HEALTHCARE PROVIDERS' PERCEPTIONS, CHALLENGES AND PROPOSED SOLUTIONS FOR THE USE OF ELECTRONIC HEALTH RECORDS IN RWANDAN RURAL HOSPITALS: CASE OF REMERA RUKOMA HOSPITAL.

MUGAMBINUMWE Didace

College Of Medicine and Health Sciences

School Of Public Health

Master of Health Informatics

August, 2023

HEALTHCARE PROVIDERS' PERCEPTIONS, CHALLENGES AND PROPOSED SOLUTIONS FOR THE USE OF ELECTRONIC HEALTH RECORDS IN RWANDAN RURAL HOSPITALS: CASE OF REMERA RUKOMA HOSPITAL.

By

MUGAMBINUMWE Didace

Registration: 220017065

A dissertation submitted in partial fulfilment of requirements for the degree of MASTER OF SCIENCE IN HEALTH INFORMATICS

In the

DIRECTORATE OF POSTGRADUATE STUDIES

In the

COLLEGE OF MEDICINE AND HEALTH SCIENCES

Supervisor: Dr. RUGEMA Lawrance

Co-Supervisor: Dr. NASIRU Sani

August, 2023

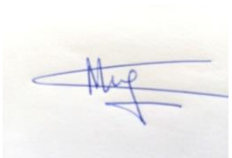
DECLARATION

I Didace MUGAMBINUMWE, hereby declare that this research dissertation entitled" Healthcare providers' perceptions, Challenges and proposed solutions for the use of electronic health records in Rwandan rural hospitals: Case of Remera Rukoma hospital" submitted in partial fulfillment of the requirements for the degree of Masters of Science in Health Informatics to the University of Rwanda is my own work except where specifically acknowledged.

Didace MUGAMBINUMWE

220017065

Signature



Date 12th August, 2023

ACKNOWLEDGEMENTS

First and foremost, I want to give thanks to the Almighty God for giving me the power, resources, and life I need to do this task; without him, nothing would have been possible.

I want to express my gratitude to my family for their support and their sacrifices while I was studying. I also acknowledge my supervisors, all my classmates for the best moments bonded together.

ABSTRACT

Electronic Health Records (EHR) system is defined by International Organization for Standardization (ISO) as a database of patients' data in digital format, which can be stored and exchanged between multiple authorized users in a secure manner. It is a significant technological advancement that helps to increase the standards of healthcare delivery and is considered as the backbone integrating various information tools in healthcare systems. The aim was to determine the challenges, proposed solutions and perception of healthcare providers on the use of EHR in Rwanda. A prospective cross-sectional design was used to determine the challenges, proposed solutions and perceptions of healthcare providers on the use of EHR at Remera Rukoma hospital. A consecutive sampling method was used to choose all the healthcare providers working at Remera Rukoma hospital who were eligible for the study criteria to obtain the sample. The tool was developed based on the literatures about EHR use, a conceptual framework and the research goals. Descriptive statistics was used to present and analyze data. At Remera Rukoma hospital, the majority of healthcare providers (72.2%) have a positive perception toward EHR system use. They have the challenges including being unable to export paper-based documents to digital records (63.9%); lack of interoperability with other systems and healthcare institution like hospital, clinics and health centers (56.5%); frequent lack of internet connection or poor connection (55.5%); lack of technical trainings (54.6%); the smooth use is difficult (50.9%); and lack of technical expertise and provider support (50%). They proposed solutions including (71.3%) is improving the network and electricity in the hospital followed by linking the health centers, clinics and hospitals (interoperability) and maintaining the patient identification so that patient's information can be easily found (63.9%). This study showed that the healthcare providers of Remera Rukoma hospital have positive perception towards the use of EHR. The hospital needs to combat the challenges showed and to use the solutions proposed to improve the usability of EHR.

