR Officers	5%	11
Other Support Staff	50%	113
Total	**100%**	**222**

Source: IRC Staffing Estimates, 2025

Random selection was conducted within each stratum using staff lists to avoid selection bias and to enhance representativeness. This sampling approach reinforced the internal validity of the study and allowed reliable comparison across functional roles regarding EMR use and impact (Saunders *et al.,* 2020; Bell, Bryman, & Harley, 2022).

3.6. Data Collection

The study used a strategy of primary data collection in which structured questionnaires were administered to assess healthcare workers' opinions on the EMR functionality and its consequent patient outcome. This primary data was helpful for gaining first-hand insights from the system's users, thus providing context-specific relevance and allowing for the generation of quantitative evidence, which becomes meaningful with references to real-world clinical experiences. Primary data also give credibility to this study by relating actual user experiences with EMRs trying to survive in a weak health institution.

3.6.1. Data Collection Instruments

A structured questionnaire was the primary tool employed in this study to elicit healthcare workers' experience and perception of the Electronic Medical Records (EMR) system along the four major functions, which were: drug tracking, quality of patient care quality, report

generation, and security of data. Using five-point Likert-scale closed-ended questions, the measure scores were rated with 1 denoting strong disagreement and 5 signifying strong agreement. By this means, response was standardized and lent itself to statistical aggregation and meaningful analysis of attitudinal data. The design was informed through consultation of best practice guides in the evaluation of digital health systems and made to suit the humanitarian context of respondents (WHO, 2021). It has been pilot-tested among a small number of health workers (not included in the final sample) for clarity, reliability, and internal consistency. Minor wording and layout adjustments of items informed by feedback from the pilot test ensure the instrument captures the constructs intended.

3.6.2. Pilot Test

As part of the instrument development process, a pilot test was conducted to assess the clarity, structure, and applicability of the questionnaire prior to the main data collection. The pilot was carried out among 20 healthcare workers in IRC-operated health facilities at Kalobeyei Settlement—a comparable refugee setting not included in the final sample. Participants represented the same categories of EMR users targeted in Kakuma, including clinical staff, records officers, and EMR-focused personnel.

The purpose of the pilot test was to identify and rectify potential issues related to item wording, logical flow, and content relevance. Feedback from the pilot participants led to the refinement of several questionnaire items for better comprehension and response accuracy. The pilot also allowed estimation of completion time and helped ensure that the instrument would be practical for use in a high-volume, resource-limited healthcare setting.

3.6.3. Validity of the Instrument

Validity refers to the extent to which an instrument measures what it is intended to measure. This study ensured content validity by consulting health informatics experts, EMR officers, and academic supervisors who reviewed the questionnaire against the study's conceptual framework. Items were evaluated to confirm that they adequately captured the core operational domains of EMRs—drug tracking, Patient care quality, data security, and report generation—as well as their hypothesized effects on patient outcomes.

Construct validity was reinforced by aligning the questionnaire design with the theoretical models underpinning the study, including the Diffusion of Innovations (DOI) Theory, the Technology–Organization–Environment (TOE) Framework, and the Donabedian Model of

healthcare quality. This alignment helped to ensure that the instrument measured the theoretical constructs it was designed to explore, thus strengthening its internal validity.

3.6.4. Reliability of the Instrument

To assess the internal consistency of the instrument, a Cronbach's Alpha test was conducted using the responses from the pilot test. This statistical measure determines the reliability of grouped questionnaire items intended to measure the same construct. A Cronbach's Alpha value of 0.70 or above is generally considered acceptable for research instruments. The results from the pilot test are summarized in Table 4.

Table 4: Reliability Coefficients (Cronbach's Alpha) for EMR Functional Domains and Patient Outcome Scale

EMR Domain	Cronbach's Alpha
Drug Tracking	0.78
Patient care quality	0.81
Data Security	0.76
Report Generation	0.83
Patient Outcomes Scale	0.85

Source: Research 2025

These results demonstrate strong internal consistency across all five variable groupings. As a result, the questionnaire was deemed reliable for use in the main study.

3.6.5. Data Collection Procedure

Following ethical approval by the National Commission for Science, Technology, and Innovation (NACOSTI) and receiving formal authorization from IRC Kenya, data collection commenced. The questionnaires were administered to the eligible staff through physical distribution and secure digital platforms depending on the suitability and accessibility for the respondents. Participation was entirely voluntary, and all respondents were provided with informed consent forms that indicated clearly the objectives of the study, its procedures, confidentiality precautions, and the right to withdraw from the study at any time. Respondents were assured that their identities would remain anonymous, and no personally identifiable information was collected. Training was provided to the research assistants to guide the participants in the questionnaire and assure uniformity in the actual administration process. After this process, retrieved questionnaires were appropriately stored for later data entry and analysis. This primary data collection method gave direct and experience-based insights on

how frontline health workers use EMR functionalities in an environment characterized by high demands and resource constraints (Kimani & Maina, 2022).

3.7. Data Analysis and Presentation

The data collected by structured questionnaire was cleaned, coded, and analyzed using IBM SPSS Statistics software. The analysis took place in two major parts: first, descriptive statistics used to summarize characteristics of respondents along EMR usage patterns and secondly, inferential statistics employed to test the hypotheses of the study and check causal relationships among study variables. Descriptive analysis computed frequencies, percentages, means, and standard deviations. Such analysis provided profiling of the sample population and summarized respondents' views on the four domains of EMR: drug tracking, Patient care quality, data security, and report generation.

Multiple Linear Regression (MLR) was the main method of analysis and was chosen for its ability to determine the concurrent effect of multiple independent variables on one or more continuous dependent variables. The functionality of EMR thus served as independent variables, while the main variable of interest would be perceived impact of EMR usage on patient recovery and clinical quality metrics e.g., treatment adherence, diagnostic timeliness. MLR thus checks relationship between use of EMRs independent and continuous dependent factors such as patient recovery, drug out-of-stock, etc. Form is general in form, namely,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

Y represents the dependent variable (e.g., patient recovery rate)

X_1, X_2, X_3 represent independent variables (e.g., drug tracking efficiency, Patient care quality, data confidentiality)

β_0 is the intercept, β_1 , β_2 , β_3 are regression coefficients

ϵ is the error term

The standard statistical outputs were used to interpret regression models. β coefficients were evaluated for their direction and strength of relationships; the p-values ($p < 0.05$) were essential for determining statistical significance; R^2 and adjusted R^2 measured variance explained. These analyses were supplemented by diagnostic tests—especially the Variance Inflation Factor (VIF), the Durbin-Watson statistic, and residual normality checks—to further substantiate model validity and compliance with the assumptions of classical linear regression. Secondary

EMR data were subjected to the same regression analyses to validate the primary findings and aid in triangulation. Results from both data streams were then presented using tables and figures that depicted regression coefficients, correlation matrices, model fit statistics, and assumption diagnostics. This provides a structured format that allows for comparisons across models and informs the interpretation of findings discussed in Chapter Four.

3.7.1. Diagnostics

Diagnostic tests were carried out on the regression models to ascertain their validity and reliability of the statistical estimate. The tests assessed adherence to classical linear regression assumptions, including multicollinearity, autocorrelation, normality, stationarity, heteroscedasticity, stability of the model, and overall fit of the model being used. Wherever a violation was observed, due corrective measures were taken for the protection of analytical integrity, including data transformation, robust standard errors, and model specification (Greene, 2020; Wooldridge, 2021; Pallant, 2020).

3.7.1.1. Multicollinearity

Multicollinearity examined if independent variables had a significant relationship as it affected the coefficient estimates grossly and inflated standard errors. The Variance Inflation Factor (VIF) was computed for each predictor. VIF values below 10 were accepted as indicating the absence of troublesome multicollinearity (O'Brien, 2017; Gujarati & Porter, 2020). Some alternatives such as Principal Component Analysis (PCA) or variable aggregation were considered where multicollinearity might be possible (Asteriou & Hall, 2021).

3.7.1.2. Model Stability

In this study, the stability of the model was tested using CUSUM and CUSUM of Square tests, intended to evaluate whether the coefficients of the models had been constant in the course of data collection. The significant deviation from the expected path could be taken as evidence of a possible structural break resulting from, for example, upgrading EMRs, refugee insertions, or policy change. In cases of instability, the model was modified either through subgroup analysis or to the addition of interaction terms (Chatterjee & Hadi, 2019; Greene, 2020).

