DETERMINANTS OF POINT-OF-CARE TECHNOLOGY USE AMONG HEALTH CARE WORKERS OFFERING SERVICES AT COMPREHENSIVE CARE CENTRES IN CENTRAL KENYA

KEZIAH KANINA MUIRURI (BSc. HRIM)
Q58/CTY/PT/26300/2018

A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF PUBLIC HEALTH (MONITORING AND EVALUATION) IN THE SCHOOL OF HEALTH SCIENCES OF KENYATTA UNIVERSITY

NOVEMBER, 2024

DECLARATION

Student

I declare that this thesis is my original work and that it has never been presented for another degree in any other University.

Signature: ……..…… Date:……

Keziah Kanina Muiruri

Q58/CTY/PT/26300/2018

Supervisors

This thesis has been submitted for review with our approval as University Supervisors.

Signature: ……..…… Date:……

Dr. Mary W. Gitahi

Department of Family Medicine Community Health and Epidemiology

School of Health Sciences

Kenyatta University

Signature: ……..…… Date:……

Dr. George O. Otieno

Department of Health Management and Informatics

School of Health Sciences

Kenyatta University

DEDICATION

This thesis is dedicated to my dear parents who were always a motivation to me, although you are long gone, your memories live on.

ACKNOWLEDGEMENTS

I express my heartfelt gratitude to the Lord Almighty who is my maker and the one who provides me with inspiration, wisdom, knowledge, and understanding, and who is my strong pillar. He has been the foundation of my strength throughout this part of my life.

To Dr. Mary W. Gitahi, Dr. George Otieno, and Prof. Ephantus Kabiru, who are my supervisors from the school of health sciences, I would like to appreciate the priceless and irreplaceable assistance that you all provided during my study, the goal of this study wouldn't have been achieved without your guidance, support, and your patience with me.

I extend my heartfelt gratitude to my family and friends for their unwavering moral support, encouraging words, and consistent encouragement during this journey.

Sincere appreciation and special mention go to my son Vincent Muiruri for being my hope, motivation, and source of strength in every step of this journey and to my house manager for always taking great care of my son as I attended my studies.

I would also wish to thank everyone whose assistance offered a breakthrough in the successful completion of this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

CCC – Comprehensive Care Center

KHIS - Kenya Health Information System

EMR – Electronic Medical Records

HRIO – Health Records and Information Officer

IT – Information Technology

MOH – Ministry of Health

POC – Point-of-Care

CDS – Clinical Decision Support

CDSS - Clinical Decision Support System

RDE – Retrospective Data Entry

HCW - Health Care Worker

CHMT - County Health Management Team

DEFINITION OF OPERATIONAL TERMS

Electronic medical record (EMR) – It is a digital version of a patient's medical information that is stored on a computer and can be accessed by authorized healthcare providers.

Health facility – An institution that offers health care services and where the sick receives treatment.

Implementation – It is the process of ensuring correct installation of the required electrical medical record system at the desired point of use in health facilities.

Point of care (POC)- This refers to real time data entry by the health care provider while they are providing health care services to the clients/patients.

Retrospective data entry (RDE) - This refers to data entry into the electronic system after the services have been offered and client has exited the service delivery point.

Determinant – It is a factor that makes something happen or leads directly to a decision.

ABSTRACT

The most sophisticated level of interaction between healthcare professionals and the information system is the POC approach taking place during clinical meetings. The POC strategy offers benefits HCW, the patients they serve, and the individuals tasked with overseeing and assessing their performance. In central Kenya, the health facilities have continued to use both paper systems alongside the EMR system despite having POC implementations. The objective of the study was to determine the elements that affect the utilization of Point-of-care services by healthcare professionals. The study's specific goals were to recognize the socio-demographic, organizational, technical, and financial elements, extent of clinical decisions features use and level of accuracy and consistency of automated indicator reporting in influencing POC technology use among CCC's in Central region of Kenya. Descriptive cross-sectional design was utilized in this study. The study population included clinical officers, nurses, health records and information officers among other cadres offering services in the CCCs. The sample was determined using a multi-stage cluster sampling design, and EMR users at health facilities sampled based on population size. The sample size for health facilities was 102 and for system users it was 239 HCW. Data was collected using structured questionnaire in an in-person environment. The data gathered was inputted and examined using descriptive statistics, including percentages. Additionally, Inferential statistical methods such as the chi-square test and Fisher's exact test were utilized to establish correlations with the assistance of R software. The findings indicated that POC use was unaffected by the social demographic factors of healthcare workers, Age X^2 (1, n=225)=0, p=1; by sex X^2 (1, n=224)=0.507, for education level, p=0.317; for computer skills, the chi-square statistic was X2 (2, n=225)=0.038 with p=0.981; regarding profession, p=0.070; and for county, the chi-square statistic was X2 (4, n=225)=1.589 with p=0.791. The use of POC technology was significantly influenced by organizational elements including the availability of adequate workstations (p=0.0) and the decrease in patient wait times facilitated by EMR (p=0.012). The origin of financial resources for the upkeep of software and hardware had a significant impact on POC use w p=0.001. Furthermore, the application of EMR for the real-time assessment of client progress (p=0.001) and the reporting of data to KHIS (p=0.014) was observed to significantly impact the utilization of POC services. 71% of participants stated that the presence of CDS features in the EMR was enhancing the utilization of POC. Additionally, 72% expressed strong motivation to use POC technology because of its capability to automatically generate reports. The success of POC use was attributed to three main factors, with 44% emphasizing the importance of a dependable power supply, 24% stressing the need for sufficient and well-trained healthcare workers, and 17% pointing to the significance of standard and reliable EMR Systems. Recommendations include training for HCWs on EMRs, ensuring adequate workstations and power supply, and adopting standard EMRs for effective clinical decision support and reporting.

CHAPTER I: INTRODUCTION

1.1 Background to the study

In the field of healthcare, a point-of-care (POC) system is comprised of bedside terminals or various devices designed to collect and enter data at the site of patient care. Healthcare professionals utilize POC systems to document patient interactions, access relevant information, and request diagnostic tests and services. These systems perform multiple functions traditionally associated with paper charts and are often identified as electronic medical records. (Source: Point of Care Systems - an Overview | ScienceDirect Topics, n.d.)

The use of these advancements allows healthcare providers to expedite diagnoses and treatment decisions, leading to better patient results and decreased use of healthcare resources (Siegle, 2023).

Health Information Systems (HIS), such as Electronic Medical Record (EMR) systems, present significant opportunities for enhancing healthcare delivery. This potential is recognized in various sub-Saharan African nations, where eHealth technologies, mobile health initiatives, electronic health records, and risk assessment systems have been successfully implemented. In contrast, certain developed countries have demonstrated leadership by making substantial investments in the most advanced versions of health information systems (Badeia et al., 2016).

The aim is to enhance the utilization and implementation of information and communication technology for data management in Kenya, in accordance with the fifth strategic objective outlined in the Health Information System (HIS) strategic plan for the

period 2009-2014. This objective corresponds to the requirement for organized and compatible ICT systems, such as EMRs. In 2010, the Ministry of Health in Kenya began the process of standardizing electronic medical records (EMRs), following the Health Information Systems (HIS) framework and adhering to the established standards and guidelines set by the MOH.

Currently, there are over 1198 health facilities with EMR implementations in Kenya spread across 44 Counties in the Country. In regions such as Nyanza, Western, Rift valley, Coast, some sites have transitioned to paperless implementations, which is not the case in Central Kenya. There are 3 EMR systems in use across which are KenyaEMR, E-Care and AMRS systems. E-care has 14 Faith-based health facilities based in Nairobi County, 80 health facilities in western and Rift Valley facilities use AMRS system while over 1100 facilities use KenyaEMR system. In Central Kenya the PoC EMR in use is KenyaEMR (https://dwh.nascop.org).

Point-of-care (POC) systems enable healthcare institutions to enhance their operational efficiency while minimizing expenses linked to conventional laboratory procedures, including sample transport and staffing. Furthermore, the automation of data integration mitigates the likelihood of human error, thereby enhancing the overall precision of results (Duffy, 2024). Healthcare professionals can quickly determine if patients have missed appointments, require essential medications, or are at risk of significant health problems. The Point-of-Care system triggers healthcare provider intervention and provides contact details to connect with patients and motivate them to seek the necessary medical attention (Point-of-Care, n.d.).

1.2 Problem statement

The problem to be addressed by this study is the sub-optimal utilization of PoC systems which is evident from the fact that none of the CCCs in Central Kenya has transitioned to paperless implementation.

The Ministry of Health, along with implementing partners, has been working on providing computing hardware, developing and deploying EMR, and continually training healthcare providers on using the EMR system. However, the full benefits of Point-of-care use in comprehensive care centers have not been fully achieved despite these efforts.

CCCs in Central Kenya have a PoC system that supports Point-of-care use and would therefore expect optimal benefits of EMR to be realized from these sites. Despite this, all sites are using a combination of both paper and EMR system which increases time taken to clear the workload. Manual reporting process requires more time and more human resources, and the process is prone to incompleteness, inaccuracy, inconsistency and transcription errors, EMR sites are still reporting manually even when the system auto generates standard reports and has capability to upload directly to the nation reporting system (KHIS).

This study aimed at uncovering determinants of POC technology use and identifying factors that influence POC technology use which may be used to guide decisions relating to PoC implementation and ensure successful implementation that yield optimal benefits.

1.3 Justification

The aim of the study was to establish the determinants of POC technology use among the CCCs in Central Kenya. According to reporting rates on (https://dwh.nascop.org), there's

a gap comparing aggregate data reported in KHIS versus the individual-level data from the PoC Systems.

Kenya recognizes Integrated health information systems as one of the pillars towards achieving the universal health coverage and this has been emphasized on the Kenya digital health bill, 2013.

This study provided insights on the key factors to consider while implementing a POC system and therefore the results of it can be used to guide the government in their journey towards digitizing the health sector. It provides rich information on what motivates the health care providers towards utilizing a POC system and this would be helpful to the implementers in focusing on the motivating factors hence widening the chances of realizing the digital superhighway agenda.

1.4 Research Questions

i. What are some of the socio-demographic factors that influence point-of-care technology use among health care workers?

ii. What are the organizational, technical, and financial factors that influence use of Point-of-care technology among health care workers?

iii. To what extent does the inbuilt clinical decisions support features utilization influence use of point-of-care technology among health care workers?

iv. What level of accuracy and consistency of automated indicator reporting influence point-of-care technology use?

1.5 Null Hypotheses

i. H_0: Socio-demographic factors do not significantly influence point-of-care technology use.

ii. H_0: There are no organizational, technical, and financial factors that significantly influence point-of-care technology use.

iii. H_0: Inbuilt clinical decisions support features do not significantly influence point-of-care technology use.

iv. H_0: Accuracy and consistency in automated indicator do not significantly influence point-of-care technology use.

1.6 Objectives

1.6.1 Main Objective

This study's main objective was to establish the determinants of Point-of-care technology use among Comprehensive Care Centers in Central Kenya.

1.6.2 Specific Objectives

i. To identify socio-demographic factors influencing point-of-care technology use.

ii. To identify organizational, technical, and financial factors influencing point-of-care technology use.

iii. To determine the influence of inbuilt clinical decisions, support features utilization on point-of-care technology use.

iv. To determine the influence of accuracy and consistency in automated indicator reporting on point-of-care technology use.

1.7 Significance

The research focused primarily on identifying the factors that impact the adoption of point-of-care technology, and its results are anticipated to inform the decisions of stakeholders. These stakeholders comprise of the MOH, donors, County health management teams (CHMT), care and treatment implementing partners, HIS partners, and healthcare workers, enabling them to make informed choices regarding the most suitable EMR implementation model for maximizing EMR benefits.

1.8 Limitation and Delimitation

1.8.1 Limitation

The research was conducted in select EMR Implementing sites and on select users due to time and budget constraints.

1.8.2 Delimitation

The study only included sites implementing KenyaEMR system. Sites with other EMRs were not included in the research.

1.9 Conceptual Framework

The independent variables of the study included:

Social demographic – Consisting of variables such as sex, age, level of education, profession and computer literacy

Organization, financial and technical factors – Consisting of variables such as time, cost, computer skills, power and training.

Inbuilt clinical decision support features – Consisting of variables such as alerts, appointment management, Patient overview

Accuracy and consistency in automated indicator reporting – consisting of variables such as patient summaries, standard reports, automated reporting.

The dependent variable was point-of-care use which was measured by observing various metrics such as time of data entry, workstations available, human resource, power supply among others.