Key words: Perception, Challenges, Health, Hospital

LIST OF SYMBOLS AND ACRONYMS

CHUK: Centre Hospitalier Universitaire de Kigali

CMHS: College of Medicine and Health Sciences

EHR: Electronic Health Record

EMR: Electronic Medical Records

ICT: Information Communication Technologies

IRB: Institutional Review Board

HIV: Human Immunodeficiency Virus

ISO: International Organization for Standardization

IT: Information Technology

MINALOC: Ministry of Local Government

MRS: Medical Record System

PBHR: Paper-Based Health Record

TB: Tuberculosis

USA: United States of America

WHO: World Health Organization

Table of content

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: GENERAL INTRODUCTION

1.0 Introduction

The paper-based health record (PBHR) system is being quickly replaced by electronic health record (EHR) system as we are advancing in information communication technologies (ICT) use in healthcare system (Alanazi, Butler-, & Alanazi, 2020)(Ngusie, Kassie, Chereka, & Enyew, 2022). The relevance of the EHR system in providing accurate, current, and comprehensive information is crucial for providing effective and efficient healthcare services (Ngusie et al., 2022).

This chapter consists of the background of the study, statement of the problem, research objectives, research questions, and research significance, definition of concepts, limitation of the study and scope of the study, and structure and organization of the study.

1.1 Background of the study

Electronic Health Records (EHR) system is a computerized tool for collecting patient data; storing and accessed by authorized health care professionals to offer health services to patients effectively (Hussein et al., 2019).

According to WHO, the Electronic Health Record is database of all a patient's personal health data that is entered and accessed by medical professionals over the course of patient lifetime; and it goes beyond acute inpatient situations including all outpatient care locations where the patient receives care (WHO,2006).

EHR can also be defined by International Organization for Standardization (ISO) as a database of patients' data in digital format which can be stored and exchanged between multiple authorized users in a secure manner (ISO/DTC 20514 in Odekunle, & Shankar, 2017).

Studies indicate that medical records have started to be used by Egyptian between 1600 and 3000 before Christ but the steady use of medical records were reached between 1900 and 1920; this time it was a paper-based medical records (Evans, 2016).

The first computer-based medical record or electronic health record has started in the world between 1960 and 1970 and has made patient's medical information easily available and readable at any location in the world (Evans, 2016).

The study conducted in developing countries has shown that EHR can make significant augmentation on health care transformation by improving patient safety, help the patient participating in their care and lower the expenses for the health services.

The advantages of EHR include ensuring that patients are always uniquely identified, that all healthcare data produced in the facility is recorded at the point of care, that information is widely understood, and that all medical records are accurate, dependable, and completed on time. Better decision-making by healthcare professionals; instant access to patient information for today and coming care; increased healthcare standards; maintenance of patient confidentiality and privacy; completion of morbidity and mortality statistics fast and accurately; elimination of problems with filing and losing sheets; and elimination of problems with space for storage of paper medical records (WHO,2006).

EHR has been started to be use in Rwanda in 2005 by the Partners In Health (PIH) to assist and enhance HIV and TB patient care(Amoroso, Akimana, Wise, & Sf, 2010).

1.2 Problem statement

Electronic Health Records system is a crucial technology that is helps to improve the healthcare service delivery (Hussein et al., 2019) and is considered as the backbone integrating various information tools in healthcare systems (Yitayew et al., 2020). Nowadays, having an electronic health record can be both a benefit and a disadvantage for healthcare professionals(Azliza et al., 2018). The perception of users is one among the factors that influence the acceptance and use of EHR successfully(Alanazi et al., 2020). When compared to using a paper-based medical record, the use of the EHR was perceived positively, according to a study carried out at a referral hospital in the capital city of Kigali(Uwambaye et al., 2017). However, little is known about health care providers' perception, challenges and solution for the use of EHR in rural settings, which also have low resources. Therefore, there is a need to conduct this study to find out the perception and challenges of healthcare providers, from a region other than Kigali, on the use of EHR to bridge this gap in knowledge related to how electronic health record is used in rural area hospitals.

1.3 Objectives

1.3.1 Main objectives

To determine the challenges, proposed solutions and perception of healthcare providers on the use of EHR in Rwanda.

1.3.2 Specific objectives

- To assess the perceptions of healthcare providers on the use of EHR at Remera Rukoma district hospital.
- To determine the challenges that healthcare providers meet while using EHR at Remera Rukoma district hospital.
- To determine the possible solutions for the challenges that healthcare providers meet while using of EHR at Remera Rukoma district hospital.