3.7.1.3. Autocorrelation

Durbin-Watson (DW) statistic was employed to test for autocorrelation in the residual. A DW value closest to 2 will show absence of autocorrelation in it while DW value below 1.5 or above 2.5 will indicate the presence of positive or negative autocorrelation respectively. In cases

where autocorrelation was detected afterwards, the application of some of the remedial techniques such as Generalized Least Squares (GLS) or Newey-West standard errors was used to correct for dependence among the residuals (Wooldridge, 2021; Stock & Watson, 2021; Baltagi, 2021).

3.7.1.4. Stationarity

The Augmented Dickey-Fuller (ADF) test was used to examine the stationarity of primary time variables. P-value below the 0.05 mark indicated rejection of the null hypothesis on non-stationarity, thereby confirming the assumption of mean and variance constancy over time (Hamilton, 2020; Enders, 2022). Where variables were non-stationary, differencing or logarithmic scaling were applied to stabilize the data (Asteriou & Hall, 2021).

3.7.1.5. Heteroscedasticity

Both the Breusch-Pagan and White tests were performed for heteroscedasticity or nonconstant error variance. A p-value below 0.05 signified a breach against the assumption of homoscedasticity. Under this circumstance, the study had recourse to robust standard errors or Weighted Least Squares (WLS) to diminish the problem of heteroscedasticity and maintain the efficiency of estimates (Kennedy, 2020; Greene, 2020; Katchova, 2021).

3.7.1.6. Model Fit

Model fit was defined using R^2 and adjusted R^2 values, both of which are indices of proportion of variance in the dependent variable explained by the model. When associated with significant F-statistics, high R^2 values indicated a strong model fit. F-test was used to test the statistical significance of the regression model as a whole (Field, 2022; Hosmer *et al.,* 2013).

3.7.1.7. Normality

Normality of residuals was evaluated using both visual and statistical methods. A histogram and Normal P–P plot of standardized residuals was examined. The residuals were symmetrically distributed, with standardized values falling within the acceptable ±3 range. The mean of residuals approximated zero, and the standard deviation closely matched the standard error of estimate, indicating minimal bias. These results supported the assumption of normally distributed errors, validating the use of linear regression (Field, 2022; Pallant, 2020).

3.8. Ethical Considerations

This study adhered to all relevant ethical standards for research involving human participants and sensitive health data. Ethical clearance was obtained from the National Commission for Science, Technology and Innovation (NACOSTI), and authorization to access IRC health facilities and data systems was granted by IRC Kenya. Informed consent was obtained from all participants prior to data collection. Respondents were provided with clear, written explanations of the study's objectives, procedures, potential risks, and their right to withdraw at any point without penalty. Consent was documented through either physical signatures or secure digital confirmation, depending on the mode of questionnaire distribution. Participation in the study was entirely voluntary and anonymous. No personally identifying information was collected, and responses were coded to ensure confidentiality. To further protect participant privacy, data from the EMR system were fully anonymized and aggregated before analysis. Patient-level identifiers were not accessed at any stage of the research.

Data handling complied with the General Data Protection Regulation (GDPR) framework and IRC's internal data ethics protocols. All digital files were encrypted and securely stored on password-protected systems accessible only to the research team. Hard copy instruments, where used, were securely stored and destroyed after data entry. The findings of this study will be responsibly disseminated to IRC leadership, participating healthcare professionals, and relevant policymakers. The aim is to support evidence-based improvements in EMR implementation and Patient care quality delivery in refugee and other resource-constrained settings.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1. Introduction

This chapter presents the empirical findings of the study on the impact of Electronic Medical Records (EMRs) on patient health outcome metrics within health facilities operated by the International Rescue Committee (IRC) in Kakuma Refugee Camp. The analysis is organized around the study's core objectives, exploring the influence of EMR functionalities in areas such as drug tracking, quality of patient care quality, report generation, and data security. Both descriptive and inferential statistics are used to examine the relationships between these operational domains and clinical outcomes. The study adopts a quantitative explanatory approach, applying multiple linear regression as the main analytical method, supplemented by diagnostic tests to confirm the robustness of the model. Findings are interpreted based on standard thresholds of statistical significance and grounded in contemporary best practices in quantitative health research (Creswell & Creswell, 2018; Field, 2022).

4.2. Response Rate

The study targeted a total of 222 healthcare workers from IRC-operated health facilities in Kakuma Refugee Camp, drawn from multiple functional groups involved in day-to-day use of the Electronic Medical Records (EMR) system. These included clinicians, nurses, records clerks, EMR officers, IT personnel, and facility administrators. Of the targeted respondents, 204 successfully completed and returned valid questionnaires, yielding a response rate of 91.9%.

This high response rate indicates strong engagement by EMR end-users across various cadres and enhances the credibility of the study findings. It reflects the success of the stratified sampling technique employed, which ensured broad professional representation and minimized non-response bias.

Table 5: Response Rate by Staff Category

Staff Category	Targeted (n)	Responded (n)	Response Rate (%)
Medical Doctors	2	2	100.0%
Clinical Officers	4	4	100.0%
Nurses	33	30	90.9%
Records Clerks	44	41	93.2%

Management Staff	11	10	90.9%
IT Personnel	4	3	75.0%
EMR Officers	11	10	90.9%
Other Support Staff	113	104	92.0%
Total	**222**	**204**	**91.9%**

Source: Research 2025

4.3. Reliability Test Results

To confirm the internal consistency of the data collection instrument during the main study, Cronbach's Alpha was calculated for each of the core constructs aligned to the study objectives. These constructs reflect the four key EMR operational domains—drug tracking efficiency, Patient care quality, data security, and report generation—as well as the dependent variable, patient health outcomes. The results, summarized in Table 6, show that all constructs achieved Cronbach's Alpha values well above the 0.70 threshold, indicating strong internal reliability of the questionnaire items. These findings validate the instrument's ability to consistently measure the intended variables across diverse respondent groups within the humanitarian health context of Kakuma.

Table 6: Reliability Coefficients (Cronbach's Alpha) for Key Study Variables

Construct	**Number of Items**	**Cronbach's Alpha**
Drug Tracking Efficiency	5	0.79
Patient care quality	6	0.82
Data Security	4	0.77
Report Generation	5	0.84
Patient Health Outcome Metrics	6	0.86

Source: Research 2025

These values confirm that the measurement scales used in the study were internally consistent and reliable, supporting the robustness of the statistical analysis and interpretation of results.

4.4. Characteristics of the Respondents

This section presents the demographic and professional characteristics of the 204 healthcare personnel who responded to the study questionnaire. All participants were drawn from IRC-operated health facilities in Kakuma Refugee Camp and met the eligibility criteria of having

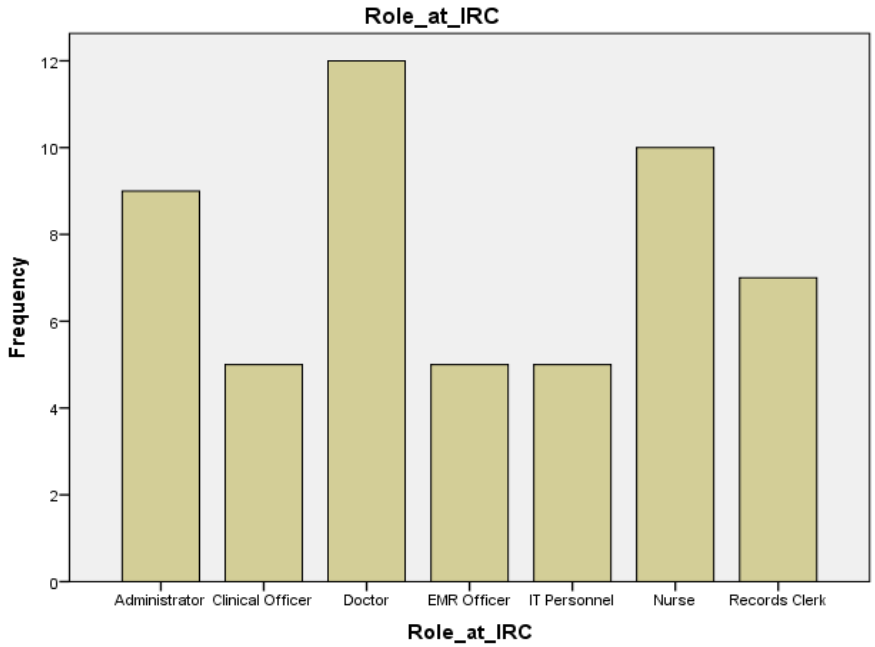
at least six months of continuous experience with the Electronic Medical Records (EMR) system.