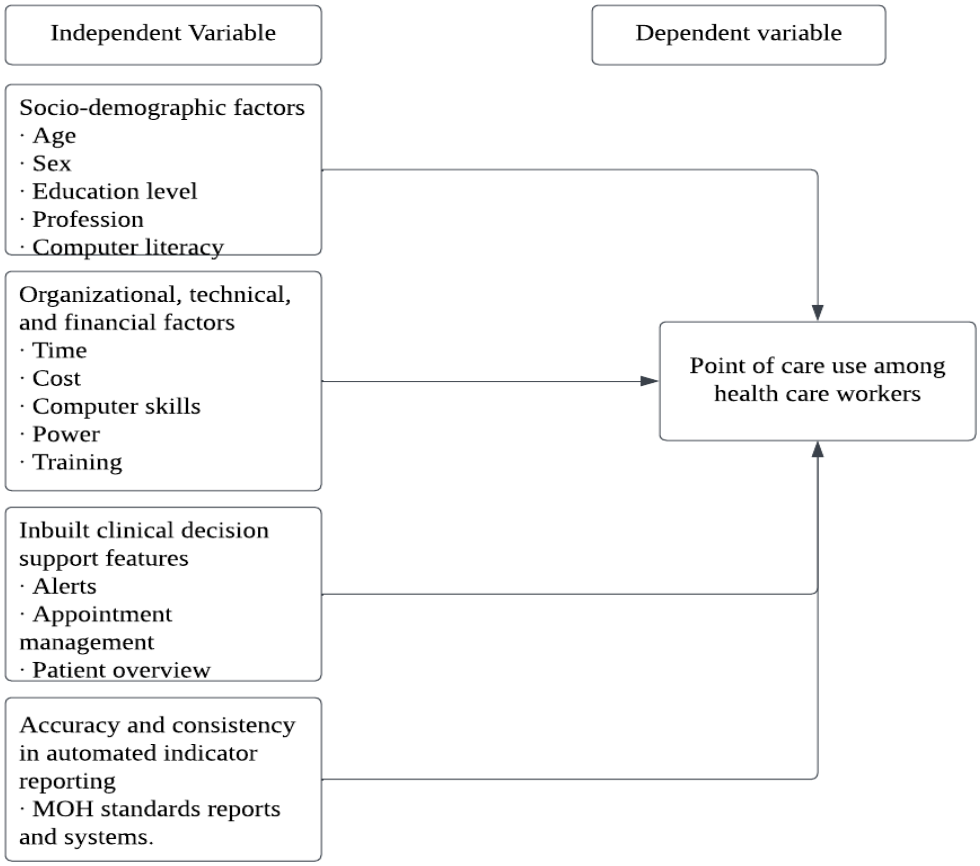


Figure 1.1 Conceptual Framework
(Source: Modified from technology acceptance model (TAM) theory)

CHAPTER II: LITERATURE REVIEW

2.1 Point-of-care technology use

Point-of-care technology (PoC) empowers healthcare providers responsible for delivering medical care and achieving positive clinical results. These tools allow healthcare professionals to swiftly and precisely diagnose and treat patients, enhancing outcomes and minimizing unnecessary use of healthcare resources. Point-of-care technology signifies a fundamental change, enabling healthcare professionals to seamlessly integrate data-driven decision-making with personalized patient interaction, patient care provided in the moment and directly at the point-of-care. (Siegle, 2023).

Documentation of PoC offers several advantages to both healthcare personnel and patients. Enhancing the integrity and accuracy of the information is achieved by inputting data in real-time. This eliminates the need for handwritten notes or relying on memory to recall patient details. Additionally, the prompt availability of documentation to other healthcare professionals improves the timeliness of sharing the patient's encounter findings. This is particularly crucial in situations where patients are cared for by multiple disciplines during the same encounter (Gr_supadude, 2022).

2.2 Social Demographic Factors

In Ethiopia, research findings indicated a notable link between male gender and possessing awareness of electronic health records (Wubante et al., 2023).

Healthcare providers' preparedness and adoption of EMRs correlated positively with factors like gender, age, proficiency in using computers, computer-related abilities, presence of computers in the workplace and at home, previous experience with IT, access to training, system intricacy, and level of expertise, as indicated by Biruk et al. (2014).

In Malawi, a research study revealed that 34 out of 58 respondents, accounting for 58.6 percent, who were between the ages of 21 and 30, utilized EMRs instead of paper-based records. The study included just 2 participants between the ages of 61 and 70, and they both used more file-based documents rather than electronic data. In despite of this change, EMR differences were not statistically significant about paper-based record usage in age groups (P=0.93). Several prior studies have shown that younger healthcare workers comprehend the use of EMRs in more ways than their older counterparts. Significant difference did not exist between EMR and paper-based record preference between women and men (P = 0.35). The use of EMR varied significantly according to the level of education (P=0.01). Healthcare professionals in higher education have made almost the same utilization of electronic medical records and traditional paper-based records. EMRs were employed with greater regularity compared to their paper counterparts by most data clerks (27 out of 36, or 75.0 percent). Approximately 65.4 percent (n = 17/26) of clinicians surveyed indicated a preference for using paper records instead of EMRs. According to Khwima & Mkalira (2017), the difference in preference for EMRs or paper records based on job title was not found to be statistically significant (P = 0.07).

2.3 Organizational, technical, and financial factors influencing PoC use

The finding of the study barriers for implementation of EMRs ((Fernado, 2010) highlighted several factors that influence the implementation of EMRs such as Human barriers (Health Care Professionals), Legal and regulatory barriers (law and policies), Financial barriers (money and funding), Technical barriers (Computer and Information Technology), Organizational barriers (hospital management). Several studies on barriers to EMR

implementations have been carried out, and some of the challenges highlighted are as follows:

Time- Despite having invested time and greatly benefited, Physicians take no time to get acquainted with the products available, choose an EMR, use it and practice using it (Loomis et al., 2002). It has been recognized that the use of EHR has taken additional time, and a light load has not been compensated for. Physicians said they needed to fully use the system, engage in ongoing training, or learn new features, but they didn't always have time (Ford et al., 2006).

Cost - Doctors should weigh up the costs to develop and support their own information technology structures and applications or provide external providers services. These costs may include acquisition prices, cost coordination and monitoring, cost negotiation, cost upgrading, and cost governance, the benefits of the EMR conflict with these costs. Rao et al. (2011) stated that the main challenge was practices of a small to medium scale with restricted budgeting for information technology and expenses associated with adoption. The elevated upfront financial cost of implementing EMR is a significant hurdle to their introduction. Uncertainty to the extent and duration of any financial advantages exacerbates this obstacle (Meinert, 2004).

Absence of computer skills – Healthcare providers' restricted proficiency with computers has been consistently cited as a major obstacle. According to various systematic reviews, the most prevalent obstacle to EMR adoption is the lack of computer literacy. Research carried out in developing countries has indicated that insufficient computer skills among healthcare professionals contribute to the challenges faced in the effective implementation of electronic medical record (EMR) systems (Yehualashet et al., 2021).

The level of computer skills required by doctors appears to be underestimated by EMR providers. The system is considered very difficult for these doctors to use in practice. Also, the entry of patient information, notes, and prescriptions in EMRs require good typing skills, and some doctors lack these skills (Boonstra & Broekhuis, 2010).

Training – In a study conducted in 2017, Mkalira Msiska and colleagues identified that healthcare workers' adoption of EMR was hindered by factors such as insufficient EMR training and lack of managerial support. The utilization of EMR was significantly influenced by educational level. "Numerous physicians have expressed dissatisfaction with the supplier's subpar service, citing insufficient technical monitoring and absence of training and support for issues related to EMR" (Randeree, 2007). Similarly, in 2009, Ludwick et al., noted that physicians are struggling to obtain adequate vendor technical and system support. Since medical experts are not always technical experts, and the system is complex, doctors are unhappy and unwilling to take advantage of EMRs without the necessary technical training and support. In 2002, Loomis et al. noted that the lack of technical support by two-thirds of physicians as an impediment to EMRs (Ludwick et al. 2009) indicated a lack of medical practitioners' access to technical support suppliers.

2.4 Inbuilt clinical decisions support features utilization

Computerized decision support systems (CDSS) consist of software or technology-based solutions that provide tailored recommendations for patients, which are based on research findings, expert insights, machine learning, artificial intelligence, or a combination of these elements. The primary aim of these systems is to influence the clinical decision-making processes of healthcare practitioners (Thompson et al., 2023).

The aim of a CDSS is to enhance decision-making in healthcare by integrating clinical expertise, patient data, and additional health-related information. (Sutton et al., 2020).

The quality of healthcare could be enhanced by electronic health records, thanks to the evidence-based decision-making abilities of clinical medicine computing. The integration of electronic health record (EHR) data and computerized clinical knowledge enables the generation of personalized patient recommendations for physicians in real-time by combining patient-specific characteristics with clinical algorithms (Garg et al., 2005).

There are several ways in which the EMRs has supported clinical decisions:

Better Informed - EMR technology provides healthcare providers with information which is not possible in paper diagrams. Press and graphs of values such as cholesterol, pressure and weight can now be viewed and printed by primary care providers, tracing changes over time. As shown in studies showing improved quality measures, “chronic disease can be easily managed, prevented, and screened using EMR” (Kern et al., 2012).

Clinical decision support - Electronic databases will provide vendors with care targets or warnings when the utter preventive and screening strategy is due or obsolete. The EMR also requires accessibility to data and services from primary care providers to help manage multiple practical conditions. The result of disease can be changed with expanded access to laboratory data (Rose et al., 2008). It is possible to reduce duplicated data and costs (Canadian Electronic Library et al., 2013). The optimal standard of care as perceived by the patient was not diminished due to the positive correlation between EMRs and patient satisfaction (Finney, 2014).

Structured EMR provides access to information on service points that can be used in hands-on information and research. EMR data allows doctors to use valuable practical information meaningfully, including standard and constant data entry in certain areas. “These data can be used for practical operations, such as patient identification without screening for bowel cancer or identifying mammograms” (Xu et al., 2014).

Improved Relationships- “the EMR enhances coordination among family doctors and members of their multidisciplinary teams” (El-Kareh et al, 2009). The experts and team members have readable, organized information through chart summaries, medical reports and appointment letters models. “Requests and tasks for different staff members are standardized, minimizing drug mistakes” (Canadian Electronic Library et al., 2013). Reservation schedules can easily be accessed by clinics, clinicians, and, in some instances, patients who can book appointments remotely. “Using patient portals and personal records, EMRs could also improve communication with patients, allowing patients to handle their care more effectively” (Delbanco et al., 2012).

Beneficial effect on workflow- The EMR provides better access for clinicians to a wide range of patient records, including clinical data, helping doctors save more time while searching for results and reports (Canadian Electronic Library et al., 2013). Remote patient diagrams, better laboratory results, warnings of medication errors, and precautionary care records are the benefits received.

The healthcare worker can access current clinical data, such as the current CD4 results and past information like the patient's past medical history through a patient "dashboard." This allows for instantaneous availability of information for any healthcare worker managing a patient in the system (Landis et al., 2010).

2.5 Accuracy and consistency in automated Indicator Reporting

National health information systems in developing countries are being strengthened to support informed decisions. Progress is impeded by the lack of capability to automatically transmit reports from electronic medical record systems. Consequently, information is frequently printed and entered again manually into aggregate reporting systems. This manual procedure affects the thoroughness and precision of information, additionally, the timeliness of reporting, and adds pressure on the staff tasked with routine indicator reporting from patient-level data (Kariuki et al., 2016).

Combating HIV has been a crucial part of the introduction and use of HIS for longitudinal medical records in many Low and middle-income countries. Over the last ten years, there has been a significant increase in the total count of HIV/AIDS patients under antiretroviral therapy because of enhanced availability and revised guidance requiring an early TRI start for individuals who have been infected (Hermans et al., 2012). This has further improved the integration, size, control, and assessment of EMR information systems for patient management and program outcomes (Williams & Boren, 2008). International donor organizations like UN Joint Program on HIV / AIDS and PEPFAR have set high objectives to end the epidemic and fostered extensive metrics to monitor the advancements achieved through various programs. The US government is responsible for the development of the AIDS emergency plan for AIDS relief (UNAIDS, 2014). It is necessary to move towards a data-driven approach that employs national data at the service providers (health facilities) to achieve these goals.

A study conducted in Kenya indicates that the automation of reporting indicator data from electronic medical records (EMRs) to aggregate data systems is not only feasible but also

beneficial. The implementation of automated processes significantly enhances the thoroughness and precision of reports concerning indicator information (Kariuki et al., 2016). The results further indicate that the automation of reporting alleviates the burden on human resources within the facility by removing the need for manual data entry, a process that is not only labor-intensive but also susceptible to human error (Thompson IM. 1999).

The study revealed that executing tasks for automated reporting necessitated one employee for each task, whereas the manual reporting process demanded a minimum of one personnel for each of the three tasks involved. Consequently, Healthcare personnel are often diverted from their primary responsibilities to focus on report compilation. As the demand for data escalates, high-volume facilities may struggle to maintain the necessary human resources for manual data reporting. The introduction of automated reporting allows current staff to produce and send reports from the Electronic Medical Record (EMR) system to the national Health Management Information System (HMIS), thus diminishing the need for extra personnel. The findings of this study revealed that facility staff were bypassing the KenyaEMR system and spending over half a workday (5.75 hours) each month on the manual collection of reporting data from paper records.

The study found that electronically transmitted data from the OpenMRS EMR to the health center DHIS2 increases the completeness of the data, avoids errors in transcription and reporting delays, and reduces the problem of reporting on health personnel. This confirms the availability of data on quality metrics and the resources needed to monitor and measure progress towards the objectives set (Kariuki et al., 2016).

2.6 Importance of Public Health in the study

“Electronic medical records will enhance public and environmental wellbeing by correctly gathering data in the medium used for clinical assurance and preventative initiatives” between the different health departments (HealthIT.gov, 2019)

EMR's will improve monitoring, monitor and supply public health or neighborhood health information services by enabling the gathering of standardized and system-based data through the provision of syndrome tracking, immunization registration and e-Lab monitoring. “Public health authorities have more and better evidence available to improve outbreak monitoring, prevention and management (HealthIT.gov, 2019).

EMRs will enhance the capabilities of disease prevention organizations. The availability of electronic health records for the entire population served enables a more detailed examination of patient needs, thereby facilitating improved care delivery (HealthIT.gov, 2019).

EMRs strengthen contact with public health employees through the meaningful application of EMRs within the agency, thereby enhancing connectivity and cooperation with public health authorities.

2.7 Summary of the Literature

Point of Care technology covers devices and systems that support healthcare professionals in monitoring, caring for, and documenting their health progress in their daily activities. Point of Care EMRs lead to improved quality of care as they improve the completeness, provide better search and retrieval orders, provide data quality validity checks, reduce patient waiting time, research, and support clinical decision-making. They also improve reporting through automated indicator reporting, which ensures accuracy and timeliness of

reports, thus improving the overall quality of data that is reliable for guiding stakeholders' informed decisions. EMRs can enhance patient care by effectively and efficiently managing the medical and personal information of patients. However, several factors affect the implementation of EMRs, such as infrastructure costs, time taken by doctors, and computer skills among health care providers.

2.8 Gaps identified in the Literature review

Some of the gaps identified include Paper charts lack information formats provided by EMR technology, manual reporting process requires more time and more human resource, and the process is prone to incompleteness, inaccuracy, inconsistency and transcription errors, inadequate infrastructure to support Point of care use and lack of time to utilize the system fully and inadequate computer skills among physicians.

The information is frequently printed and then entered again by hand into overall reporting systems. This process impacts the thoroughness and precision of the data, the timeliness of reporting, and places a strain on the staff responsible for regular indicator reporting based on individual patient data.