1.3.3 Research question

- What are the perceptions of healthcare providers on the use of EHR at Remera Rukoma hospital?
- What are the challenges that healthcare providers meet while using EHR at Remera Rukoma hospital?
- What are the possible solutions for the challenges that healthcare providers meet while using EHR at Remera Rukoma district hospital?

1.4 Significance of the study

The hospital management will use the results of this study to manage their system (EHR) and used them to assist in its smooth running to manage well the patients' data with simple retrieval when necessary, as they will be able to combat with the challenges found.

The Government will benefit from the results from this study, as it will be easy to plan and monitor the use of EHR at Hospital after recognizing the perception and challenges of users.

This study will make it simpler for future researchers because they will have a reference point and a better understanding of how the EHR operates at the study site. Based on the findings of this study, they will be able to have a clear path to follow and be aware of the difficulties encountered when utilizing EHR.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter presents a literature review of the topic of the health care providers' perception and challenges about the use of electronic health record.

2.1 Theoretical literature

2.1.1 Health care providers' perception on EHR

It is difficult in both developed and developing nations to switch from manual to electronic documentation due to resistance from some medical experts and health professionals in general (WHO, 2006).

Electronic health records are crucial for the delivery of high-quality healthcare(Alanazi et al., 2020).

As found in a systematic review done by Sadoughi, Khodaveisi and Ahmadi about the utilized theories for the adoption or electronic health record, the adoption of EHR systems is multi-dimensional, complex, and impacted by a variety of factors in healthcare organizations (Sadoughi, Khodaveisi & Ahmadi, 2019).

The theory of change from the study done by Adedeji et Al. about utilizing of EHR in primary care said that for the sustainable usage of EHR requires a mindset change from utilizing paper systems (Adedeji et Al., 2022).

The positive healthcare perceptions for EHR can result from the system's advantages such as work efficiency, quality of care, patient safety, communication and access to patient information. It can also be influenced by personal characteristics like age, profession, computer literacy and training in EHR; and system aspects like perceived utility and perceived usability but not an organizational factor like management support (Alanazi et al., 2020).

2.1.2 Health care providers' challenges for the use of EHR

According to WHO, the major challenges for developing countries on the use of EHR can be the price; available technology; lack of the staff's technical and computer skills; lack of information processing facilities; availability of data on request time; issue concerning privacy, confidentiality, accuracy and quality of generated information of the patients; electricity wiring and supply; and amount and quality of space needed for computers (WHO, 2006).

Greiver's qualitative study on the use of electronic medical records identified several difficulties with EMR, including the lack of relative benefit for many processes, the system's high complexity, its low compatibility with physician needs and prior experiences, its difficulty being adapted to the organization and to the EMR, and its lack of organizational slack(Greiver et Al., 2011).

A systematic review about the perceptions of healthcare professionals about the adoption and use of EHR in Gulf Cooperation Council countries found that the challenges for adoption of EHR include the disruption with workflow and provider–patient communication, privacy and security concerns, high initial costs and inadequate training (Alanazi et al., 2020).

According to the theory of change from the study done by Adedeji et Al. about the using electronic health records in primary care, the sustainability of EHR requires trained health care professionals, having enough IT equipment and funds (Adedeji et al., 2022).

The study conducted by Moomba in Zambia has found the challenges for EHR use include lack of network connectivity and antivirus updates and hardware (Moombo, 2017).

The study done by Anyango about the challenges to EMR adoption in Kenya has found that the challenges to EMR include inadequate financial resources, unavailability of computers, lack of technical training, system limitation, system complexity and customizability, lack of proper leadership and support from decision makers (Anyango, 2017).

The study done by Bisrat et Al. in Ethiopia has found that the challenges to EHR use include lack training and follow up, lack of management commitment and poor network infrastructure (Bisrat et Al., 2021).

The systematic review by Woldemariam and Jimma about the adoption of electronic health record systems to improve the quality of healthcare in low-income countries has identified the challenges which include inadequate infrastructure, a lack of management commitment, standards, interoperability, support, experience and inadequate EHR systematics (Woldemariam & Jimma, 2023).