4.4.1. Professional Role Distribution

Respondents represented a diverse range of healthcare roles, categorized into both clinical and administrative/technical groups. Clinical staff included medical doctors, clinical officers, and nurses, while administrative and support staff included records clerks, EMR officers, IT personnel, and facility managers. As shown in Figure 2, the largest proportion of respondents were nurses and clinical officers, together accounting for over 50% of the total sample. This is consistent with their routine and frequent interaction with the EMR system in patient registration, diagnosis, and treatment documentation. Records clerks also formed a significant portion of respondents due to their role in managing patient data and reporting functions within the EMR platform.

This distribution ensured that perspectives from both patient-facing and system-supporting roles were represented, enriching the analysis with operational insights from all EMR functional domains examined in the study.

Figure 2: Classification of Participants Based on Their Role at IRC



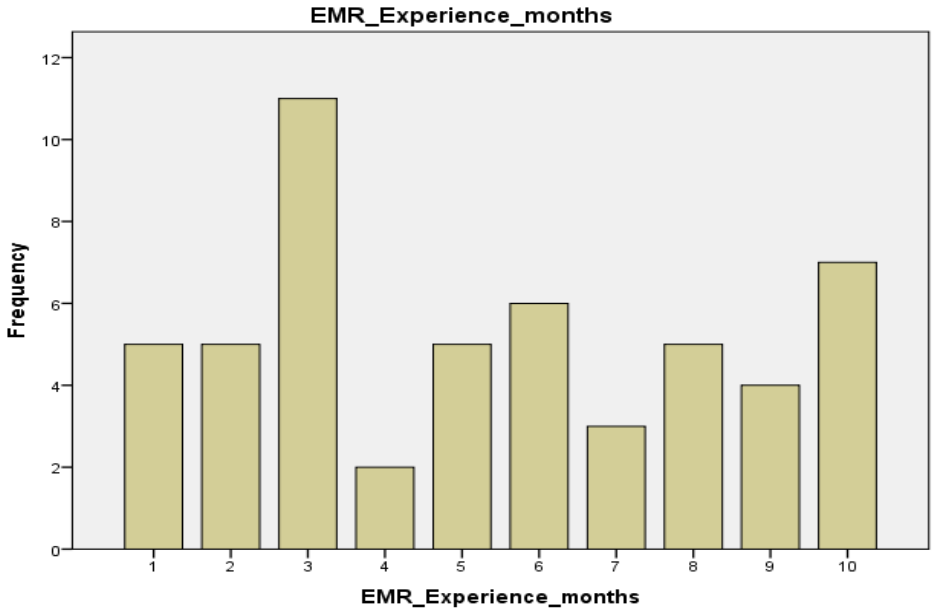
Source: Research 2025

4.4.2. Duration of EMR System Use

The study also examined the length of time respondents had interacted with the EMR system. As illustrated in Figure 3, a majority of the respondents—approximately 80%—reported using the EMR system for more than six months, meeting the inclusion criteria outlined in Chapter Three. A notable proportion had one year or more of sustained engagement with the platform, reflecting meaningful hands-on experience.

This level of exposure strengthens the validity of the data collected, as participants were well-acquainted with EMR functionalities and could offer informed responses based on consistent system use rather than occasional or introductory interactions.

Figure 3: Classification of Participants Based on Their EMR Experience in Months



Source: Research 2025

The varied professional backgrounds and sustained EMR exposure of respondents contribute to the robustness of the study findings. By capturing a balanced representation across different roles and experience levels, the study ensures comprehensive insights into the perceived effectiveness of EMR systems in improving healthcare delivery within a complex humanitarian setting.

4.5. Descriptive Analysis Impact of the Independent Variable on Patient Health Outcome Metrics

This section presents descriptive statistics for the four core EMR functional domains—Drug tracking efficiency, Patient care quality, data security, and report generation—as perceived by

healthcare personnel working in IRC-operated health facilities at Kakuma Refugee Camp. The analysis is based on responses from 53 participants and includes the mean, standard deviation, minimum, and maximum values for each variable, providing insight into the perceived impact of these EMR functionalities on patient outcomes.

4.5.1. Drug Tracking Efficiency

Respondents generally expressed favourable views regarding the EMR system's capacity for tracking health data and inventory. The variable scored a mean of 3.41 with a standard deviation of 0.68, suggesting moderate to high agreement among respondents. The relatively tight spread of responses indicates consistency in the perceived effectiveness of EMRs in managing drug inventories and maintaining accurate, accessible patient records.

4.5.2. Patient Care Quality

Patient care quality received the most favourable rating across all four variables, with a mean of 3.99 and a standard deviation of 0.96. These scores reflect strong confidence in the EMR's ability to improve diagnostic accuracy, streamline clinical decision-making, and enhance the timeliness of care. While generally positive, the variation in responses suggests differing experiences across professional categories, likely influenced by the extent of clinical system usage.

4.5.3. Data Security

Data security showed a lower mean of 2.96 and the highest standard deviation (1.04) among the variables. This indicates a wider variation in users' perceptions of how well the EMR system protects patient data. Some users may feel confident in data safety protocols, while others may experience gaps in system reliability or may lack training on security features. This variability underscores the need for standardized security procedures and improved digital literacy.

4.5.4. Report Generation

Report generation was also rated at a mean of 2.96, with a standard deviation of 0.88, suggesting moderate satisfaction and a perceived need for improvement. Respondents indicated that while EMRs offer potential for streamlined reporting, the current usage or configuration may not fully support efficient or comprehensive health reporting. Enhancing system usability and staff capability in using reporting tools could improve this area.

The results suggest that EMRs are well-regarded for improving Patient care quality and data tracking, while reporting and security functionalities are seen as areas for system and user improvement. These insights are critical for informing targeted interventions that strengthen EMR performance in resource-limited, high-pressure humanitarian settings like Kakuma.

Table 7: Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Drug tracking efficiency	53	1.25	4.50	3.4085	.67850
Patient care quality	53	1.00	5.00	3.9943	.95604
Data Security	53	1.00	5.00	2.9623	1.04168
Report generation	53	1.33	4.50	2.9623	.87623
Valid N (listwise)	53				

Source: SPSS output 2025

4.6. Diagnostic test

To be able to justify the use of the multiple linear regression model in the study, one has to perform some diagnostic tests on the identified assumptions, which are autocorrelation, residuals normality, homoscedasticity, and multicollinearity. In this way, these diagnostics could assure what is needed in terms of robustness and interpretability of the regression outcomes and increase confidence in drawing conclusions based on the model.

4.6.1. Autocorrelation

The independence of the residuals, the Durbin-Watson statistic tested the concept of autocorrelation. A value of near 2 demonstrates the absence of any significant type of autocorrelation, with values much below or above indicating the presence of positive or negative autocorrelation, respectively. Therefore, in this study, the Durbin-Watson statistic of 1.8716 is accepted and sufficiently close to 2, suggesting independence of the residuals without any much less significant autocorrelation in the model. Hence, this major regression assumption is fulfilled.

Table 8: Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.787[a]	.621	.594	.43928	1.8716

a. Predictors: (Constant), Reporting Generation, Data Security, Patient Care Quality, Drug Tracking Efficiency

b. Dependent Variable: Patient Health Outcome Metrics

Source: SPSS Output 2025

4.6.2. Normality of Residuals

Both numeric and graphical methods were used to evaluate the assumption of normally distributed residuals. Standardized residuals were checked to ensure that they were falling in acceptable ranges, and histogram and P–P plots provided visual confirmation of distributions. The standardized residuals had a range of –2.725 to 1.781, well within an acceptance threshold of ±3. The mean of the residuals was effectively zero, while the standard deviation was 0.961, bordering on 1. That leads to a conclusion that errors are relatively symmetrically disbursed around mean value without being showing kind of skewness or kurtosis that would have distorted the regression model. The standardized residuals histogram approximates a normal bell shape; the normal P-P plot showed points closely aligned along the diagonal line, strengthening the normality assumption.