Health professionals' limited computer literacy is often cited in literature as a persistent barrier and the most common obstacle to EMR adoption.

CHAPTER III: MATERIALS AND METHODS

3.1 Research Design

A descriptive cross-sectional study design was adopted for this study. Data pertaining to all variables was gathered simultaneously, ensuring that the variables remained unaffected during the collection process.

3.2 Study Variables

The study identified the point-of-care technology usage among healthcare workers as the dependent variable. In contrast, the independent variables encompassed socio-demographic factors, as well as organizational, financial, and technical elements influencing Point-of-care technology use, clinical decision functions utilization, and accuracy and consistency in automated indicator reporting.

3.3 Study Location

This research was conducted in the five counties within the Central Region of Kenya, namely: Kiambu, Muranga, Kirinyaga, Nyeri, and Nyandarua.

3.4 Study Population

The group of individuals participating in the research consisted of all EMR system Users. The users include Nurses, Doctors, clinical officers, Health Records and Information officers, Pharmacy technologists, social workers, Peer educators and HTS providers offering services in the Comprehensive Care Centers.

3.4.1 Inclusion Criteria

The research comprised of EMR system users who were working in the Comprehensive Care Centers and were directly interacting with the EMR system and who consented to take part in the research.

3.4.2 Exclusion Criteria

The research did not include users of the EMR system who did not provide consent for participation and those who work in the CCC but do not interact directly with the EMR system.

3.5 Sampling Techniques

The selection of the sample for this study was conducted using a two-stage cluster sampling design method. Initially, EMR implementing sites were sampled from each of the five counties. The second stage involved sampling EMR system users from the chosen EMR implementing sites.

To achieve a representative study sample, all level three and higher EMR facilities were selected from every County, and due to the anticipated varied staffing levels at the various EMR implementing facilities, the selection of users for the EMR system was conducted using a method known as probability proportional to size (PPS).

3.6 Sample Size Determination

The formula for determining sample size proposed by Fischer et al. (1999) was utilized in this study to ascertain the appropriate sample size to allow the true representation of the eligible population:

$n = Z^2 pq/ d^2$

n = sample size = 384

Z = Normal deviation at the desired confidence interval = 1.96

P = proportion of the population with the desired characteristics = 0.5

Q = proportion of the population without the desired characteristics = 0.5

D = degree of freedom = 0.05

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

N = 500

n = 217 + 10% adjustment = 22 = 239

n = 239

Facilities to be sampled= Total 139 n =111

Table 3.1 Sample size distribution

County	Total EMR sites	# of sites sampled	# of HCW	Target Sample size
Kiambu	39	30	137	65
Muranga	31	25	118	56
Kirinyaga	16	12	57	27
Nyeri	34	27	113	55
Nyandarua	19	17	75	36
Total	**139**	**111**	**500**	**239**

3.7 Construction of Research Instruments

A questionnaire was used to guide the data collection process. Both types of questions, namely open-ended and closed-ended, were employed.

3.8 Pretesting

The questionnaire was pretested on a selected sample before the actual study. In pre-testing the questionnaire, the procedure to be used was similar to the actual procedure used in the study. This was performed to ensure the significance of the research items, acquire knowledge of how to administer the tools, and test the tools' validity and reliability, thereby verifying whether the tools are ambiguous. The pretesting was done in Vihiga County which is a neutral location not included in the study area.

3.9 Validity

Validity refers to the extent to which the research instrument accurately measures what it is intended to measure. The literature review guided the questionnaire development. It was reviewed by the supervisors to ascertain that the questions covered the full range of the problem and ensured that it provided the required measure that conveniently envelops the content area of the research questions.

3.10 Reliability

Reliability describes the degree to which, under all circumstances, the research instrument can yield consistent results. The split-half method was used to ensure that all subparts of the questionnaire measured the same characteristic and an α of 0.8 was obtained.

3.11 Data Collection Techniques

For this study, a systematically organized questionnaire consisting of both open-ended and closed-ended questions was employed. The randomly chosen respondents were interviewed in person by either the researcher or a research assistant.

3.12 Data Analysis

Before data analysis, the completed questionnaires were reviewed to ensure they were complete and accurate. R Software was utilized to conduct data exploration, manipulation, organization, and statistical analysis.

To determine association, simple descriptive statistics like percentages and inferential statistics such as Chi-square and Fischer's exact were employed. Bar charts and pie charts were utilized to present the data for easier interpretation.

3.13 Logistical and Ethical Considerations

This work was submitted for approval to KU Ethics and Review Committee for Ethical clearance. A research permit was obtained from NACOSTI, and approval from the County Directors of Health was sought before the study's commencement. Written informed consent was secured from the participants, and data collected was treated highly confidential.

CHAPTER IV: RESULTS

4.1 Introduction

This section outlines the outcome achieved from the research conducted in this study. Analysis and interpretations with reference to the study objectives, are presented under thematic subsections and are presented in charts, figures, texts, and tables. The findings were based on information from questionnaires for a representative sample of 225 health care workers. The chapter was organized as follows: Socio- demographic characteristics, organizational factors, technological factors and financial factors, inbuilt clinical decisions support features utilization**,** accuracy and consistency in automated indicator reporting affecting point-of-care technology use.

4.1.2 Response Rate

The targeted sample size for this research was 239 health care workers using the EMR system, however, 225 respondents consented to the interview, accounting for over 94% response rate.

4.2 General respondent's characteristics

This segment presents the results for various background attributes of the participants. Table 4.1 presents the descriptive statistics for age, gender, education level, computer skills, profession and County of the respondents.

The findings revealed that a significant proportion (85%) of the individuals were within the age band of 18 to 35 years. Among them, 63% were female, and an overwhelming 99% possessed a tertiary level of education. Additionally, 44% demonstrated advanced computing skills, while Health Records and Information specialists constituted 44% of the total respondents.

Table 4.1 General respondent's characteristics

Variable	Frequency (n)	%
Age		
18 to 35 years	191	85
36+ years	34	15
Sex		
Female	142	63
Male	83	37
Education Level College, university, or polytechnic	223	99
Secondary school	2	1
Computer skills		
Basic	95	42
Expert	30	13
Proficient	100	44
Profession		
Clinical officer	66	29
HRIO	100	44
Nurse	16	7
Social worker	17	8
HTS Provider	8	4
Pharmacy Technologist	5	2
Other (Statisticians, IT personnel, orthopedic technologist)	13	6
County		
Kiambu	54	24
Kirinyaga	25	11
Murang'a	52	23
Nyandarua	36	16
Nyeri	58	26

4.2.1 Respondents' distribution by Counties

Figure 4.1 presents a summary of the distribution of respondents by counties. Nyeri County had 26% of the respondents, 24% from Kiambu County, 23% from Murang'a County, 16% from Nyandarua County while 11% of the respondents were from Kirinyaga County.

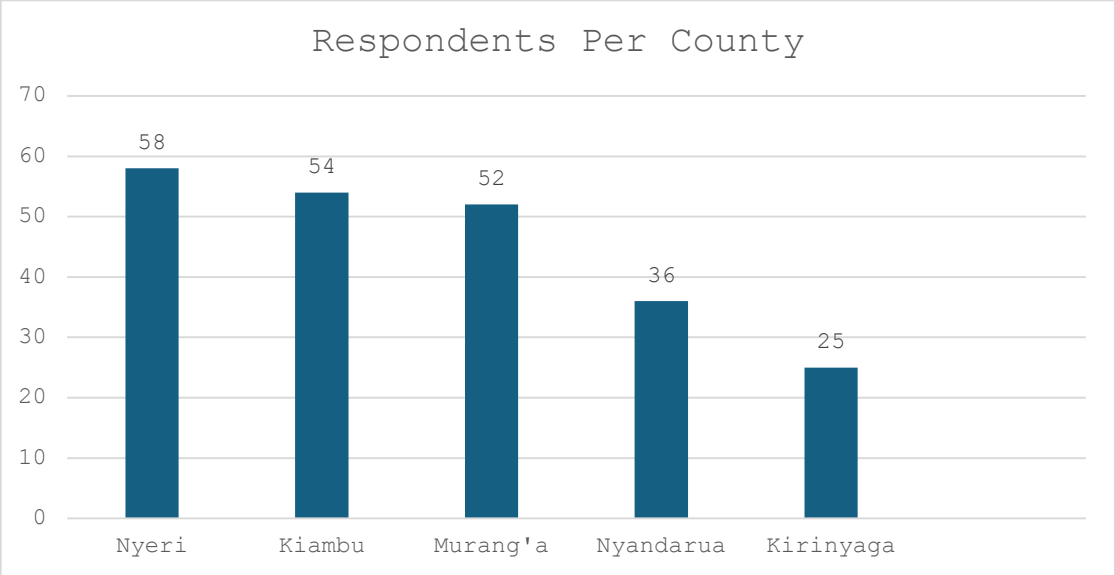


Figure 4.1 Respondents' distribution by County

4.3 Point of care Use among the respondents

In all the Counties that participated in the survey, the EMR system in use in all the CCCs is KenyaEMR which by design is a point-of-care EMR.

Figure 4.2 presents the mode of EMR use. Majority of the respondents reported that they are using Point-of-care EMR (83%) in comprehensive care centers.

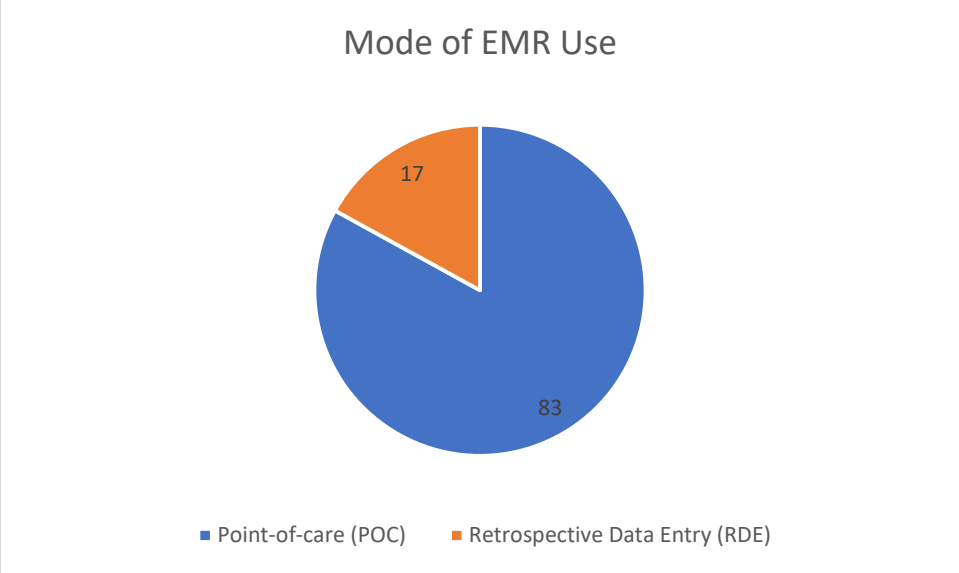


Figure 4.2 Mode of Electronic Medical Records system use

Figure 4.3 illustrates findings on the mode of EMR use preferred: 96% of respondents reported that they prefer point-of-care use over retrospective use, which had only 4% supporting it.

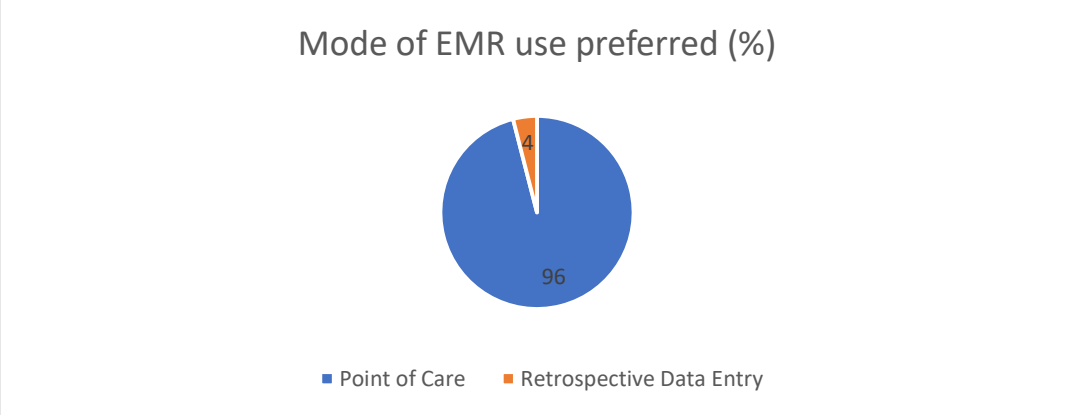


Figure 4.3 Preferred Mode of Electronic Medical Record system use

4.3.1 Factors to consider for POC Implementation

The top three contributing factors were noted as: reliable power supply at 44%, adequate and trained health care workers at 24% and standard and stable EMR at 17%.

Table 4.2 highlights the factors to consider for successful implementation of point-of-care EMR from the leading to the least.

Table 4.2 Factors to consider for successful Point-of-Care implementation.

Variable	POC	Retrospective	Total
Reliable power supply	79 (35%)	19 (8%)	98 (44%)
Adequate and trained health care workers	45(20%)	9(4%)	54 (24%)
Standard and stable EMR Systems	36 (16%)	2 (1%)	38 (17%)
Adequate infrastructure	9(4%)	5 (2%)	14 (6%)
Prompt technical support	11 (5%)	0	11 (5%)
Adequate working stations	7 (3%)	3 (1%)	10 (4%)
Total	**167 (74%)**	**38 17%)**	**225(100%)**

4.4 Socio-demographic Factors influence on Point-of-care technology use

The analysis revealed that the distribution of respondents utilizing Point-of-care technology was statistically like those employing retrospective EMR across various demographic factors. No notable differences were found in relation to age, $X^2(1, n=225) = 0$, $p = 1$; sex, $X^2(1, n=224) = 0.507$, $p = 0.466$; education level, $p = 0.317$; computer skills, $X^2(2, n=225) = 0.038$, $p = 0.981$; profession, $p = 0.070$; and county, $X^2(4, n=225) = 1.589$, $p = 0.791$. The findings regarding social demographic factors are detailed in Table 4.3.