A qualitative study conducted in Southern Ghana about EHR post-use challenges in selected hospitals found the challenges to EHR use are poor equipment as the frequently mentioned post-use challenges that affected EHR utilization, unreliable internet and network connectivity as a source of frustration and budget shortage (Mensah et al., 2022).

The study done in different countries including Rwanda at CHUK in 2021 has found that the challenges to EHR include financial, procedural, cultural, and political problems (Blankemeier, 2021).

2.1.3 Proposed solutions for better use of electronic health record

The study done by Cifuentes et Al., the solutions to EHR use include customizing EHR templates, EHR upgrading and having a unified EHR (Cifuentes et Al., 2017).

The study conducted by Moomba in Zambia has found that the solutions for EHR use include updating computer hardware infrastructure, such as the backup power supply, network connectivity between computers, internet connectivity for antivirus updates, and having a sufficient supply of computer hardware; and addressing human resource issues by giving regular health care workers EMR orientations and training, teaching them the basics of computer use, and hiring more staff (Moombo, 2017).

The study done by Bisrat et Al. has found that the solutions to EHR use include a commitment from management, ICT infrastructure, equipment accessibility, and incentive systems (Bisrat et Al., 2021).

2.2 Empirical literature

2.2.1 Health care providers' perception on EHR

The study done in Pakistan about nursing perceptions of electronic documentation found that the whole (100%) nurse-participants perceived EHRs as having the potential to increase patient care and patient protection (Shabnum et Al., 2017)

The study done in Oman by Raddaha et Al. in Saudi Arabia about Seventy-four percent (74%) of the study nurses had very positive attitudes toward the EHR system, according to opinions, perceptions, and attitudes among practicing nurses(Raddaha, Obeidat & Hayudini, 2018).

The study done by Uwambaye et Al. in Rwanda at CHUK about healthcare user's perception of the EMR system found that 90% have positive perception on the use of EMR (Uwambaye et Al., 2017).

2.2.2 Health care providers' challenges for the use of EHR

The research done by Bisrat et Al. in Ethiopia about the user challenges and perception of care providers on electronic medical records found that the lack of training and follow-up is the most probing challenge at 38% (Bisrat et al., 2021)

2.3 Conceptual framework

This conceptual framework was developed based on the study conducted by Ogolla Judith Anyango about the challenges to EHR adoption in Kenya.