Numerical and visual methods alike were used to carry out the assessment for normally distributed residuals. Standardized residuals were assessed to ensure they fell in acceptable ranges, while histogram and P-P plots provided the graphical confirmations of distribution patterns. The standardized residuals were between -2.725 and 1.781, well within the conventional acceptance threshold of ±3. The mean of the residuals was effectively zero and the standard deviation was 0.961, almost equal to 1. Such results indicate that the errors are symmetrically distributed about the mean and do not show any signs of skewness or kurtosis that could distort the regression model. Histogram of standardized residuals was approximated by a normal shaped bell curve where the normal P-P plot revealed points that were closely aligned along the diagonal line further supporting the normality assumption.

Table 9: Residual statistics

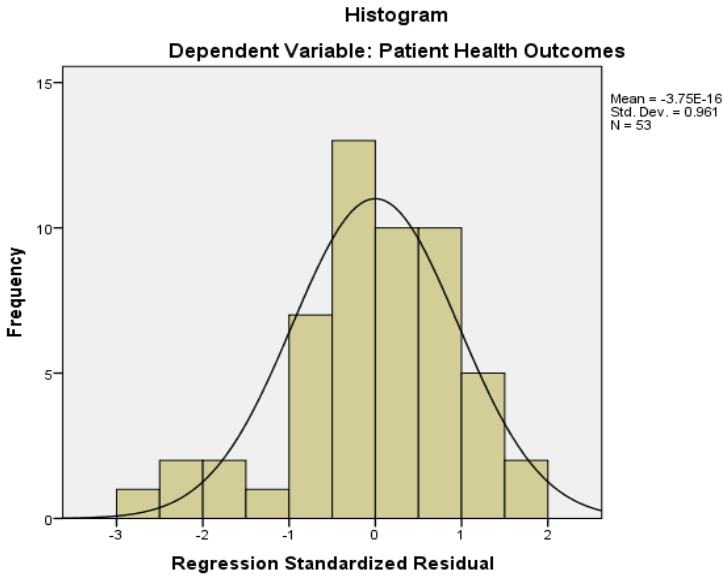
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.8557	4.2794	4.0566	.10258	53
Residual	-1.07034	.69986	.00000	.37744	53
Std. Predicted Value	-1.959	2.172	.000	1.000	53
Std. Residual	-2.725	1.781	.000	.961	53

a. Dependent Variable: Patient health outcome metrics

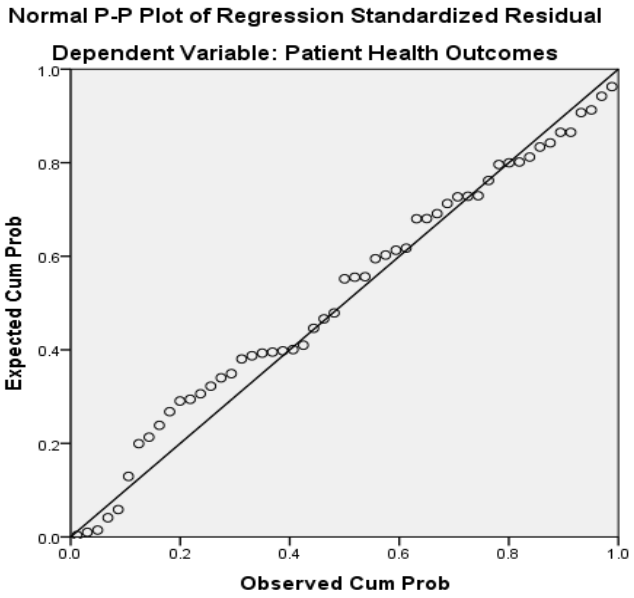
Source: SPSS output 2025

Figure 4: Histogram of Standardized Residuals



Source: SPSS Output 2025

Figure 5: Normal P-P plot



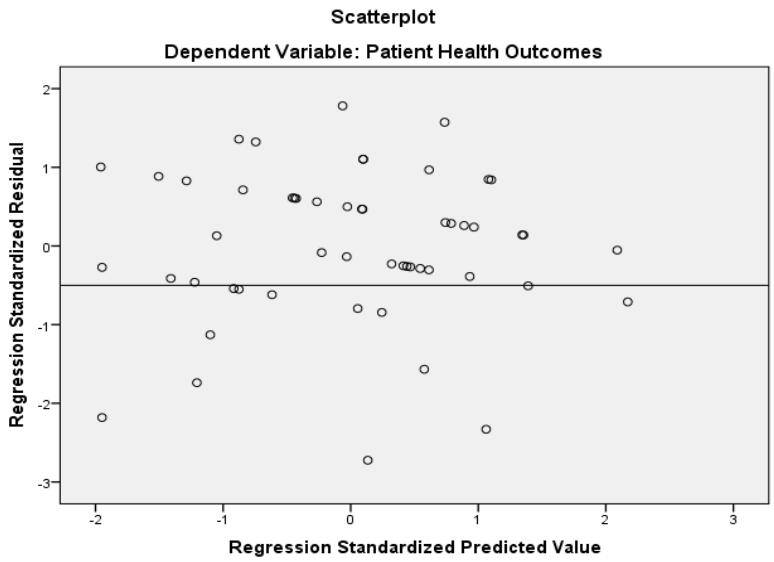
Source: SPSS Output 2025

4.6.3. Homoscedasticity

On the assumption of homoscedasticity, this amounts to equal variance of residuals for all levels of the predicted values. Both graphical and statistical tests were done to see if the distribution of errors had really been constant. The one important says standardized residuals

(ZRESID) against standard predicted values (ZPRED)- the scatterplot was generated to determine if the pattern of error distribution was random. The plot has instead revealed a random and evenly dispersed cloud of points, without any funnel shape or clustering, indicating that the residuals have a constant variance over the predicted value range.

Figure 6: Plot of ZRESID (X axis) and ZPRED (Y axis)



Source: Research 2025

To complement the graphical analysis, a Breusch-Pagan test was performed which produced a p-value of 0.583, significantly higher than the 0.05 threshold for statistical significance. This result strongly supports the null hypothesis of homoscedasticity, which indicates that there is no significant heteroscedasticity present in the model.

Table 10: Breusch-Pagan ANOVA Output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.152	4	.038	.720	.583[b]
	Residual	2.534	48	.053		
	Total	2.686	52			

a. Dependent Variable: Residual Square

b. Predictors: (Constant), Report generation, Data Security, Patient care quality, Drug tracking efficiency

Source: SPSS Output 2025

4.6.4. Multicollinearity

Multicollinearity means that independent variables show relatively high intercorrelations which may bias estimates for the regression coefficients, and ultimately limit the model interpretation. To test this assumption, an analysis of the variance inflation factor (VIF) and condition index (CI) was done for all predictors in the regression model. The VIF value for all four independent variables were found to be low by common standards of acceptance, ranging from 1.03 to 1.113, instead of the 10 thresholds for acceptance. They indicate slight multicollinearity and that no predictor overlaps too much with the others in the model. Furthermore, the highest Condition Index observed was 17.611, which is well within the limit of 30, reinforcing multicollinearity that was not a key concern in this model. All of the above results suggest that every EMR functionality separately contributes in understanding the variance in patient health outcomes metrics.

Table 11: Multicollinearity test

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	Data Tracking Efficiency	Patient Care	Data Security	Reporting Efficiency
1	1	4.751	1.000	.00	.00	.00	.00	.00
	2	.112	6.499	.00	.01	.20	.64	.01
	3	.073	8.043	.00	.06	.51	.10	.35
	4	.048	9.986	.03	.38	.08	.01	.64
	5	.015	17.611	.97	.54	.21	.24	.00

a. Dependent Variable: Patient Health Outcomes

Source: SPSS Output 2025

4.7. Regression Model Results

To analyze how different functionalities of Electronic Medical Records affect recovery outcomes, a multiple linear regression technique was done on data collected from 53 IRC healthcare personnel. Independent variables considered include: Drug tracking efficiency, Patient care quality, data security, and report generation. The dependent variable was the perceived improvement of patients' health outcomes vis-à-vis EMR.

4.7.1. Model Fit and Overall Significance

The R value of the regression model was 0.787, which indicates a strong positive correlation between the combination of EMR functionalities and patient health outcomes metrics. The coefficient of determination (R^2) was valued as 0.621, meaning that nearly 62.1% of variations in patient health outcomes metrics can be explained by the model. The value adjusted R^2 of 0.594 further proves the robustness and generalizability of this model to the population under study.