Table 4.3 Socio-demographic factors influence on point-of-care technology use

Variable		Mode of EMR Use				χ^2	df	P - value
		POC		Retrospective				
		n	%	n	%			
Age	18 to 35 years	158	83	33	17	0	1	1
	36+ years	28	82	6	18			
Sex	Female	115	81	27	19	0.507	1	0.466
	Male	71	86	12	14			
Education Level	College, University or Polytechnic	185	83	38	17			0.317
	Secondary School	1	50	1	50			
Computer Skills	Basic	78	82	17	18	0.038	2	0.981
	Expert	25	83	5	17			
	Proficient	83	83	17	17			
Profession	Clinical Officer	60	91	6	9			0.070*
	HRIO	76	76	24	24			
	HTS Provider	6	75	2	25			
	NURSE	13	81	3	19			
	Pharmacy Technologist	5	100	0	0			
	Social Worker	13	76	4	24			
	Other	13	100	0	0			
County	Kiambu	44	81	10	19	1.585	4	0.791
	Kirinyaga	19	76	6	24			
	Murang'a	44	85	8	15			
	Nyandarua	29	81	7	19			
	Nyeri	50	86	8	14			

*Fischer's exact reported

4.5 Organizational, technical, and financial factors influence on Point-of-care technology use

The findings on the effects of some of the organizational, technical, and financial elements have on the point-of-care technology use were as follows:

i. Organizational factors

Table 4.4 presented below indicates that 68% of the participants perceived their workload as manageable, whereas 8% considered it to be overwhelming, and 24% reported that the workload was somewhat overwhelming.

Table 4.4 Workload level at health facilities

Variable	Point-of-Care	Retrospective	Total
Manageable	123 (55%)	30 (13%)	153 (68%)
Overwhelming	17 (7%)	2 (1%)	19 (8%)
Slightly overwhelming	46 (21%)	7 (3%)	53 (24%)

Additional factors were observed to assess if workload affects data entry time, if there's adequate workstations and staffing levels, EMR easing workload and EMR reducing patient time. 42% of the respondents agreed to the fact that the workload affected data entry time, 52% reported that the workstations were adequate, 62% were confident that the staffing levels were adequate, 89% were positive about EMR easing workload while 75% were positive about EMR reducing patient time.

Table 4.5 displays the results.

Table 4.5 Other organizational factors influence on point-of-care technology use

Variable	Agree	Neutral	Disagree	Total
Workload affecting data entry time	95 (42%)	51 (23%)	79 (35%)	225 (100%)
Adequacy of workstations	117 (52%)	34 (15%)	74 (33%)	225 (100%)
Adequate staffing levels	139 (62%)	40 (18%)	46 (20%)	225 (100%)
EMR easing workload	200 (89%)	14 (6%)	11 (5%)	225 (100%)
EMR reducing patient time	169 (75%)	32 (14%)	24 (11%)	225 (100%)

Power

Findings on Power source by mode of EMR Implementation were as follows: The results demonstrated that 98% of the locations depend on electricity as their primary energy source, while a mere 2% with standby generators.

Table 4.6 Main source of power at health facilities

variable	POC	Retrospective	Total
Electricity	174 (79%)	47 (21%)	221 (98%)
Generator	4 (100%)	0 (0%)	4 (2%)
Total	**178 (79%)**	**47 (21%)**	**225 (100%)**

Findings on alternative sources of power were as below: Despite the figures stipulated, a mere 25% (28 out of 111) of the unique sites indicated the presence of an alternative power supply.

Table 4.7 Availability of alternative power sources at health facilities

Variable	No	Yes	Total
Electricity	103 (47%)	118 (53%)	221 (98%)
Generator	1 (25%)	3 (75%)	4 (2%)
Total	**104 (46%)**	**121 (54%)**	**225 (100%)**

The analysis revealed that the percentage of participants who indicated utilization of Point-of-care (POC) technology was comparable to those utilizing retrospective Electronic Medical Records (EMR) across various workload levels, $X^2(2, n=225) = 1.796$, $p = 0.473$. Additionally, no significant differences were observed based on data entry time, $X^2(2, n=225) = 2.614$, $p = 0.271$; the perceived ease of workload associated with EMR, $p = 0.158$;

the primary source of power, $p = 0.582$; or the occurrence of power outages, $X^2(2, n=225) = 1.170$, $p = 0.279$.

The proportion of participants reporting on the use of Point-of-care technology exhibited a significant difference when compared to those employing retrospective Electronic Medical Records (EMR). This variation was influenced by several factors, including the adequacy of workstations, $X^2(2, n=225) = 9.194$, $p=0.01$; the effect of EMR on decreasing patient wait times, $X^2(2, n=225) = 8.908$, $p=0.012$; and the presence of alternative power sources, $X^2(2, n=225) = 16.426$, $p=0.001$.

Table 4.8 presents the results on association of organizational factors and PoC use

Table 4.8 Organizational factors influence on point-of-care technology use

Variable		Mode of EMR use				$\chi 2$	df	p value
		POC		Retrospective				
		n	%	n	%			
Workload Levels	Manageable	123	80	30	20	1.796	2	0.473
	Overwhelming	17	89	2	11			
	Slightly overwhelming	46	87	7	13			
Effect of workload on data entry time	Agree	76	80	19	20	2.614	2	0.271
	Disagree	61	77	18	23			
	Neutral	41	80	10	20			
Adequacy of workstations	Agree	18	85	117	15	9.194	2	0.01
	Disagree	53	72	21	28			
	Neutral	26	76	8	24			
EMR helping in easing workload	Agree	160	80	40	20			0.1581*
	Disagree	6	55	5	45			
	Neutral	12	86	2	14			
EMR reducing patient time	Agree	139	82	30	18	8.908	2	0.012
	Disagree	15	62	9	38			
	Neutral	24	75	8	25			
Main power source	Electricity	174	79	47	21			0.5822*
	Generator	4	100	0	0			
Alternative power source	No	66	63	38	37	16.426	2	0.001
	Yes	112	93	9	7			
Power outage	No	105	81	25	19	1.170	2	0.279
	Yes	73	77	22	23			

*Fischer's exact reported

ii. Financial factors

The study suggested that a significant majority, specifically 92%, of the financial resources allocated for system and security improvements originated from donors, whereas a mere 6% was sourced from the Kenyan government. Regarding the maintenance of hardware and software, it was reported that 91% of the resources were derived from donors, while merely 8% contributed by the Kenyan government.

Table 4.9 Source of Funding for EMR

Variable	Donor funding	Government of Kenya funds	Do not Know	Total
Source of financing for system/security enhancement	206 (92%)	13 (6%)	6 (2%)	225 (100%)
Source of financing for software and hardware maintenance	204 (91%)	19 (8%)	2 (1%)	225 (100%)

Figure 4.4 illustrates the results concerning budget allocation for the maintenance of Electronic Medical Records (EMR). Specifically, 60% of respondents indicated that no budget had been allocated, 10% confirmed the existence of a budget allocation, while 29% were uncertain about whether a budget had been designated.

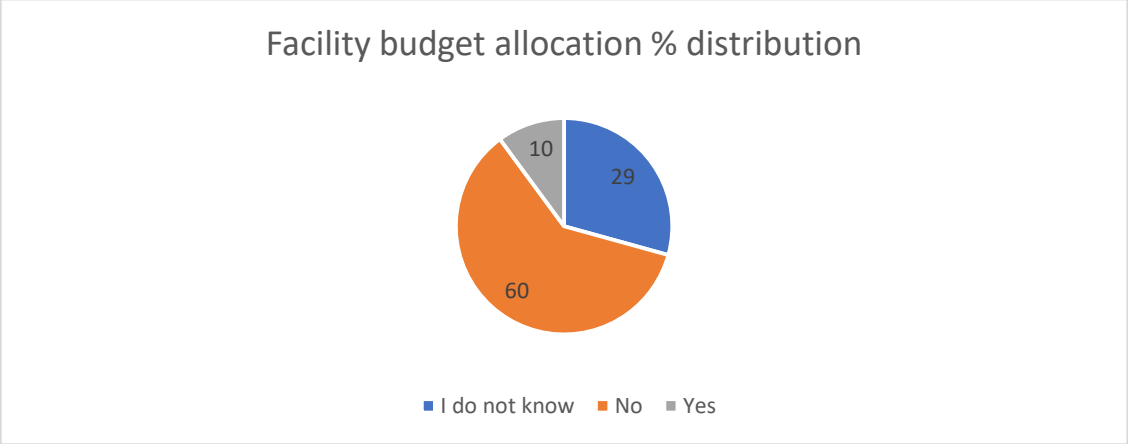


Figure 4.4 Facility budget allocation

The percentage of participants indicating the application of Point-of-care (POC) technology was comparable to those utilizing retrospective EMR, with no significant differences observed based on the Source of financing for system and security improvements (p=0.125) or Budget allocation at the facility level (p=0.435).

The percentage of participants reporting the use of POC technology differed from those using RDE Electronic Medical Records, depending on the funding source for both software and hardware, p=0.

Table 4.10 contains results of analysis on the association between financial factors and point-of-care technology use.

Table 4.10 Financial factors influence on point-of-care technology use

Variable		Mode of EMR use				χ2	df	P - value
		POC		Retrospective				
		N	%	n	%			
Source of financing for system and security enhancement	Don't know	1	17	5	83			0.125*
	Donor funds	174	84	32	16			
	Government of Kenya funds	11	83	2	17			
	Both Donor and facility investment	1	100	0	0			
Source of financing for software and hardware maintenance	Don't know	0	0	1	100			0.001*
	Donor funds	167	82	37	18			
	Government of Kenya funds	16	83	3	17			
Budget allocation at facility level	I do not know	56	85	10	15			0.435*
	No	109	80	27	20			
	Yes	21	91	2	9			

*Fischer's exact reported

iii. Technical factors

Table 4.11 presents the results regarding the training received by respondents on use of EMR during the Initial Phase, categorized by training type. It was found that 72% of the respondents indicated they had undergone training, whereas 28% stated they had not received any training during this phase. Among those who received training, 67%

participated in On-the-Job training, 20% benefited from Onsite mentorship, and 12% engaged in formal training programs.

Table 4.11 Mode of training applied

Variable	Formal (offsite)	On-job training	Onsite mentorship	NA	Total
No	0 (NA%)	0 (NA%)	0 (NA%)	64	64 (28%)
Yes	20 (12%)	108 (67%)	33 (20%)	0	161 (72%)
Total	**20 (12%)**	**108 (67%)**	**33 (20%)**	**64**	**225 (100%)**

Table 4.12 presents the results regarding the satisfaction levels associated with the training received by respondents. Among the participants who completed the training, 52% reported that the training was thorough, 42% characterized it as moderately thorough, while 6% deemed the training insufficient.

Table 4.12 Rating of the training received

Variable	Comprehensive	Insufficient	Somewhat comprehensive	Total
Formal (offsite)	35 (16%)	0 (0%)	25 (11%)	60 (27%)
On-job training	51 (23%)	10 (4%)	47 (21%)	108 (48%)
Onsite mentorship	30 (13%)	3 (1%)	24 (11%)	57 (25%)
Total	**116 (52%)**	**13 (6%)**	**(42%)**	**225 (100%)**

The percentage of participants who reported using Point-of-care technology was comparable to those utilizing retrospective Electronic Medical Records (EMR), regardless of whether they had received training, orientation, or mentorship in EMR usage, X^2 (1, n=225) = 0.817, $p=0.817$.

Table 4.13 contains results of analysis on the association between technical factors and point-of-care technology use.

Table 4.13 Technical factors influence on point-of-care technology use

Variable		Mode of EMR use				$\chi 2$	df	P - value
		POC		Retrospective				
		n	%	n	%			
Trained/oriented/mentored on EMR use	Yes	132	82	29	18	0.054	1	0.817
	No	54	84	10	16			

4.6 Influence of Inbuilt clinical decisions support features utilization on PoC technology use.

The results regarding the utilization of integrated clinical decision support features in point-of-care (POC) revealed that 43% of participants indicated that the TB module in EMR aligns well with the clinical workflow, 40% expressed neutrality and another 40% disagreed. In terms of the MCH program, 42% agreed on its consistency, 38% disagreed, and 20% remained neutral. A significant 94% strongly affirmed the consistency of the CCC program, with 4% disagreeing and 2% neutral. Regarding the HTS Program area, 60% strongly agreed on its consistency, 23% disagreed, and 17% were neutral, with 6% strongly disagreeing, 18% disagreeing, and 17% remaining neutral.

Table 4.14 shows the findings on EMR workflow consistency with the patient workflow at the clinics:

Table 4.14 Data consistency per program

Variable	Agree	Neutral	Disagree	Total
TB	97 (43%)	89 (40%)	90 (40%)	225 (100%)
MCH	93 (42%)	46 (20%)	86 (38%)	225 (100%)
CCC	211 (94%)	5 (2%)	9 (4%)	225 (100%)
HTS	134 (60%)	38 (17%)	53 (23%)	225 (100%)

Table 4.15 presents the results regarding the status of legacy data transfer and visit updates. Specifically, 85% of respondents indicated that data transfer had been completed, while 9% stated that it remained incomplete, and 6% expressed uncertainty about the completeness of the migration. In terms of visit summaries, 94% of respondents confirmed that these summaries were current, whereas 4% reported that they were not up to date, and 3% were unsure about the status of the visit summaries.

Table 4.15 Data migration and visit summary completeness

Variable	Maybe	No	Yes	Total
Data migration completeness	14 (6%)	20 (9%)	191 (85%)	225 (100%)
Visit summary completeness	6 (3%)	8 (4%)	211 (94%)	225 (100%)

Table 4.16 presents the results regarding the availability and utilization of the EMR Patient Overview by clinicians. A significant majority, 95%, of the respondents indicated that the EMR facilitated rapid access to patient overviews, whereas 5% disagreed. Among those

who affirmed the EMR's support for patient overviews, 50% stated that clinicians used this feature in real time to assess client progress. Furthermore, 23% of participants indicated that they used patient overview frequently, while 21% reported occasional use. Additionally, 3% of respondents mentioned that clinicians either never or rarely interacted with the patient overview.