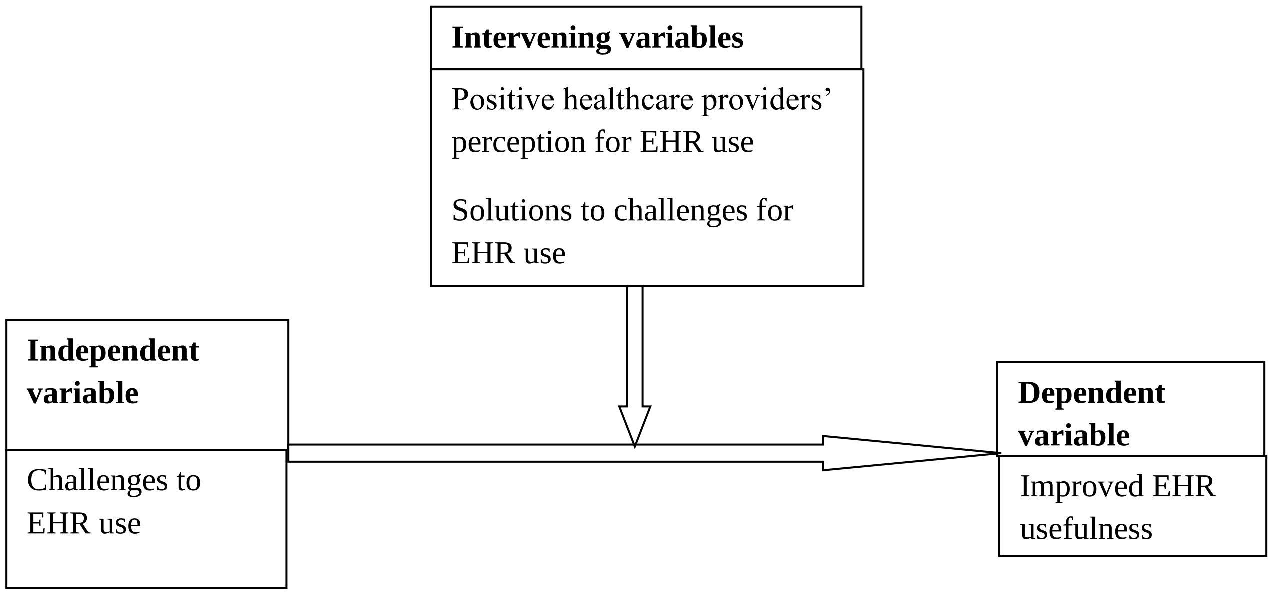


Figure1: Conceptual framework

The WHO defines healthcare quality as the extent to which, for both individuals and populations, health services increase the likelihood of desirable health outcomes (WHO, 2020). Despite the importance of EHR systems to healthcare, challenges are impeding the successful utilize EHR systems in healthcare institutions (Woldemariam & Jimma, 2023). The positive healthcare providers' perceptions and solutions can help shedding light to those challenges and improve the utilization of EHR system for healthcare delivery (Woldemariam & Jimma, 2023).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. **Introduction**

This chapter outlines the research technique that underpinned the investigation, analysis and results interpretation; and it outlines the steps in the research process.

3.2. Research approach

In this study, we used a quantitative non-experimental approach to identify the challenges, proposed solutions and healthcare providers' perceptions on the utilization of EHR at Remera Rukoma hospital.

3.3. Research design

We used a prospective cross-sectional design to assess the challenges, proposed solutions and healthcare providers' perceptions on the utilization of EHR at Remera Rukoma hospital.

3.4. Research setting

The researcher conducted this study at Remera Rukoma district hospital which is in Rwanda, Province of west, Kamonyi district and Rukoma sector. Remera Rukoma hospital provides healthcare service to the population that comes from 13 health centers of Kamonyi district, Western Province of Rwandan and they are all the public institutions.

3.5. Study population

The study population for this study is composed by all healthcare providers from Remera Rukoma hospital equal to 148. The setting areas were chosen because it is the older hospital which uses the electronic health recording system without combining it with paper-based electronic health recording and which has older infrastructures which put it at risk of experiencing more challenges about the use of EHR system.

3.6. Sampling

This section describes the sample size and sampling techniques that was used for the study.

3.6.1. Sampling strategy

A non-probability consecutive sampling method was used to choose all the healthcare providers working at Remera Rukoma hospital who were eligible for the study criteria to obtain the sample. This sampling method was chosen because when all members of an accessible population are allowed to get involved in a study, the risks of bias is greatly reduced.

3.6.1.1 Inclusion criteria

All healthcare providers who work at Remera Rukoma hospital and who were at the study site during the period of study.

3.6.1.2 Exclusion criteria

All healthcare providers who work at Remera Rukoma hospital but who do not use EHR/ OpenMRS were not involved in the study.

3.6.2. Sample size

Every healthcare provider that met the inclusion criteria was selected until the survey period is over. In this study, 108 participants were recruited for the study to get the sample.

3.7. Data Collection

3.7.1. Data Collection instruments

Data were collected using a self-administered questionnaire that consisted of variables to assess the challenges and healthcare providers' perceptions on the use of EHR at Remera Rukoma hospital and possible solutions about those challenges. The questionnaire has four sections: Section one which assessed the information about demographic data of participants, section two which assessed the information about healthcare providers' perception on the use of EHR, section three which assessed the information about the challenges that healthcare providers meet while using EHR at the study site and section four which assessed the proposed solutions about the challenges that healthcare providers meet while using EHR. Every section consisted of a set of structured variables developed using a simple language that the participants were able to understand so that they complete it easily in order to minimize biases during data collection. The questionnaire was also developed in English, as the language used when providing care at the data collection site is English.