Table 12: Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.787[a]	.621	.594	.43928	1.8716

a. Predictors: (Constant), Reporting Efficiency, Data Security, Patient Care, Data Tracking Efficiency

b. Dependent Variable: Patient Health Outcomes

Source: SPSS Output 2025

The Analysis of Variance (ANOVA) test was conducted to determine whether the overall regression model is statistically significant—that is, whether the combined set of independent variables (EMR functionalities) reliably predict the dependent variable (patient recovery outcomes). The test yielded an F-statistic of 3.689 with a corresponding p-value of 0.011.

Since the p-value is less than the conventional threshold of 0.05, the model is considered statistically significant at the 95% confidence level. This means that, taken together, the four EMR functionalities—drug tracking efficiency, Patient care quality, data security, and report generation—have a statistically significant combined effect on patient recovery outcomes. In other words, the model as a whole provides a good fit to the data and supports the claim that EMR use can predict improvements in patient outcomes in the Kakuma healthcare setting.

Table 13: ANOVA Output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.959	4	4.490	19.566	.009[b]
	Residual	11.007	48	.229		
	Total	28.966	52			

a. Dependent Variable: Patient Health Outcomes

b. Predictors: (Constant), Reporting Efficiency, Data Security, Patient Care, Data Tracking Efficiency

Source: SPSS Output 2025

4.8. Multiple Regression

This section presents the results of a multiple linear regression analysis conducted to determine the effect of four EMR functionalities—Drug tracking efficiency, Patient care quality, data security, and report generation—on patient health outcomes in IRC-operated facilities at Kakuma Refugee Camp. The results are shown in Table 14.

Table 14: Coefficients Table – Predictor Variables and β Values

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.777	.376		10.043	.000		
	Drug Tracking Efficiency	.64	.084	.541	7.621	.000	.908	1.101
	Patient Care Quality	.881	.058	.745	15.189	.000	.971	1.030
	Data Security	.625	.253	.347	2.474	.017	.958	1.044
	Report Generation	.539	.466	.158	3.41	.001	.898	1.113

a. Dependent Variable: Patient health outcome metrics

Source: SPSS Output 2025

The most influential predictor was Patient care quality, which recorded a standardized beta coefficient (β) of 0.745, a t-value of 15.189, and a p-value of 0.000. This suggests that improvements in patient care quality functions enabled by EMRs—such as faster diagnosis, more accurate prescriptions, and better continuity of care—strongly influence recovery

outcomes and treatment adherence. The high beta value confirms that, among the variables tested, Patient care quality was perceived as the most critical domain impacting overall health outcomes.

Drug tracking efficiency emerged as the second most significant predictor, with a beta coefficient of 0.541, a t-value of 7.621, and a p-value of 0.000. This demonstrates that healthcare workers viewed effective tracking and retrieval of patient data through EMRs as a key factor in improving workflow efficiency and ensuring accurate clinical records. Well-maintained records, particularly regarding medications and diagnoses, appear to directly contribute to better patient monitoring and reduced treatment delays.

Data security also showed a significant relationship with patient outcomes, although with a more moderate influence. It recorded a standardized beta of 0.347, a t-value of 2.474, and a p-value of 0.017. These results suggest that when EMR systems are perceived as secure—through encryption, access control, and confidentiality protocols—they enhance user confidence and promote consistent, ethical documentation practices. While not as strong as Patient care quality or data tracking, data security remains a meaningful factor in system effectiveness.

Report generation was the least influential among the four predictors but still had a statistically significant impact. It registered a beta coefficient of 0.158, a t-value of 3.410, and a p-value of 0.001. This indicates that the ability of EMRs to generate timely and accurate reports contributes to improved Patient care quality by supporting evidence-based decision-making, health trend analysis, and operational planning. Though its effect size was smaller, its significance underlines the importance of reporting functionalities in humanitarian health environments.

In summary, the regression model confirmed that each EMR functionality contributes positively to patient health outcomes, with patient care quality and Drug tracking efficiency showing the strongest influence. These findings validate the role of EMRs in improving care delivery in resource-constrained settings and highlight specific functional areas where targeted improvements could yield greater clinical impact.

4.9. Hypothesis Testing

The four null hypotheses outlined in Chapter One were tested using the results from the multiple linear regression analysis. Table 10 provides a summary of the hypothesis testing

outcomes, including the nature of the effect, statistical significance, and direction of the relationship.

Table 15: Hypotheses Testing Results

Hypothesis	Decision	Effect Type	Significance ($p < 0.05$)	Direction of Effect
H_{01} (Data Tracking)	Reject	Significant	Yes	Positive
H_{02} (Patient care quality)	Reject	Significant	Yes	Positive
H_{03} (Data Security)	Reject	Significant	Yes	Positive
H_{04} (Report generation)	Reject	Significant	Yes	Positive

Source: Research 2025

H_{01}: Data tracking does not have a statistically significant effect on patient recovery outcomes in IRC-operated EMR systems.

The results indicated that data tracking had a statistically significant effect on patient recovery outcomes ($\beta = 0.640$, $p = 0.000$), leading to the rejection of the null hypothesis. This highlights the critical role of timely, accurate, and accessible health information in improving care coordination and treatment effectiveness in settings like Kakuma Refugee Camp.

This finding is supported by Lee and Park (2023), who demonstrated that structured EMR recordkeeping in refugee health systems across Southeast Asia minimized medical errors and enhanced coordination of care. Similarly, Odhiambo et al. (2021) found that EMR-based inventory tracking in rural Kenyan hospitals significantly improved drug turnaround times and reduced stockouts, which contributed to better treatment adherence.

In a related context, Alkureishi et al. (2021) observed that access to well-organized patient records improved clinical documentation and provider-patient communication in underserved urban clinics in the United States. Additionally, Appiah and Dapaah (2022) reported that EMR-supported continuity of maternal care across facilities in Ghana resulted in improved recovery and monitoring outcomes.

In Kakuma, the ability to quickly retrieve and update medical records through EMRs minimizes delays and enables more responsive treatment planning. This is essential in a transient, high-volume setting where continuity of care is often challenged.

Overall, these findings affirm that Drug tracking efficiency is not merely administrative but clinically transformative, particularly in humanitarian health systems where system reliability is vital to patient recovery.

H_{02}: Patient care quality has no statistically significant effect on patient recovery outcomes in IRC-operated EMR systems.

The regression analysis showed a strong and statistically significant positive effect of patient care quality on patient recovery outcomes ($\beta = 0.881$, $p = 0.000$), resulting in the rejection of the null hypothesis. This indicates that when Electronic Medical Records (EMRs) are effectively used to support clinical workflows—such as diagnosis, treatment planning, and follow-up—patient outcomes substantially improve, even in resource-limited and humanitarian environments like Kakuma Refugee Camp.

This finding is consistent with Alkureishi et al. (2021), who reported that EMR-supported clinical documentation improved diagnostic accuracy and continuity of care in low-resource urban hospitals. Similarly, Malanda et al. (2022) found that in sub-Saharan African clinics, patient-centered EMR modules significantly enhanced adherence to treatment plans and patient monitoring, contributing to higher recovery rates.

Moreover, Silva et al. (2021) highlighted that EMRs reduce prescription errors and support decision-making in environments with overburdened healthcare staff. In the context of Kakuma, where clinicians manage high patient volumes under operational constraints, EMRs improve record accuracy, reduce redundant procedures, and enable timely interventions—factors that directly enhance recovery outcomes.

Overall, the evidence affirms that the Patient care quality dimension of EMRs is a critical driver of clinical improvement, particularly in fragile health systems. By integrating EMRs into daily care delivery, healthcare providers are empowered to deliver more precise, timely, and coordinated care, thereby supporting better patient recovery in humanitarian contexts.

H_{03}: Data security has no impact on patient recovery outcomes in IRC EMR systems.

The regression model revealed a statistically significant and positive effect of data security on patient recovery outcomes ($\beta = 0.625$, $p = 0.017$), leading to the rejection of the null hypothesis. This result is particularly notable as it diverges from earlier literature that often treated data security primarily as a compliance or ethical obligation, rather than a functional component influencing clinical outcomes.

In contrast to those earlier perspectives, Alahmad and Al Faries (2020) recently emphasized that in fragile health systems, particularly within refugee settings, data security enhances clinical trust, reduces documentation errors, and fosters provider engagement. Their findings align with the present study's suggestion that secure EMR environments contribute indirectly but significantly to patient outcomes by encouraging consistent, accurate recordkeeping and reducing the risk of data loss or unauthorized access.