Table 4.16 Interaction of Clinicians with the patient overview feature

Variable	**Always**	**Never**	**Rarely**	**Sometimes**	**Very Often**	**NA**	**Total**
No	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)	11	11 (5%)
Yes	108 (50%)	6 (3%)	6 (3%)	45 (21%)	49 (23%)	0	214 (95%)
Total	**108 (50%)**	**6 (3%)**	**6 (3%)**	**45 (21%)**	**49 (23%)**	**11**	**225 (100%)**

Table 4.17 presents the results regarding additional factors examined: A significant majority of respondents, specifically 96%, agreed that the Electronic Medical Record (EMR) enabled swift access to patient information. Additionally, 96% acknowledged that the EMR improved clinical decision-making capabilities. Furthermore, 93% expressed a positive opinion regarding the EMR's effectiveness in managing appointments. A notable 94% concurred that the EMR supplied essential data for decision-making processes, while 90% recognized its contribution to the improvement of care quality. Lastly, 71% believed that the clinical decision support functionalities have a substantial impact on the use of the EMR.

Table 4.17 Other CDS features influence on point-of-care technology use

Factor	Agree	Neutral	Disagree	Total
Quick access to patient information	215 (96%)	8 (3%)	2 (1%)	225 (100%)
Clinical Decision Support Features	217 (96%)	6 (3%)	2 (1%)	225 (100%)
Appointment management	210 (93%)	11 (5%)	4 (2%)	225 (100%)
Data for Decision making	211 (94%)	9 (4%)	5 (2%)	225 (100%)
EMR Improving Quality-of-Care	203 (90%)	18 (8%)	4 (2%)	225 (100%)
Clinical Decision Support features influence on EMR Use	160 (71%)	11 (5%)	54 (24%)	225 (100%)

The proportion of participants reporting the utilization of Point-of-care technology was like that of those employing retrospective Electronic Medical Records (EMR) across multiple dimensions. These dimensions included EMR assistance for patient overview (p=0.219), quick access to information (p=0.310), support for clinical decision-making (p=0.364), management of appointments (p=0.276), data utilization for decision-making (p=1), improvement of care quality (p=0.192), and features of clinical decision support that enhance EMR (p=0.401).

The proportion of participants reporting the utilization of Point-of-care technology demonstrated a significant difference compared to those utilizing retrospective Electronic Medical Records (EMR) for evaluating client progress, with a p-value of 0.001.

Analysis on the association between Clinical decision support and point-of-care technology use is provided on Table 4.18.

Table 4.18 Clinical Decision Features influence on point-of-care technology use

Variable		Mode of EMR use				χ2	df	p value
		POC		Retrospective				
		N	%	N	%			
EMR support to patient overview	No	11	100	0	0			0.219*
	Yes	175	82	39	18			
Utilizing EMR to review client progress	Always	132	84	25	16			0.001*
	Never	2	33	4	67			
	Sometimes	34	67	17	33			
Quick access to information	Agree	179	83	36	17			0.310*
	Disagree	1	50	1	50			
	Neutral	6	75	2	25			
Clinical decision support	Agree	180	83	37	17			0.364*
	Disagree	1	50	1	50			
	Neutral	5	83	1	17			
Managing appointments	Agree	172	82	38	18			0.276*
	Disagree	3	75	1	25			
	Neutral	11	100	0	0			
Data for decision making	Agree	174	82	37	18			1*
	Disagree	4	80	1	20			
	Neutral	8	89	1	11			
Improving quality of care	Agree	168	83	35	17			0.192*
	Disagree	2	50	2	50			
	Neutral	16	89	2	11			
Clinical decision support features contributing to improved EMR use	Agree	121	81	31	19			0.401*
	Disagree	48	89	6	11			
	Neutral	9	82	2	18			

*Fischer's exact reported

4.7 Influence of Accuracy and consistency in automated indicator reporting on PoC technology use.

Figure 4.5 presents the results regarding the effectiveness of Electronic Medical Records (EMR) in capturing all data variables from paper records. Specifically, 73% of respondents indicated that EMR successfully captured all data contained in paper forms, while 24%

expressed that EMR failed to capture all relevant data. Additionally, 3% of respondents were uncertain about the EMR's data capture capabilities.

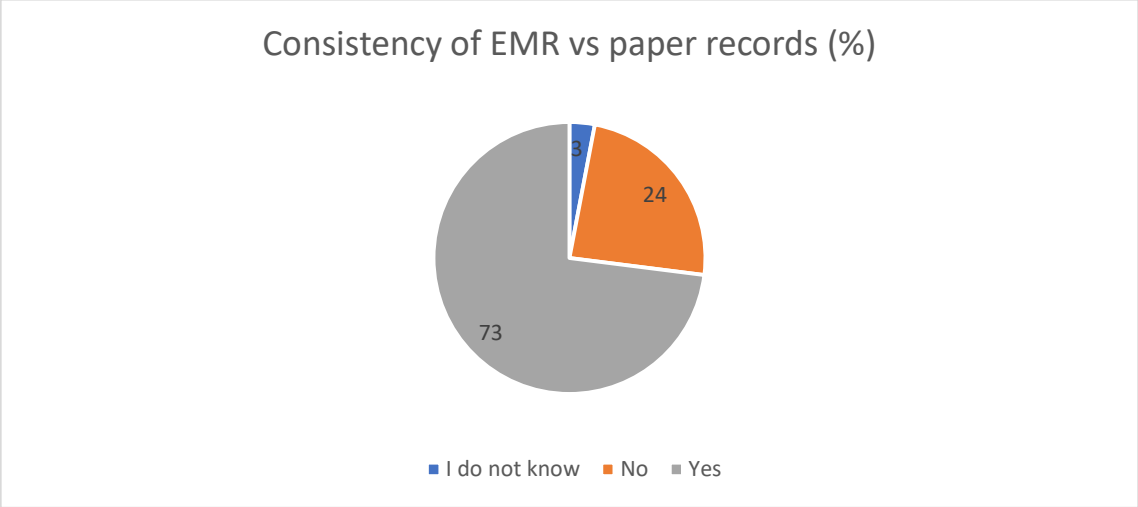


Figure 4.5 Completeness of data Captured in Electronic Medical Records system

Table 4.19 presents the results concerning the utilization of Electronic Medical Records (EMR) for KHIS reporting during the past three months, specifically January, February, and March of 2021. A total of 86% of participants reported using EMR for KHIS reporting during this timeframe, with 73% of these cases linked to Point of Care (POC) usage. In contrast, 9% of respondents indicated that they didn’t utilize electronic medical records (EMR) for reporting within the Kenya Health Information System (KHIS), whereas 5% expressed a neutral stance on the matter.

Table 4.19 Facilities reporting to KHIS from Electronic Medical Records system

Reporting to KHIS from EMR	POC	Retrospective data entry	Total
Yes	163 (73%)	30 (13%)	193 (86%)
No	18 (8%)	3 (1%)	21 (9%)
I do not know	6 (3%)	6 (3%)	12 (5%)
Total	**186 (83%)**	**39 (17%)**	**225 (100%)**

Table 4.20 displays the findings related to the influence of the EMR system on the reporting process. Notably, 45% of respondents strongly agreed that the EMR has improved reporting, while 47% indicated general agreement. In contrast, 0.4% of the participants expressed strong disagreement, 2% indicated disagreement, and 6% remained neutral in their responses.

Table 4.20 Electronic Medical Records system easing reporting process

Variable	POC	Retrospective data entry	Total
Agree	172 (76%)	37(16%)	209 (93%)
Neutral	8 (4%)	3 (1%)	11 (5%)
Disagree	3 (1%)	2 (1%)	5 (2%)
Total	**183 (81%)**	**42 (19%)**	**225 (100%)**

Table 4.21 displays the findings related to motivation levels concerning the use of Electronic Medical Records (EMR). Notably, 72% of participants reported being highly

motivated, 27% indicated a moderate level of motivation, while just 1% stated they felt unmotivated.

Table 4.21 Motivation to use Electronic Medical Records system.

Variable	POC	Retrospective data entry	Total
Very motivated	130 (58%)	32 (14%)	162 (72%)
Somewhat motivated	55 (24%)	6 (3%)	61 (27%)
Not at all motivated	1 (0.4%)	1 (0.4%)	2 (1%)
Total	**186 (83%)**	**39 (17%)**	**225 (100%)**

The percentage of participants indicating the utilization of Point-of-care technology was comparable to that of those employing retrospective Electronic Medical Records (EMR) in terms of data completeness, yielding a p-value of 0.221. Similarly, the availability of up-to-date patient visit summaries did not show a significant difference, as reflected by a p-value of 0.850. Furthermore, the inclination to automatically generate reports, which promotes the adoption of EMR, produced a p-value of 0.080.

The percentage of participants indicating the use of Point-of-Care technology varied from those who depended on retrospective Electronic Medical Records (EMR) by providing data to the District Health Information System (DHIS) from EMR, yielding a p-value of 0.016. Table 4.22 illustrates analysis on the association between accuracy and consistency of reporting and point-of-care technology use.

Table 4.22 Reporting influence on point-of-care technology use

Variable		Mode of EMR use						
		POC		Retrospective		$\chi 2$	df	p value
		n	%	n	%			
Data completeness	Maybe	13	93	1	7			
	No	19	95	1	5			0.221*
	Yes	154	81	37	19			
Up to date Patient visit summaries	Maybe	6	100	0	0			
	No	7	88	1	12			0.850*
	Yes	173	82	38	18			
Reporting to DHIS from EMR	I do not know	6	50	6	50			
	No	18	86	3	14			0.016*
	Yes	162	84	30	16			
Auto generating reports, a motivating factor to EMR use	Not at all motivated	1	50	1	50			
	Somewhat motivated	55	90	6	10			0.080*
	Very motivated	130	80	32	20			

*Fischer's exact reported

CHAPTER V: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the study's conclusions and recommendations, which are aligned with the research objectives and findings. It explores both qualitative and quantitative results, offering an interpretation that corresponds with the existing literature and the researcher's observations. The analysis of the findings is conducted in relation to the established research questions and objectives. Additionally, the outcomes are contrasted with those from comparable research to highlight both the similarities and discrepancies in the results. The section offers conclusions based on the discussions and provides recommendations for professionals in the field and for future researchers.

The chapter was organized as follows: Socio- demographic characteristics, organizational factors, technological factors and financial factors, inbuilt clinical decisions support features utilization**,** accuracy and consistency in automated indicator reporting affecting POC technology use.

5.2 Discussions

5.2.1 Point-of-care use

The results revealed that Point-of-care use was in 83% of the Comprehensive care centers sampled and only 17% were using retrospective mode of data entry.

Majority of the respondents (96%) reported that they preferred point-of-care use over retrospective use (4%) which was an indication that negative attitude is no longer a barrier to EMR adoption. These results are aligned with an Ethiopian study carried out by Shekur Mohammed Awol, et al., 2020 who also observed that most doctors and nurses (60%) were ready to use EMRs.

Further to this, the three topmost determinants of point-of care use were reported to be a reliable power supply at 44% followed by adequate and trained health care workers at 24% and the third being standard and stable EMR at 17%. Based on these results, anyone intending to implement a point-of-care EMR system should put into consideration the three factors for successful implementation.

5.2.2 Socio-demographic factors and point-of-care technology use

The findings indicate that there exists no association between health care workers, socio-demographic factors and POC utilization. However, most EMR system users in the selected sites were female at 63% and male 37%, it was also evident that most the individuals surveyed were categorized within the age range of 18 to 35 years (85%), and age category 36 and above years (15%). The results were consistent with a study carried out in Malawi, where 34 out of 58 respondents aged 21 to 30 (58.6%) preferred using EMRs over paper-based records (Mkalira Msiska et al., 2017). Previous research findings suggest that younger healthcare workers have utilized EMRs more extensively compared to their older counterparts.

The study results revealed that 99% percent of respondents have highest level of education as college, university, or polytechnic. The findings align with earlier research that indicated healthcare professionals in tertiary education have utilized similar quantities of EMRs and paper records (Khwima & Mkalira, 2017).

No significant influence was noted as every variable presented a p-value > 0.05.

5.2.3 Organizational, technical, and financial factors influence on PoC technology use.

Findings of this study revealed that 68% of the participants felt that the workload was manageable, 43% of respondents indicated that workload affected time of data entry and 36% indicated that the workload did not affect time of data entry. In Loomis et al, 2002 research found out that over 50% of users of EMR declared that data entry was both time-consuming and burdensome. 75% of the respondents were positive about EMR reducing time used on a patient, these results disagree with Laerum et al. (2001) who observed in their research that numerous physicians indicate that the utilization of EMRs may require more time per patient compared to traditional paper records. It was observed that, under specific conditions, utilizing paper documentation during clinical interactions may prove to be more practical and efficient.

The findings indicated that 52% of respondents were positive on adequacy of infrastructure while 33% disagreed, 62% of respondents reported that staffing was adequate with only 20% disagreeing. The results of a study conducted by Essuman et al. (2020) corroborate this observation, revealing that several institutional factors are significantly associated with the adoption of electronic medical record (EMR) systems. These factors include inadequate general IT infrastructure, costs associated with EMR resources and facilities, maintenance challenges, a lack of technical staff, unreliable EMR software, insufficient internet bandwidth, and concerns regarding the privacy of patient data.

Findings also revealed that 89% were positive that EMR has helped in easing the workload with only 5% disagreeing, 75% of respondents agreed that EMR has reduced time taken on a patient, 14% were neutral with only 11% disagreeing which indicates that the system

users believe that EMR is the way to decongest long queues at the health facilities. The findings contradict the research carried out by Laerum et al, 2001, who observed that numerous physicians believe that utilizing EMRs will result in allocating additional time with every patient compared to using manual system. In certain situations, utilizing paper records during patient consultations may prove to be more practical and efficient.

The research findings show that 98 percent of the health facilities depend on electricity as their primary source of power, while only 2 percent rely on generators. Additionally, the data suggests that just 25% (28 out of 111) of the facilities surveyed have an alternate power supply. This implies that the use of point-of-care services could be disrupted in the event of an electricity supply failure. According to Isemeck et al. (2019), most healthcare facilities in developing nations often lack access to main power, and where it is available, the power supply is highly unstable or uncertain, posing a potential risk to electronic equipment that is not adequately protected.

A significant effect on the use of point-of-care technology was observed in relation to the suitability of workstations, $X^2(2, n=225) = 9.194$, $p=0.01$; the decrease in patient wait times facilitated by electronic medical records (EMR), $X^2(2, n=225) = 8.908$, $p=0.012$; and the availability of alternative power sources, $X^2(2, n=225) = 16.426$, $p=0.001$. Conversely, no substantial impact was found concerning other variables.

Findings revealed that 92% of funding for infrastructure and security enhancement came from donors, 6% from GOK while 2% were not sure of the source. 91% of funds for hardware and software maintenance came from donors, 8% from GOK and 1% didn’t know the source. In the context of budget allocation at the facility level, 60% of respondents indicated that no budget had been allocated, 10% confirmed the existence of a budget

allocation, while 29% were uncertain about whether a budget allocation was in place. These results indicate that with absence of donor funding then it would be difficult for the government of Kenya and Facilities to implement EMRs. The results align with a study carried out by Boonstra & Broekhuis in 2010, which stated that "Numerous researchers assert that initial costs are substantial and should be considered a major obstacle to doctors implementing EMRs, a significant number of studies, specifically twelve out of the twenty-two examined, indicated that substantial initial expenses represent a significant barrier to the implementation of electronic medical records (EMR), especially for organizations with constrained IT budgets. This article further highlighted that the implementation of an EMR system entails not only upfront costs but also requires considerable dedication to system administration, oversight, maintenance, and support to guarantee its effective and efficient functioning. The ongoing costs related to monitoring, modification, upgrading, and upkeep of EMRs are considerable. Additionally, vendors charge high fees for post-purchase support (Boonstra & Broekhuis, 2010). These anticipated budgets create reluctance among physicians to adopt EMR systems. The substantial initial and recurring costs of EMR implementation can pose challenges in securing adequate monetary resources for health practices. Particularly in minor and moderate enterprise practices with limited Information Technology financial allocations, the high costs may exceed available financial resources (Boonstra & Broekhuis, 2010). The funding source for maintaining software and hardware, which had a p-value of 0, was found to significantly influence the use of point-of-care.

The results also indicate that 94% of the respondents reported to have undertaken computer classes, of which 98% undertook the computer classes before EMR implementation and 46% of these rated their computer skills as proficient. Most system users were Health

Records and Information officers (44%) and clinicians forming 29% of the respondents. The findings showed that the ability to use computers is not a significant obstacle to adopting EMRs, as most survey participants are computer literate. This stands in opposition to the conclusions drawn by Meade et al. (2009), which suggested that physicians possess insufficient knowledge and skills concerning electronic medical records, resulting in resistance to their use. According to the research conducted by Meade et al. (2009), the existing group of physicians in Ireland obtained their professional qualifications before the introduction of IT programs, unlike the current generation, as demonstrated by their findings.

The results indicated that 72% of system users received training while 28% didn't receive training on the initial phase. 48% were trained via On-job training, 27% were trained through formal training while 20% were trained through Onsite mentorship. These results were consistent with a Malawi study which also indicated that 72.4% had received basic training on EMR use (Mkalira Msiska et al., 2017). Results revealed that 52% of participants considered the training to be thorough, 42% regarded it as moderately comprehensive, and 6% perceived it as insufficient. The results indicate that training has been done for most system users using various available methods with the largest percentage favoring its content. The findings align with research conducted by Ford et al in 2006, indicated that while some participants viewed initial formal training positively, others frequently cited inadequate training as a hindrance. This was often due to classroom training not meeting the clinical needs and learning preferences of physicians, or due to insufficient training opportunities. The results contradict research conducted by Loomis et al in 2002, which revealed that 66% of doctors identified insufficient assistance with

technical issues as a hindrance to their adoption of Electronic Medical Records. Meanwhile, Ludwick et al in 2009 pointed out that certain physicians mentioned an absence of availability of supplier technical assistance. No significant impact was observed on the technical factors.

5.2.4 Influence of Inbuilt clinical decisions support features utilization on PoC technology use.

Findings regarding EMR workflow consistency with the patient workflow at the clinics revealed a 94% consistency in CCC Program and 60% in HTS Program with 43% and 42% consistency in TB and MCH respectively. This indicates that the sites implementing EMR can collect complete HIV data using EMR system mainly in the CCC where consistency was reported at 94%.

The results indicate 85% data migration completeness, 9% data migration incompleteness and 6% uncertainty of the migration completeness status. They also reported that 94% of visit summaries are current, while 4% are not up to date, and 3% are uncertain regarding the status of visit summaries. This indicates that the EMR system encompasses both historical and current records.

The electronic medical record (EMR) system is reported to support patient overview by 95% of respondents, whereas 5% indicated that it does not provide this functionality Among the respondents who acknowledged the electronic medical record's (EMR) facilitation of patient overview, half indicated that healthcare professionals employ this overview in real-time to evaluate patient progress. Of this group, 23% stated that clinicians very often use the overview, 21% said they use it sometimes, and 3% reported that clinicians rarely or never utilize the patient overview. This indicates that 97% of clinicians

utilize the patient overview to review patient progress which acts as an indication that EMR provides a simplified version of the patient summary to the HCW for quick reference and clinical decision making.

The results indicate that 96% of system users concurred that the Electronic Medical Record facilitates rapid access to patient information, 3% neutral and only 1% disagreed. The findings contradict the study's discovery that a significant number of physicians believed that paper-based records were more effective and practical when interacting with patients during clinical encounters, as using EMR systems would increase the time spent with each patient. When using EMR systems, physicians might need to interrupt consultations to input information into the system, such as patient diagnoses or prescription typing, which could disrupt the workflow (Pizziferri et al., 2005).

The results further show that 96% of respondents were positive about the EMR support on clinical decisions features, 3% neutral with 1% disagreeing. 90% strongly agreed that EMR supports improvement of quality of care, 8% neutral while 2% disagreed. This indicates that 96% of system users agree to the fact that the integrated clinical decision-making features play a crucial role in directing clinical choices, ultimately resulting in enhanced care provided to clients which is evident to 90% who concurred that EMR supports improvement of exceptional medical care.

The findings also indicate that EMR supports appointment management, evidenced by 93% agreeing and support towards data for decision making with 94% responding positively.

Findings on whether Clinical Decision Features contribute to improved use of EMRs revealed that 71% were positive about this contribution, 24% disagreed while 5% were

neutral. The results suggest that the predominant motivation for healthcare professionals to engage with the EMR system is the availability of integrated clinical decision-making functionalities.

The results of the study align with the research conducted by Sutton et al. in 2020, who observed that the incorporation of clinical decision support functionalities enhances compliance with clinical guidelines, notifies clinicians to contact patients who have not adhered to treatment plans or require follow-up, and assists in identifying patients who meet specific criteria for research participation.

A notable impact on the use of POC was detected when employing EMR to assess client progress, as evidenced by a p-value of 0.001. However, no significant effects were observed regarding the other variables examined.

5.2.5 Accuracy and consistency in automated indicator reporting influence on PoC technology use.

The findings showed that 73% expressed satisfaction with the EMR's ability to capture all data from paper forms, while 24% indicated that the EMR was not capturing all data, and 3% were unsure. This discovery aligns with Msukwa's 2013 report, which stated that 22% of clinicians lacked confidence in EMRs due to incomplete and inaccurate information and results collected by the EMR system. Similarly, the results contradict Alharthi et al.'s 2015 findings, which highlighted physicians' concerns about The precision and thoroughness of data documented within electronic medical record (EMR) systems. However, it’s encouraging to note that the highest percentage of HCWs were confident about EMR ability to capture all data.

The findings showed that 86% of participants indicated that they utilized EMR for reporting in KHIS during the past 3 months (January, February, March 2021). Out of this percentage, 73% reported using EMR at points of care, while 9% stated that they did not utilize EMR for reporting to Kenya Health Information System, and 5% were unsure. This is a great motivation to note that the EMR can generate quality reports that can be relied upon for decision making if all health facilities adopt the use and update the data accordingly.

On EMR easing the reporting process 93% agreed, 5% were neutral and only 2% felt that it did not help in easing the reporting process. This finding indicates that HCWs are likely to use an EMR system if it’s capable of auto generating reports as the manual process is tedious and time consuming. The results align with the research conducted in Kenya, demonstrating that the automated transmission of indicator data from a health facility's electronic medical record (EMR) to the national reporting system is both feasible and advantageous. This approach removes the necessity for manual data entry, which is susceptible to transcription errors, and reduces delays, thus enhancing the completeness and accuracy of indicator data for use at the facility, subnational, and national levels. Additionally, it was observed that this method shortens the time required to prepare and submit indicator data, as well as decreases the number of facility staff needed to meet reporting requirements at health facilities. This is crucial for the advancement of health information systems (HIS) without the need for additional human resources (Kariuki et al., 2016).

The results further revealed that 72% of respondents were very motivated to use EMR system by the ability to auto generate reports, 27% were somewhat motivated while 1%

were not at all motivated. These shows that the ability to generate reports from an EMR system can help motivate the health care providers to quickly adopt point-of-care use.

A significant effect on the use of PoC was observed concerning the reporting from EMR to DHIS, with a p-value of 0.016; however, no substantial influence was found on the other variables analyzed.

5.3 Conclusions

The study's objectives and findings led to the following conclusions:

For successful implementation of point-of-care technology, each healthcare professional needs to be proficient in system use, regardless of age and gender, to ensure continuity and sustainability.

Unreliable or unstable power sources lead to service interruptions during power outages, making it challenging to maintain EMR use in a point-of-care setting. This is a crucial consideration when transitioning from a paper-based system to a digital implementation.

The Ministry of Health, in collaboration with County governments, ought to allocate financial resources for the development of software and the maintenance of hardware to promote sustainability and guarantee continuity in case donor funding ceases.

If the results are generalized to the entire population, then transition from paper to paperless use should be seamless, otherwise the need to be computer literate for all health care providers should be emphasized.

To achieve maximum benefits from EMR systems, health care workers must be well trained/mentored on the full functionality of EMRs.

The findings of this study revealed a positive response on inbuilt clinical decision supports feature, EMR System users expressed their satisfaction with consistency of EMR with paper records, data completeness, EMR support in improving quality of care, appointment as well as data for decision making. With 71% of respondents expressing that clinical decision features lead to an improvement in EMR use then this EMR Capability could be considered as a motivating factor to use of POC technology use.

The integration of Electronic Medical Records (EMR) for the immediate evaluation of patient progress significantly affects the utilization of care at the point of service. This consideration is crucial in the design of an EMR system, as it is anticipated to facilitate greater acceptance of the EMR framework.

Electronic Medical Record (EMR) systems possess the ability to produce high-quality reports suitable for submission to the national reporting system (KHIS). Therefore, it is essential for all stakeholders to endorse the implementation of point-of-care technology. This adoption will address the deficiencies in reporting associated with manual processes, ultimately facilitating access to dependable data that supports informed decision-making.

Electronic Medical Record systems must adhere to national electronic medical records standards and be standardized accordingly.

5.4 Recommendations

After reviewing the study's findings, the researcher presents the following recommendations to inform policy development and strategic planning.

5.4.1 Recommendation from the study

County governments, in partnership with service delivery organizations, are required to ensure that all healthcare professionals undergo training aimed at enhancing their computer

proficiency and navigation of the EMR System, thereby equipping them to effectively utilize POC.

Maintaining the ratio of doctors to patients will hinder HCW from becoming overcome by their task load, allowing them to provide quality care while implementing point-of-care technology.

It is essential for all health facilities to have sufficient computing hardware to support facility task load and cover all service delivery points for POC use, along with the allocation of a maintenance budget.

Reliable and stable power supply is necessary for uninterrupted point-of-care utilization, and exploring cost-effective power supply such as solar energy should be considered.

The implementation of point-of-care technology across all healthcare institutions will rectify the deficiencies in reporting linked to manual procedures. This advancement will facilitate automated reporting to the National Health Information System (KHIS), thereby guaranteeing the availability of high-quality data for effective decision-making.

Electronic Medical Record (EMR) systems deployed within healthcare institutions must comply with the recognized standards and guidelines governing Electronic Medical Record Systems in Kenya. This compliance encompasses critical functionalities, including integrated clinical decision support mechanisms and comprehensive reporting capabilities.

5.4.2 Recommendation for further research

Carrying out a study assessing the effects of point-of-care technology on care quality, especially in comparison to facilities that do not use electronic medical records (EMR) would be beneficial, after this research.

REFERENCES

Alharthi H, Youssef A, Radwan S, Al-muallim S, Zainab A. *J Taibah Univ Med Sci [Internet]* 3. Vol. 9. Elsevier Ltd; 2014. [10 April 2015]. Physician satisfaction with electronic medical records in a major Saudi Government hospital; pp. 213–218.

Biruk, S., Yilma, T., Andualem, M., & Tilahun, B. (2014). Health Professionals' readiness to implement electronic medical record system at three hospitals in Ethiopia: a cross-sectional study. *BMC Medical Informatics and Decision Making*, *14*(1). https://doi.org/10.1186/s12911-014-0115-5

Boonstra, A., & Broekhuis, M. (2010). *Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. BMC Health Services Research*,

Canada Health infoway, (2013). *The emerging benefits of electronic medical record use in community-based care*

Castillo V, Martínez-García A, Pulido J, (2010). *A knowledge-based taxonomy of critical factors for adopting electronic health record systems by physicians*: a systematic literature review. BMC medical informatics and decision-making. 2010: 10: 6.

Chaulagai, C. Moyo, C. Koot, J. Moyo, H. Thokozani C, Ferdinand M, & Patrick D. (2005) *Design and implementation of a health management information system in Malawi: issues, innovations, and results*. Health Policy and Planning, 2005; 20(6): 375-84.