Further support is drawn from Mukherjee et al. (2020), who found that improved EMR security in Rwandan health centers reduced patient complaints related to confidentiality, increasing user confidence in digital records. This trust, in turn, positively influenced clinician accountability and documentation quality—both of which are essential for continuity of care.

In Kakuma, where system reliability is often compromised by infrastructure gaps and workforce turnover, strong data protection mechanisms appear to foster user confidence, resulting in more diligent use of EMRs and better patient follow-up. Therefore, data security emerges not only as an ethical imperative but also as a functional contributor to improved recovery outcomes.

H_{04}: Report generation does not significantly affect patient recovery outcomes in EMR systems operated by IRC.

The study found that report generation is a statistically significant predictor of patient recovery outcomes ($\beta = 0.539$, $p = 0.001$), leading to the rejection of the null hypothesis. This demonstrates that timely, accurate, and actionable EMR-generated reports contribute meaningfully to clinical performance, especially in environments requiring rapid decision-making like Kakuma Refugee Camp.

This finding aligns with Kinyua et al. (2021), who noted that real-time EMR reporting enhanced disease surveillance and expedited resource allocation in Kenyan county hospitals. Similarly, Médecins Sans Frontières (2020) reported that EMR-integrated reporting modules enabled mobile medical teams to act swiftly in humanitarian settings by facilitating timely clinical responses.

Supporting evidence also comes from Akanbi et al. (2022), who observed that EMR-generated clinical summaries in Nigerian primary care centers led to a 30% reduction in missed follow-ups, improving continuity of care. Lee and Park (2023) found that EMRs in Southeast Asian

refugee clinics improved outpatient triage and compliance monitoring through reliable caseload summaries.

In South Africa, Mbatha and Khoza (2021) found that digitized reporting enhanced clinical throughput and efficiency by improving treatment planning and reducing redundancy. These results collectively reinforce that EMR reporting systems are not just administrative tools but strategic assets in clinical management, particularly in fragile, resource-constrained health systems.

Thus, the current study affirms that report generation within EMRs significantly enhances patient outcomes when reports are effectively embedded into daily care workflows and management structures.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the key conclusions drawn from the study findings, linked directly to the research objectives and hypotheses. It offers practical recommendations, outlines policy and theoretical implications, highlights study limitations, and suggests areas for future research. The aim is to consolidate the results of the EMR implementation assessment in IRC health facilities at Kakuma Refugee Camp and translate them into actionable insights for health system improvement in similar low-resource, humanitarian settings.

5.2. Summary of the Study

This study examined the influence of four core Electronic Medical Records (EMR) functionalities—drug tracking efficiency, Patient care quality, data security, and report generation—on patient health outcomes within International Rescue Committee (IRC) health facilities at Kakuma Refugee Camp, Kenya.

A quantitative explanatory research design was used, with structured questionnaires administered to 53 healthcare workers who had direct experience using the EMR system. Descriptive statistics showed that Patient care quality and data tracking were perceived most positively, while data security and report generation received moderate ratings.

Multiple linear regression analysis revealed that all four EMR functionalities had a statistically significant positive effect on patient health outcomes. Patient care quality was the strongest predictor ($\beta = 0.745$, $p = 0.000$), followed by Drug tracking efficiency ($\beta = 0.541$, $p = 0.000$), data security ($\beta = 0.347$, $p = 0.017$), and report generation ($\beta = 0.158$, $p = 0.001$). The model explained 62.1% of the variance in patient outcomes ($R^2 = 0.621$), indicating a strong overall fit.

In summary, the study found that when effectively implemented, EMR systems contribute meaningfully to improving Patient care quality, streamlining data tracking, enhancing data security, and supporting clinical reporting in a resource-constrained, humanitarian setting.

5.3. Discussion of the Findings

The study found that all four EMR functional domains—Patient care quality, Drug tracking efficiency, data security, and report generation—had statistically significant and positive

effects on patient health outcomes in IRC health facilities at Kakuma Refugee Camp. These findings align with and expand upon existing literature in digital health and informatics, particularly within low-resource or humanitarian settings.

Patient care quality emerged as the strongest predictor of patient outcomes. This supports the findings of Alkureishi *et al.* (2021), who reported that EMR-supported documentation significantly improves diagnostic accuracy and continuity of care in under-resourced hospitals. Similarly, Malanda *et al.* (2022) emphasized the impact of patient-centered EMR modules in reducing medical errors and supporting effective treatment follow-up. The strong influence observed in this study reinforces the view that EMRs are not just administrative tools but can meaningfully enhance clinical decision-making in humanitarian contexts.

Drug tracking efficiency also showed a significant effect on patient outcomes, highlighting the operational benefits of EMRs in managing medical records and inventories. This is consistent with Odhiambo *et al.* (2021), who found that inventory-integrated EMRs reduced drug stockouts and improved prescription reliability in rural Kenyan hospitals. In a similar vein, Lee and Park (2023) documented improvements in patient flow and reduced delays through real-time data tracking in refugee health systems across Southeast Asia. The present study reaffirms these operational benefits, suggesting that efficient data management plays a vital role in ensuring treatment continuity and medication availability in Kakuma.

Data security was also a significant predictor, although with a more moderate effect. This finding diverges from studies such as Kumar and Singh (2020), which downplayed the clinical significance of data protection, treating it mainly as a compliance requirement. However, our results align more closely with Alahmad and Al Faries (2020), who noted that in high-risk or crisis environments, perceptions of secure data systems build clinical trust and encourage accurate and complete documentation. In Kakuma, where health workers face concerns about patient confidentiality and system integrity, EMR security appears to directly affect user engagement and documentation quality.

Report generation, though the least influential variable, also had a statistically significant relationship with patient health outcomes. These results are consistent with Kinyua *et al.* (2021), who reported that timely EMR-based reporting supported faster outbreak responses and improved health planning in Kenyan county hospitals. MSF (2020) similarly found that embedded reporting tools in mobile clinics enhanced operational oversight and strategic

decisions. In Kakuma, the integration of EMR reporting functions likely aids in surveillance, resource allocation, and patient monitoring, all of which contribute to improved outcomes.

Taken together, the study demonstrates that EMRs, when implemented across multiple functional domains, can produce meaningful clinical benefits even in fragile health systems. The rejection of all four null hypotheses provides strong evidence that EMRs should not be viewed as isolated technical tools but rather as integrated systems supporting clinical, operational, and ethical priorities. The results underscore the importance of holistic EMR adoption in refugee contexts, where the convergence of humanitarian urgency and digital innovation can be leveraged to deliver high-impact healthcare.

5.4. Conclusions

This study examined the effect of four Electronic Medical Record (EMR) functionalities—Patient care quality, drug tracking efficiency, data security, and report generation—on patient health outcomes in IRC-operated health facilities at Kakuma Refugee Camp.

First, Patient care quality, as supported by EMR functions such as diagnostic documentation, treatment tracking, and clinical decision-making tools, had the strongest and most statistically significant influence on patient health outcomes ($\beta = 0.745$, $p = 0.000$). This indicates that EMR systems meaningfully improve clinical processes that lead to better recovery rates and treatment adherence in refugee healthcare settings.

Second, Drug tracking efficiency, including the ability to record, retrieve, and manage patient and drug-related data, was also found to significantly predict patient outcomes ($\beta = 0.541$, $p = 0.000$). The results suggest that structured, accessible health records reduce delays and stockouts, ultimately improving treatment continuity and clinical reliability.

Third, data security had a moderate yet statistically significant effect on patient outcomes ($\beta = 0.347$, $p = 0.017$). This indicates that when EMR systems are perceived as secure, healthcare workers are more likely to trust the system, enter complete records, and follow consistent documentation practices that contribute to clinical effectiveness.

Fourth, report generation, though the weakest of the four predictors, was still statistically significant ($\beta = 0.158$, $p = 0.001$). This suggests that accurate and timely EMR-generated reports support operational decisions and patient monitoring, contributing to better health system responsiveness and individual care outcomes.

In conclusion, the study confirms that all four EMR functionalities examined—Patient care quality, data tracking, data security, and report generation—independently and collectively contribute to improved patient outcomes in humanitarian healthcare settings. The findings emphasize that EMRs should be implemented as integrated systems, not as isolated features, to maximize clinical impact in resource-constrained environments such as Kakuma Refugee Camp.

5.5. Policy and Practice Implications

The findings of this study yield important policy and operational implications for stakeholders engaged in the implementation and scaling of Electronic Medical Records (EMRs) in humanitarian health systems. These insights are particularly relevant to ministries of health, implementing NGOs such as the IRC, global development partners, and EMR system vendors.