Da've D. (2004). *Benefits and Barriers to EMR Implementation*. Caring. 2004; 23(11):50–51.

Davidson E, Heslinga D. Bridging the IT Adoption Gap for Small Physician Practices: An Action Research Study on Electronic Health Records. *Information Systems Management.* 2007;**24**(1):15–28. doi: 10.1080/10580530601036786.

Delbanco T, Walker J, Bell S, Darer J, Elmore J, Farag N, (2012). Inviting patients to read their doctors' notes: a quasi-experimental study and a look ahead. Ann Intern Med. 2012; 157(7):461–70.

Douglas G (2019). *Engineering an EMR System in the Developing World Necessity is the Mother of Invention* (unpublished Ph.D. thesis) the University of Pittsburgh, School of Medicine, etd-04302009-101747. 2009

Duffy, M. (2024, June 16). *Point-of-Care System: The Benefits and Challenges*. Vim. https://getvim.com/blog/point-of-care-system/#:~:text=With%20POC%20systems%2C%20healthcare%20facilities

El-Kareh R, Gandhi TK, Poon EG, Newmark LP, Ungar J, Lipsitz S, (2009). *Trends in primary care clinician perceptions of a new electronic health record*. J Gen Intern Med. 2009; 24(4):464–8.

El-Sadr WM, Holmes CB, Mugyenyi P, Thirumurthy H, Ellerbrock T, (2012). *Scale-up of HIV treatment through PEPFAR*: a historic public health achievement. J Acquir Immune Defic Syndr.60 (Suppl3), S96-104. doi: http://dx.doi.org/10.1097/QAI.0b013e31825eb27b. PubMed10.1097/QAI.0b013e31825eb27b

Finney Rutten LJ, Vieux SN, St Sauver JL, Arora NK, Moser RP, Beckjord EB, (2014). *Patient perceptions of electronic medical records use and ratings of care quality*. Patient Relat Outcome Meas. 2014; 5:17–23.

Ford EW, Menachemi N, Phillips MT, 2006. *Predicting the adoption of electronic health records by physicians: When will health care be paperless*. Journal of the American Medical Informatics Association. 2006; 13: 106-112

Ford N, Kranzer K, Hilderbrand K, Jouquet G, Goemaere E, (2010*). Early initiation of antiretroviral therapy and associated reduction in mortality, morbidity and defaulting in a nurse-managed, community cohort in Lesotho*. AIDS. 24(17), 2645-50.

Fraser HS, Biondich P, Moodley D, Choi S, Mamlin BW, Szolovits P (2005). *Implementing electronic medical record systems in developing countries*.

Fraser HSF, Moodley D, Choi S, Burk WM, Peter S (2005). *Implementing electronic medical record systems in developing countries*. Informatics in Primary Care, 2005; 13:83-95.

Garg AX, Adhikari NK, McDonald H, (2005). Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. JAMA. 2005; 293:1223–1238.

Gr_supadude. (2022, August 11). *Point of care documentation: A call to action*. Infocare Health. https://infocarehealth.com/point-of-care-documentation-a-call-to-action/

Heard S, (2006). Electronic Health Records. In: Conrick M, editor. Health Informatics: Transforming Healthcare with Technology. Victoria: Thomson Social Science Press; 2006.

Hermans SM, van Leth F, Manabe YC, Hoepelman AI, Lange JM, (2012*). Earlier initiation of antiretroviral therapy increased tuberculosis case finding and reduced mortality in a setting of improved HIV care: a retrospective cohort study*. HIV Med. 13(6), 337-44.

Horton R, 2005. *The neglected epidemic of chronic disease*. Lancet 2005; 366:1514.

How can electronic health records improve public and population health outcomes? | HealthIT.gov. (2019, May 21). Www.healthit.gov. https://www.healthit.gov/faq/how-can-electronic-health-records-improve-public-and-population-health-outcomes

https://dmrckenya.co.ke/ (accessed 18/07/2020)

https://dwh.nascop.org [Accessed 02/06/2020)

https://www.ghdonline.org/uploads/BMJ_Open-2012-Millard-.pdf (accessed 03/08/2020)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5811997/#R27

https://www.researchgate.net/publication/298787418_Barriers_for_Implementation_of_Electronic_Medical_Record_EMR_A_Review (accessed 04-09-2018)

https://www.researchgate.net/publication/343797761_Factors_Influencing_the_Utilization_of_Electronic_Medical_Records_in_the_Eastern_Region_of_Ghana

Jaakkimainen RL, Shultz SE, Tu K (2013). Effects of implementing electronic medical records on primary care billings and payments: a before-after study. CMAJ Open. 2013:1(3): E120–6.

Johari, B. (2016). Benefits and challenges of EMR implementations in low resource settings: a state-of-the-art review. International Journal of Innovation and Scientific Research, 9 (2), 20-40.

Kariuki, J. M., Manders, E.-J., Richards, J., Oluoch, T., Kimanga, D., Wanyee, S., Kwach, J. O., & Santas, X. (2016). Automating indicator data reporting from health facility EMR to a national aggregate data system in Kenya: An Interoperability field-test using OpenMRS and DHIS2. *Online Journal of Public Health Informatics*, *8*(2). https://doi.org/10.5210/ojphi.v8i2.6722

Kern LM, Barrón Y, Dhopeshwarkar RV, Edwards A, Kaushal R (2013), *HITEC Investigators Electronic health records and ambulatory quality of care*. J Gen Intern Med. 2013:28(4):496–503.

Laerum H, Faxvaag A. Task-oriented evaluation of electronic medical records systems: development and validation of a questionnaire for physicians. *BMC Med Inform Decis Mak.* 2004; **4:1**. doi: 10.1186/1472-6947-4-1.

Lakbala P, Dindarloo K (2014). *Physicians' perception and attitude toward electronic medical record.* Springerplus. 2014; 3:63.

Landis Lewis Z, Mello-Thoms C, Visweswaran S, Crowley R (2010) *Using electronic medical records to measure guideline adherence in low-resource settings*.

Loomis GA, Ries JS, Saywell RM, Thakker NR, (2002*). If electronic medical records are so great, why aren't family physicians using them?* Journal of Family Practice. 2002; 51: 636-641.

Ludwick DA, Doucette J: Primary Care Physicians' Experience with Electronic Medical Records: Barriers to Implementation in a Fee-for-Service Environment. International Journal of Telemedicine and Applications. 2009, 853524.

McLane S, (2005). Designing an EMR Planning Process Based on Staff Attitudes Toward and Opinions About Computers in Healthcare. Computers Informatics Nursing. 2005:23(2):85–92.

Meinert DB, (2004). Resistance to Electronic Medical Records (EMRs): A Barrier to Improved Quality of Care. Informing Science: International Journal of an Emerging Transdiscipline. 2004; 2: 493-504.

Mkalira Msiska, K. E., Kumitawa, A., & Kumwenda, B. (2017). Factors affecting the utilisation of electronic medical records system in Malawian central hospitals. *Malawi Medical Journal*, *29*(3), 247. https://doi.org/10.4314/mmj.v29i3.4

Msukwa MKB. User Perceptions on Electronic Medical Record System (EMR) in Malawi [Internet] University of Malawi; 2011. [20 Sept 2013].

Point-of-Care. (n.d.). AMPATH Kenya. Retrieved July 13, 2024, from https://www.ampathkenya.org/pointofcare#:~:text=BENEFITS%20OF%20THE%20POINT%2DOF%2DCARE%20SYSTEM

Point of Care Systems - an overview | ScienceDirect Topics. (n.d.). Www.sciencedirect.com. https://www.sciencedirect.com/topics/medicine-and-dentistry/point-of-care-systems

Pizziferri, L., Kittler, A. F., Volk, L. A., Honour, M. M., Gupta, S., Wang, S., Wang, T., Lippincott, M., Li, Q., & Bates, D. W. (2005). Primary care physician time utilization before and after implementation of an electronic health record: A time-motion study. *Journal of Biomedical Informatics*, *38*(3), 176–188. https://doi.org/10.1016/j.jbi.2004.11.009

Randeree E (2007): *Exploring Physician Adoption of EMRs: A Multi-Case Analysis*. Journal of Medical System. 2007, 31 (6): 489-496. 10.1007/s10916-007-9089-5.

Rao SR, DesRoches CM, Donelan K, Campbell EG, Miralles PD (2011). *Electronic health records in small physician practices: availability, use, and perceived benefits*. Journal of the American Medical Informatics Association. 2011; 18: 271-275.

Rose HL, Miller PM, Nemeth LS, Jenkins RG, Nietert PJ, Wessell AM, (2008). Alcohol screening and brief counseling in a primary care hypertensive population: a quality improvement intervention. Addiction. 2008:103(8):1271–80. Epub 2008 Apr 16.

Schouten EJ, Jahn A, Midiani D, Makombe SD, Mnthambala A, (2011). *Prevention of mother-to-child transmission of HIV and the health-related Millennium Development Goals: time for a public health approach.* Lancet. 378(9787), 282-84.

Siegle, D. (2023, October 19). *Point-of-Care Technology: What Is It and Why Is It Important?* Vim. https://getvim.com/blog/the-role-of-point-of-care-technology-in-healthcare/#:~:text=PoC%20technology%20refers%20to%20easily

Sutton, R., Pincock, D., Baumgart, D., Sadowski, D., Fedorak, R., & Kroeker, K. (2020). An overview of clinical decision support systems: benefits, risks, and strategies for success. *NPJ Digital Medicine*, *3*(1), 1–10. https://doi.org/10.1038/s41746-020-0221-y

The Office of the Global AIDS Coordinator. PEPFAR Blueprint: Creating an AIDS-free Generation. 2012 [Accessed 2013 June 19]: Available from: http://www.pepfar.gov/documents/organization/201386.pdf.

The Office of the U.S. Global AIDS Coordinator. PEPFAR 3.0. Controlling the epidemic: delivering on the promise of an AIDS-free generation. PEPFAR, Editor. 2014: Washington (DC)Available from: http://www.pepfar.gov/documents/organization/234744.pdf

Thompson, C., Mebrahtu, T., Skyrme, S., Bloor, K., Andre, D., Keenan, A. M., Ledward, A., Yang, H., & Randell, R. (2023). The effects of computerised decision support systems on nursing and allied health professional performance and patient outcomes: a systematic review and user contextualisation. In *PubMed*. National Institute for Health and Care Research.

Thompson IM., (1999). *Automated entry of nosocomial infection surveillance data: use of an optical scanning system.* J Hosp Infect. 43(Suppl), S275-78.

UNAIDS, (2014). 90-90-90 An ambitious treatment target to help end the AIDS epidemic. [Accessed 2016 March]; Available from: http://www.unaids.org/sites/default/files/media_asset/90-90-90_en_0.pdf.

WHO, UNICEF, UNAIDS, (2011). Global HIV/AIDS response: epidemic update and health sector progress towards universal access: progress report 2011. 2012, World health Organization: Geneva.[Accessed May 07, 2013], Available from: http://www.who.int/hiv/pub/progress_report2011/en/index.html.

Williams F, Boren SA. (2008). The role of the electronic medical record (EMR) in care delivery development in developing countries: a systematic review.

World Health Organization, Regional Office for the Western Pacific. Manila: (2006). WHO Western Pacific Region: *Electronic Health Records: Manual for Developing Countries.*

Wubante SM, Tegegne MD, Melaku MS, Mengiste ND, Fentahun A, Zemene W, et al. Healthcare professionals' knowledge, attitude and its associated factors toward electronic personal health record system in a resource-limited setting: A cross-sectional study. Frontiers in Public Health. 2023; 11:1114456. doi:10.3389/fpubh.2023.1114456.

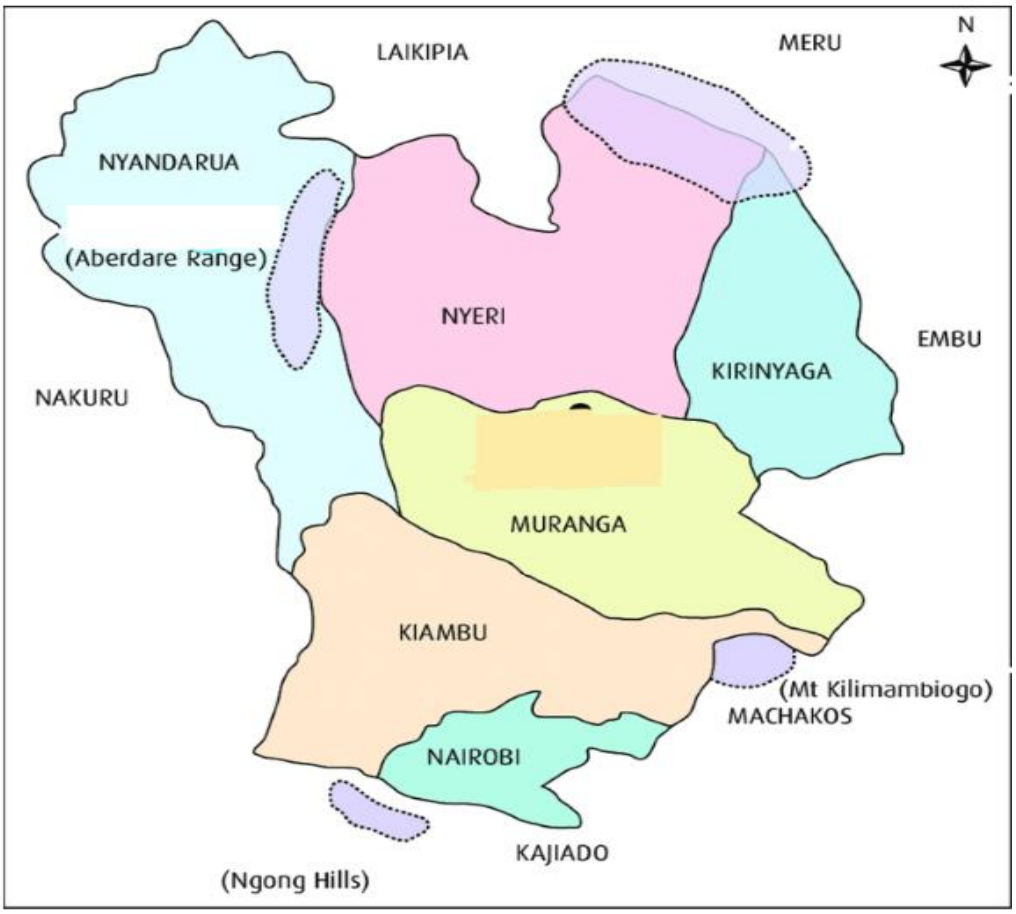
www.ncbi.nlm.nih.gov/pmc/articles/PMC4607324/#b3-0610846

Xu H, Aldrich MC, Chen Q, Liu H, Peterson NB, Dai Q, (2014). *Validating drug-repurposing signals using electronic health records*: a case study of metformin associated with reduced cancer mortality. J Am Med Inform Assoc. 2014; 22(1):179–91. Epub 2014 Jul 22.

Yehualashet, D. E., Seboka, B. T., Tesfa, G. A., Demeke, A. D., & Amede, E. S. (2021). Barriers to the Adoption of Electronic Medical Record System in Ethiopia: A Systematic Review. *Journal of Multidisciplinary Healthcare*, *14*(14), 2597–2603. https://doi.org/10.2147/JMDH.S327539

APPENDICES

Appendix I: Study Location Map



Source : https://dmrckenya.co.ke/

Appendix II: Informed Consent Form

I am Keziah Kanina Muiruri, currently pursuing a Master of Public Health at Kenyatta University, specializing in Monitoring and Evaluation. My current research focuses on exploring the factors that affect the utilization of Point-of-Care Technology by healthcare practitioners working in Comprehensive Care Centres in Central Kenya. The findings from this study aim to shed light on the key determinants that influence the adoption of Point-of-Care technology among healthcare professionals, potentially providing valuable insights for policymakers and stakeholders involved in the implementation of Electronic Medical Records Systems.

Procedures

During the participation process, I, in my capacity as the researcher, will ask a sequence of questions to the participant. Each response will be meticulously recorded as I present the questions outlined in the questionnaire. Participation is completely voluntary, and no individual will be obligated to engage. Choosing to withdraw from participation will not affect your existing or future relationship with Kenyatta University. Throughout our discussion, please feel free to raise any inquiries pertaining to the study. If at any point you feel uneasy about continuing to respond to the questions, you retain the right to terminate the interview or withdraw from participation.

Discomfort/risks

If you come across any questions that feel personal and make you uncomfortable, you are not required to answer them or to proceed with the interview. The interview may last up to

30 minutes, which might be inconvenient for you. I want to emphasize that taking part in this study involves no risks.

Benefits

Your voluntary involvement will assist me in emphasizing the primary factors influencing the utilization of point-of-care technology. The information will help in creating awareness on key considerations to factor in during EMR Implementations and therefore guide informed decision making by stakeholders. You will also benefit from any decisions made on EMR Implementations as a tool that supports your daily duties and adds value to your work.

Reward

Participation does not entail any financial remuneration.

Confidentiality

The interview is scheduled to occur in a private location within your workplace. I will avoid making a recording of any uniquely identifying information on the questionnaire. The electronically completed tools will be protected by use of passwords not to allow unauthorized access and all records will be handled with confidentiality.

Contacts

If you need any further clarification, do not hesitate to contact me at muirurikeziah@gmail.com. Additionally, you may contact my supervisors, Dr. Gitahi at +254-020-8710901-19 and Dr. Otieno at +254-020-8710901-19. Alternatively, you can also get in touch with the KU Ethical Review Committee at chairman.kuerc@ku.ac.ke.

Respondent's Statement

I have been provided with comprehensive information regarding the study and have a complete understanding of its specifics. I have had the opportunity to pose any significant inquiries, all of which have been addressed satisfactorily. I am cognizant of the possible advantages and discomforts associated with the study, and I acknowledge that there are no inherent risks involved. I understand that my participation is entirely voluntary and that my personal information will remain confidential. Consequently, I hereby grant my consent for any information that may be required from me.

Signature…… Date……

Interviewer's Statement

I, the undersigned, have taken the opportunity to explain to the participant, using language they can comprehend, the potential risks, benefits, and methods related to the research.

Name…….... Signature……... Date……...

Appendix III: Questionnaire

No names are required to ensure anonymity of the respondent. The information provided will be treated highly confidential.

Part 1: General information

County name: ……

Facility name: …….

What kind of implementation is in this facility?

☐ Point of Care (POC)

☐ Retrospective

What is the mode of EMR use in this facility?

☐ POC (Real time data entry)

☐ Retrospective data entry (Entry happens after services are offered)

☐ Hybrid (mixed mode both real time and retrospective)

Part 2: Objective 1: To identify socio-demographic factors influencing point-of-care technology use.

What is your age category?

☐ 18 to 25 years

☐ 26 to 30 years

☐ 31 to 35 years

☐ 36 to 40 years

☐ 41+ years

State your gender

☐ Male ☐ Female

State your education level

☐ None

☐ Primary school education

☐ Secondary School education

☐ College, University or Polytechnic

What is your profession?

☐ NURSE

☐ HRIO

☐ Clinical Officer

☐ Pharmacy Technologist

☐ Other, Specify ……..

Objective 2: To identify organizational, technical, and financial factors influencing point-of-care technology use.

Workload/Time

How is the workload in this department?

☐ Overwhelming

☐ Slightly overwhelming

☐ Manageable

In your own opinion, indicate the agreement level to each of the below

	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
Does the workload affect the time of data entry?					
Does the department have enough working stations?					
Are the staff deployed in this department adequate to provide the services offered?					
Has EMR helped in easing the workload?					
Has EMR reduced time used on a patient?					

Cost

Where did the money to pay for the system/ Infrastructure (security enhancement) come from?

- ☐ Facility Investment Fund
- ☐ Donor funds
- ☐ Government of Kenya Funds
- ☐ Others Specify: …….

Where does the money for software and hardware maintenance come from in case of a breakdown?

- ☐ Facility Investment Fund
- ☐ Donor funds
- ☐ Government of Kenya Funds
- ☐ Others

Is there a budget allocation at the facility level for EMR Maintenance?

☐ Yes ☐ No ☐ I do not know

Computer Literacy

Have you undergone any computer classes?

☐ Yes ☐ No

If yes, when did you enroll for computer classes?

☐ Before EMR implementation ☐ After EMR implementation

How would you rate your computer skills?

☐ Expert

☐ Proficient

☐ Basic

Staff Training

Were you trained / oriented / mentored on Electronic medical records use at the initial phase?

☐ Yes ☐ No

If yes, what type of training?

☐ Formal (offsite)

☐ Onsite mentorship

☐ On-job training

How was the training received?

☐ Comprehensive

☐ Somewhat comprehensive

☐ Insufficient

Have you participated in any additional follow-up training since the initial session??

Yes ☐ No ☐

How satisfied are you with the training received?

Very dissatisfied ☐

Somewhat dissatisfied ☐

Neither satisfied nor dissatisfied ☐

Somewhat satisfied ☐

Very satisfied ☐

PowerWhich is the main source of power?

☐ Electricity

☐ Solar

☐ Generator

☐ Other Specify: ……

How often is power interruption?

☐ Daily

☐ Weekly

☐ Monthly

☐ Never

Is there an alternative source of power e.g., Generator, Solar power etc.?

Yes ☐ No ☐

If yes, which one ……

Has power outage shut down the system in the last 1 week?

Yes ☐ No ☐

Objective 3: To determine the influence of clinical decisions support functions utilization on point-of-care technology use

EMR workflow consistent with the patient workflow at the clinics - MCH, TB, CCC, and HTS?

Service delivery point	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
HTS					
CCC					
MCH					
TB					

Is data migration complete? (Data for all these categories; Active, Lost, Defaulters, Dead, Transfer Outpatient records)

Yes ☐ No ☐ Maybe ☐

Do all patient visit summaries up-to date?

Yes ☐ No ☐ Maybe ☐

If No; what is the primary cause among the following options?

☐ Power Interruption

☐ High Workload

☐ System breakdown

☐ Other, Specify……

Does the EMR provide Patient overview in graphical form?

Yes ☐ No ☐

If yes, how often do the clinicians utilize it on real time to review client progress?

☐ Always

☐ Very Often

☐ Sometimes

☐ Rarely

☐ Never

To what extent do you concur with the following statements? EMR system supports the clinicians in…...

Indicator	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Quick access of patient information					
Clinical decision features such as; alerts Clinicians when client is due for a service e.g. Viral load, CD4, Sputum etc.					
Managing appointments (alerts on number of clients scheduled on a specific day)					
Data for decision making					
providing quality of care to the clients					

To what extent do you concur with the following statements? Clinical decision features contribute to improved use of the EMR system

☐ Strongly Disagree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly Disagree

Objective 4: To determine the influence of accuracy and consistency in automated indicator reporting on point-of-care technology use

Is the EMR capturing all HIV data that is in paper forms?

☐ Yes ☐ No ☐ I do not know

Is the EMR generating accurate and consistent reports? (compare EMR generated MOH 731 report with a manually generated reported for the last complete quarter)

Month	Enrolled in care		Started ART		Current on ART	
	Paper	EMR	Paper	EMR	Paper	EMR
January						
February						
March						

NB: Fill this question in only one questionnaire per facility.

Was the EMR generated report used to report to DHIS2 in the last 3 months?

☐ Yes ☐ No ☐ I Do not know

In your own opinion, has the EMR eased the process of reporting?

☐ Strongly Agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly Disagree

To what level does the ability to auto generate reports from the EMR motivate you to use the system?

☐ Very motivated ☐ Somewhat Motivated ☐ Not at all motivated

What mode of EMR use do you prefer?

☐ Point of Care ☐ Retrospective Data Entry

Give one reason why you prefer that mode over the other: ……

In your own Opinion, what are the key factors to be considered while implementing a Point of care EMR System.

…….

……

Appendix IV: Kenyatta University Ethical Review Committee Approval

KENYATTA UNIVERSITY
DIRECTORATE OF ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575
Email: chairman.kuerc@ku.ac.ke
Nairobi, 00100

P. O. Box 43844,

Tel: 8710901/12

Website: www.ku.ac.ke
Our Ref: **KU/ERC/APPROVAL/VOL.1**

Date: 4th May, 2021

Kezia Muiruri
P.O BOX 43844-00100
Nairobi.

Dear Ms. Muiruri,

APPLICATION NUMBER: PKU/2241/I1385 - DETERMINANTS OF POINT OF -CARE TECHNOLOGY USE AMONG HEALTH CARE WORKERS OFFERING SERVICES AT COMPREHENSIVE CARE CENTERS IN CENTRAL KENYA

This is to inform you that ***KENYATTA UNIVERSITY DIRECTORATE OF ETHICS REVIEW COMMITTEE*** has approved version 4 of the study protocol together with the attached consent forms dated 12.09.2020. Your application approval number is **PKU/2241/I1385.** The approval period is ***4th May, 2021 TO 4th May, 2022.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***KENYATTA UNIVERSITY DIRECTORATE OF ETHICS REVIEW COMMITTEE.***
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***KENYATTA UNIVERSITY DIRECTORATE OF ETHICS REVIEW COMMITTEE*** within 72 hours of notification

iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***KENYATTA UNIVERSITY DIRECTORATE OF ETHICS REVIEW COMMITTEE*** within 72 hours

v. Clearance for export of biological specimens must be obtained from relevant institutions.

vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.

vii. Submission of an executive summary report within 90 days upon completion of the study to ***KENYATTA UNIVERSITY DIRECTORATE OF ETHICS REVIEW COMMITTEE***.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

To serve you better, researchers are kindly requested to access and complete a customer feedback form and sent it back online as you continue with research and upon completion of data collection found on the following websitelink:(https://docs.google.com/forms/d/1ytWefDwvyz5h1oz_VIn0xbxg3uGdlDzMXFWNDsMrRPQ/edit?usp=sharing

Yours sincerely

Prof. Judith Kimiywe

DIRECTOR- KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE.

Appendix V: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **162490**

Date of Issue: **08/March/2021**

RESEARCH LICENSE

This is to Certify that Ms.. Keziah Kanina Muiruri of Kenyatta University, has been licensed to conduct research in Embu, Kiambu, Muranga, Nyandarua, Nyeri on the topic: DETERMINANTS OF POINT-OF-CARE TECHNOLOGY USE AMONG HEALTH CARE WORKERS OFFERING SERVICES AT COMPREHENSIVE CARE CENTRES IN CENTRAL KENYA for the period ending : 08/March/2022.

License No: **NACOSTI/P/21/9202**

162490

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix VI: County Approval Letter

COUNTY GOVERNMENT OF KIAMBU
DEPARTMENT OF HEALTH SERVICES

All correspondence should be addressed to HEAD
HRDU – HEALTH DEPARTMENT
Email address: mudiritu@gmail.com
mkwasa@live.com
Tel. Nos: 0721641516
0721974633

HEALTH RESEARCH AND DEVELOPMENT
UNIT
P. O. BOX 2344 – 00900
KIAMBU

Ref. No.: KIAMBU/HRDU/21/05/10/RA_MUIRURI Date: 10th May 2021

TO WHOM IT MAY CONCERN

RE: CLEARANCE TO CONDUCT RESEARCH IN KIAMBU COUNTY

Kindly note that we have received a request by Ms. Keziah Kanina Muiruri of Kenyatta University to carry out research in Kiambu County, the research topic being on "Determinants Of Point-Of-Care Technology Use Among Health Care Workers Offering Services At Comprehensive Care Centres In Central Kenya"

We have duly inspected her documents and found that she has been cleared by NACOSTI to carry out the research for a period ending 08th March 2022. She thus does not need any further clearance with another regulatory body in order to conduct research within the county of Kiambu.

However, it is incumbent upon the institution where she is carrying out research to ensure that she receives adequate supervision during the process of conducting the research. This note also accords her the duty to provide a feedback on her research to the county at the conclusion of her research.

DR. MWANCHA KWASA
COUNTY CLINICAL RESEARCH OFFICER
KIAMBU COUNTY