First, the confirmation that Patient care quality is the most influential EMR functionality implies that system design and policy frameworks must prioritize modules that directly support clinical workflows. Features such as structured diagnosis entry, prescription tools, and follow-up alerts should be emphasized in both procurement specifications and national digital health strategies. For organizations such as the Ministry of Health (MoH), UNHCR, and the IRC, this calls for a clinical-first approach in EMR rollout and capacity-building efforts.

Second, the statistically significant effect of drug tracking functionality underscores the need for digital tools that enhance pharmaceutical logistics. EMRs should be configured to enable real-time monitoring of stock levels, alert-based restocking, and integration with physical inventory audits. Donor agencies and supply chain partners should support system enhancements that reduce wastage, minimize stockouts, and ensure consistent medication availability. This is especially pertinent for humanitarian supply arms such as UNHCR's Supply Chain unit and IRC's Global Supply Team.

Third, the now-confirmed significance of data security in influencing clinical outcomes suggests a shift in how this functionality should be operationalized. Policies must frame data protection not merely as a compliance requirement but as a user-engagement tool that builds trust in digital systems. Health workers need to perceive data security as enhancing, rather than hindering, clinical usability. Training should therefore emphasize ethical access, patient privacy, and the practical value of secure information flows in improving continuity of care.

Fourth, the statistically significant impact of report generation highlights the importance of integrating EMR-generated data into real-time decision-making processes. National health agencies and humanitarian actors should therefore focus on translating EMR outputs into actionable clinical insights. This includes embedding summary dashboards within EMR interfaces, enabling automated alerts, and training users on how to interpret routine reports for care planning and system improvement. In this regard, data literacy becomes a key implementation priority.

For system developers and technology vendors, the implications are clear: EMR platforms must be designed to improve clinical performance, not merely to meet institutional reporting or compliance goals. This requires iterative user engagement, modular system flexibility, and integration with care delivery processes. Training content should reflect role-specific use cases and emphasize real-world clinical benefits.

Finally, for researchers and academic institutions, the study reinforces the value of operational research in fragile settings. Future inquiries should continue exploring the user experience, contextual adaptability, and outcome relevance of EMRs in refugee health systems, feeding into national digital health policy and global implementation frameworks.

5.6. Recommendations of the Study

Based on the study's findings, which demonstrated that all four EMR functionalities had statistically significant and positive effects on patient health outcomes, several practical recommendations are proposed for improving EMR adoption and impact in humanitarian healthcare settings such as Kakuma Refugee Camp.

First, given that Patient care quality emerged as the most influential factor ($\beta = 0.745$, $p = 0.000$), it is recommended that health system implementers prioritize EMR modules that support clinical workflows. These include structured diagnostic templates, integrated treatment plans, and tools for scheduling follow-up visits. Enhancing real-time accessibility of EMRs during patient consultations can further strengthen diagnostic accuracy and care continuity.

Second, since drug tracking efficiency also showed a strong effect on patient outcomes ($\beta = 0.541$, $p = 0.000$), EMR systems should be equipped with robust inventory management features. These should allow for real-time tracking of medication stock levels, trigger automated low-stock alerts, and enable timely resupply requests. This functionality would help

minimize stockouts, improve prescription accuracy, and ultimately support treatment adherence.

Third, the positive influence of data security ($\beta = 0.347$, $p = 0.017$) suggests that EMR platforms must be designed with built-in data protection measures such as role-based access control, encryption protocols, and visible audit trails. Additionally, training on information security should not be limited to compliance checklists but should instead emphasize the importance of data integrity in clinical documentation and patient safety. When healthcare workers trust the system to safeguard sensitive records, they are more likely to document accurately and engage more fully with EMR processes.

Fourth, although report generation had the lowest effect size among the four variables, it was still statistically significant ($\beta = 0.158$, $p = 0.001$). This finding indicates the need to improve the use of EMR-generated reports in clinical and administrative decision-making. Functional dashboards and trend analysis tools should be embedded within the system to support disease surveillance, resource allocation, and case follow-up. Equally important is the training of healthcare staff in how to interpret and apply EMR reports within their daily workflows.

In addition to enhancing system features, it is critical that EMR training be tailored to the specific roles of healthcare workers. Clinicians should be trained in clinical documentation and decision-support features, pharmacists in inventory tools, and administrators in reporting and data protection modules. A role-based training approach ensures that users are equipped with the competencies relevant to their responsibilities, thereby improving both system utilization and care outcomes.

Given the variability in user experiences—especially concerning data security, as shown by the high standard deviation ($SD = 1.04$)—it is also recommended that health facilities establish feedback loops between frontline EMR users and system developers. These could include monthly review sessions, user suggestion platforms, or appointing EMR champions within facilities to share field-based insights and propose system improvements.

Finally, considering the overall positive impact observed across all EMR functionalities, it is essential for governments, humanitarian organizations, and donors to form strategic partnerships that support the long-term scaling and sustainability of EMR systems. These partnerships should promote national system interoperability, country-specific customizations, and continuous technical assistance to ensure that EMRs are adaptable, user-friendly, and effective in crisis-affected environments.

Collectively, these recommendations reinforce the study's central conclusion that EMRs are most effective when adopted as integrated systems across clinical, operational, and administrative domains. Aligning digital health interventions with frontline needs and contextual realities is key to realizing their full potential in improving Patient care quality and health system performance in refugee settings.

5.7. Contributions to Knowledge

This study makes an original and multifaceted contribution to the field of digital health, with a specific focus on Electronic Medical Records (EMRs) within humanitarian healthcare systems. Through its integration of theoretical models, rigorous empirical analysis, and context-specific recommendations, the research advances understanding in four key domains: theoretical, practical, methodological, and policy.

Theoretically, the study extends the application of the Diffusion of Innovations (DOI) Theory, the Technology-Organization-Environment (TOE) Framework, and Donabedian's Quality-of-Care Model to a uniquely fragile healthcare context. By examining EMR functionality within the protracted crisis setting of Kakuma Refugee Camp, the study affirms that these frameworks remain analytically useful even in low-resource, high-pressure environments. The strong statistical significance of patient care quality and drug tracking functionalities supports the DOI emphasis on perceived advantage as a catalyst for adoption. At the same time, the significance of data security and report generation demonstrates that the TOE framework's attention to organizational and environmental readiness remains relevant in humanitarian contexts. Donabedian's structure-process-outcome model is likewise validated, showing that even in refugee settings, well-integrated EMR structures can influence clinical processes and perceived recovery outcomes.

From a practical perspective, the study identifies specific EMR functionalities that deliver the greatest perceived impact on patient outcomes. The findings confirm that Patient care quality ($\beta = 0.881$) and drug tracking efficiency ($\beta = 0.640$) are the most influential predictors of recovery in IRC-operated facilities. This provides actionable guidance for implementers and funders seeking to optimize digital system design in resource-limited settings. Furthermore, the finding that data security ($\beta = 0.625$) and report generation ($\beta = 0.539$) also exert significant positive influence contradicts earlier assumptions that administrative functions are peripheral. Instead, the evidence suggests that all four domains—clinical, pharmaceutical, administrative, and informational—must work in synergy to improve care outcomes. This insight can help

stakeholders allocate limited resources more strategically and prioritize interventions that have demonstrable clinical value.

Methodologically, the study reinforces the importance of perception-based quantitative approaches in contexts where access to objective patient outcome data is constrained. By employing multiple linear regression and achieving a robust model fit ($R^2 = 0.621$), the research validates user perceptions as a meaningful proxy for clinical effectiveness in settings with incomplete or inconsistent data systems. The inclusion of diverse frontline healthcare workers—spanning clinicians, records officers, and administrative staff—ensures that the findings reflect a comprehensive view of system functionality across operational layers. This methodological approach is replicable and adaptable to other humanitarian environments, thereby contributing to the growing toolkit for digital health evaluation in low-resource settings.

In terms of policy, the study provides evidence-based direction for governments, non-governmental organizations, donors, and digital health vendors aiming to scale EMR systems in fragile healthcare systems. The demonstrated significance of all four EMR functionalities underscores the necessity of designing integrated systems that go beyond narrow compliance or reporting objectives. Policy frameworks must promote EMR platforms that support clinical workflows, ensure pharmaceutical continuity, safeguard data integrity, and provide real-time operational feedback. In addition, the study highlights the need for participatory implementation approaches that involve frontline users in system refinement, capacity building, and post-deployment evaluation. These findings support broader health systems strengthening goals and align with global priorities for sustainable digital transformation in healthcare.

In conclusion, this research contributes to both academic theory and practical policymaking by demonstrating that EMRs, when holistically implemented, can improve patient recovery perceptions even in the most challenging healthcare environments. The study advances established frameworks, offers empirical clarity on functionality-level outcomes, strengthens methodological strategies for humanitarian evaluation, and provides actionable insights for digital health governance in fragile contexts.

5.8. Suggestions for Further Research

This study has highlighted important dimensions of EMR adoption and its impact on patient outcomes in a humanitarian healthcare setting. However, several areas remain open for deeper

inquiry, especially given the study's reliance on perception-based data, the specificity of the research context, and the unexplained variance in the regression model. Future research should aim to validate, expand, and deepen the evidence base established in this study.

To begin with, there is a need to complement self-reported outcomes with objective clinical data. While this study relied on perceptions of patient recovery, treatment adherence, and diagnostic turnaround, future research should triangulate these findings using verified patient records, system usage logs, medication adherence rates, and morbidity or mortality indicators. This would strengthen the reliability of conclusions and allow researchers to assess whether perceived benefits are borne out in measurable clinical outcomes.

Moreover, given that this study focused exclusively on IRC-operated facilities within Kakuma Refugee Camp, additional studies should explore how EMR functionalities perform in different humanitarian settings. Replicating the study in other refugee camps, informal settlements, and post-conflict zones would enhance the generalizability of the results and enable comparative analysis. Such research could identify which contextual factors—such as governance structures, infrastructure levels, or population mobility—moderate the effectiveness of EMR systems.

In addition, future studies should adopt longitudinal research designs to assess how the influence of EMR functionalities evolves over time. This study captured perceptions at a single point, limiting the ability to account for system improvements, organizational learning, or user adaptation. A longitudinal approach would reveal how sustained use, iterative training, and software updates affect user confidence, system utility, and ultimately, patient outcomes.

It would also be valuable to expand the scope of EMR functionalities assessed. While this study focused on four core domains—Patient care quality, drug tracking, data security, and reporting—there are other functionalities increasingly embedded in digital systems, including referral tracking, laboratory integration, appointment scheduling, decision-support systems, and interoperability with national health databases. Including these additional elements would provide a more comprehensive understanding of how EMRs interact with complex institutional workflows and improve systemic resilience.

Furthermore, the unexplained variance in the model (37.9%) suggests the presence of additional variables not captured in the current analysis. Future research should investigate mediating and moderating factors such as healthcare worker digital literacy, organizational culture, leadership engagement, and infrastructure reliability. These variables may influence

the relationship between EMR functionalities and patient outcomes, either enhancing or inhibiting the effectiveness of digital systems.

Finally, there is a strong case for incorporating qualitative approaches—such as in-depth interviews, focus group discussions, and participant observations—to explore the lived experiences of EMR users. While quantitative data reveals what is statistically significant, qualitative data can illuminate how users interact with EMRs, what barriers they face, and what adaptations they devise to make systems work in their context. A mixed-methods approach would therefore yield richer insights and inform more responsive and human-centered system design.

In summary, future research should aim to blend perception data with objective metrics, broaden the geographic and functional scope of inquiry, adopt longitudinal and mixed-method designs, and investigate the contextual and behavioral factors that shape EMR success. These directions will help ensure that digital health systems are not only technically sound but also practically relevant, user-responsive, and ethically grounded in the realities of healthcare delivery in fragile settings.

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APPENDICES

Appendix I: Questionnaire on EMR Adoption and Patient Health Outcomes metrics in IRC Facilities, Kakuma Refugee Camp – Kenya

Section A: Respondent Information

Your Role

[ ] Doctor [ ] Nurse [ ] Pharmacist [ ] Administrator [ ] Records Officer

[ ] IT/EMR Officer [ ] Other (specify): _____

Years of Professional Experience

[ ] Less than 1 year [ ] 1–3 years [ ] 4–6 years [ ] More than 6 years

Have you received EMR training?

[ ] Yes [ ] No

How often do you use the EMR system?

[ ] Daily [ ] Weekly [ ] Occasionally [ ] Rarely

Section B: General EMR Usage Perception

Instructions: For Questions 5–9, rate each item on a scale of **1 to 5**, where **1 = Strongly Disagree** and **5 = Strongly Agree**.

Statement	Rating [1–5]	Comments (optional)
5. The EMR is better than paper-based records.	[ ]	_____ _____
6. The system is easy to use.	[ ]	_____ _____
7. I received sufficient EMR training before implementation.	[ ]	_____ _____
8. The benefits of using the EMR are clear in my daily tasks.	[ ]	_____ _____
9. What is the biggest challenge you have experienced with the EMR?	N/A	_____ _____ _____

Section C: Drug Tracking Efficiency

10. **Has the EMR helped improve drug stock management?**

    [ ] Yes [ ] Somewhat [ ] Not at all

11. **Rate your satisfaction with the drug tracking feature** (1 = Very Dissatisfied, 5 = Very Satisfied):

    Rating: [1] [2] [3] [4] [5]

    Comments: _____

12. **Describe any observed changes in drug stock management since EMR use:**

    Answer: _____

Section D: Quality of Patient care quality

13. **Since using the EMR, Patient care quality has improved in the following areas** (check all that apply):

    [ ] Fewer diagnostic delays

    [ ] Shorter waiting times

    [ ] More accurate records

    [ ] Better treatment follow-up

14. **Have medical errors (e.g., prescription mistakes) changed?**

    [ ] Reduced [ ] No change [ ] Increased

15. **How has EMR use influenced clinical decision-making?**

    Answer: _____

Section E: Data Security & Confidentiality

16. **How secure do you feel patient data is within the EMR system?**

    (1 = Very Insecure, 5 = Very Secure):

    Rating: [1] [2] [3] [4] [5]

    Comments: _____

17. **Have you experienced any unauthorized data access?**

    [ ] Yes [ ] No

    If yes, please explain briefly: _____

Section F: Report Generation

18. **The EMR helps generate timely and accurate reports.**

Rating: [1] [2] [3] [4] [5]

Comments: _____

19. **What reporting improvements have you noticed since EMR implementation?**

Answer: _____

Section G: Overall Impact on Patient Outcomes

Instructions: For each of the statements below, rate your agreement from **1 = Strongly Disagree** to **5 = Strongly Agree.**

Statement	Rating [1–5]
20. Mortality rates at our facility have decreased since EMR adoption.	[ ]
21. EMR has improved overall patient recovery rates.	[ ]
22. EMR has enhanced treatment adherence.	[ ]
23. EMR has enabled faster response to disease outbreaks.	[ ]

Comments: _____

24. **Do you have any suggestions to improve the EMR system?**

Answer: _____

Section H: Additional Comments

25. **Please provide any additional feedback on the EMR system or its impact on your work:**

Answer: _____

Appendix II: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 548239

Date of Issue: 01/April/2025

RESEARCH LICENSE

This is to Certify that Mr.. Felix Omega Muloma of Africa Nazarene University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Turkana on the topic: Electronic Medical Records Adoption and Patient Health Outcomes in IRC Facilities at Kakuma Refugee Camp for the period ending : 01/April/2026.

License No: NACOSTI/P/25/417167

548239

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See overleaf for conditions

Appendix III: Research Authorization Letter

12th March 2025

E-mail: researchwriting.mba.anu@gmail.com

Tel. 0202711213

*Our Ref:*110063126

The Director.

National Commission for Science,

Technology and Innovation (NACOSTI),

P. O. Box 30623, 00100

Nairobi. Kenya

Dear Sir/Madam:

RE: RESEARCH AUTHORIZATION FOR: FELIX OMEGA MULOMA

Mr. Felix is a postgraduate student pursuing a Master of Business Administration (MBA) at Africa Nazarene University.

As part of his academic journey, Mr. Felix is conducting a research study titled: *"***Electronic Medical Records Adoption and Patient health outcomes metrics in IRC facilities at Kakuma refugee camp, Kenya***."*

We kindly request your support in facilitating his research. Any assistance extended to him will be greatly appreciated and will contribute significantly to the successful completion of his studies.

Yours faithfully,

Kimani Gichuhi; PhD

Ag. Dean, School of Business

MBA Program Leader

Africa Nazarene University

Google Scholar

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Appendix IV: Map of the study area