3.7.2. Validity and reliability of research instruments

The research instrument in this study was a questionnaire written in English to help the participants to give accurate information and minimize biases. The questionnaire was valid and reliable as I adopted it from a recently conducted study in the same country with mine and with the same objectives, conducted by Hamish Fraser about user perceptions and use of an Enhanced EHR in Rwanda with and without clinical alerts: cross-sectional survey; published in May, 2022.

Objectives	**Research questions**	**Corresponding alternatives**
To assess the perceptions of healthcare providers on the use of EHR at Remera Rukoma district hospital.	What are the perceptions of health care providers on the use of EHR at Remera Rukoma hospital?	**№ 2.1 to № 2.5**
To determine the challenges of the health care providers for the use of EHR at Remera Rukoma district hospital.	What are the challenges of health care providers for the use of EHR at Remera Rukoma hospital?	**№ 3.01 to № 3.19**
To determine the proposed solutions for the challenges that healthcare providers meet while using of EHR at Remera Rukoma district hospital.	What are the possible solutions for the challenges that healthcare providers meet while using EHR at Remera Rukoma district hospital?	**№ 4.1**

3.7.3. Data collection procedure

After getting approval from IRB/CMHS, the researcher applied for permission to conduct research from Remera Rukoma district hospital's ethical committee. After the permission was granted, the researcher met the General Director of hospital to introduce himself and explain the study purpose and ask permission to conduct the study in his institution. The researcher asked the General Director to introoduce him to the hospital staff. After that, the researcher gave the data collection tool to the participants who met the inclusion criteria and started to collect completed questionnaire and entering data in Excel format, assigning them the codes which met the questionnaire numbers and saving every day's data on the machine and external hard disk to prevent the duplication, data loss and for longterm storage. Data was collected from Monday to Friday as they are the days corresponding to learning days of the programm for a period of weeks. After collecting the data needed, the researcher started the next step of data analysis.

3.8. Data analysis

The analysis was made using Statistical Package for Social Sciences (SPSS) and Microsoft excel. The information was expressed in numerical form such as frequencies, averages/ means etc. The research records were shown in frequencies and percentages.

3.9. Ethical considerations

The researcher adhered to the following ethical guidelines: He has asked the University of Rwanda/CMHS for permission to carry out the study, and then he submitted it to Research committee at Remera Rukoma district hospital. In order to maintain the privacy of the subjects, the researcher did not indicate the names and specific address on the questionnaire. Confidentiality was maintained by not putting the identity of participants to the questionnaire and by declining any unauthorised entry to the data from the subjects.

The results from this study assisted the researcher to prepare the recommendations and conclusion based on the findings.

3.10. Data management

All information was gathered, computed and entered in software such as SPSS version 25 and Microsoft excel for analysis and then was saved on the external hard disk. Keeping confidentiality will be assured and information will be used only for the study purpose. The information will be stored for two years after finishing the research then be incinerated.

3.11. Data Dissemination

The results findings from this research will be published in peer review journal for being available to all users in need. The final project report will be provided to the Remera Rukoma hospital for facilitating them to set methodologies to successfully use EHR and its all modules.

CHAPTER FOUR: PRESENTATION OF FINDINGS

4.0 Introduction

In this chapter, we present the research results according to the research goals that were (1) To assess the perceptions of healthcare providers on the use of EHR at Remera Rukoma district hospital, (2) To determine the challenges of the healthcare providers for the use of EHR at Remera Rukoma district hospital and (3) To determine the possible solutions for the challenges that healthcare providers meet while using of EHR at Remera Rukoma district hospital. A total of 108 healthcare providers were included in the study with a respondents rate of 100%.

4.1 Distribution of respondents by socio-demographic characteristics (N=108)

Table 4.1 The respondents were found into two age-groups classification, as defined by MINALOC Rwanda, 34(31.5%) were in 21-30 age-group called youth, and 74(68.5%) in the 31-50 age-group called old adults. According to the sex of respondents, 75(69.4%) were females and 33(30.6) were males. The majority of respondents, 62(57.4%) were nurses, 12(11.0%) were midwives, 10(9.3%) were medical doctors (General practitioner), 8(7.4%) accountants and cashiers, 6(5.6%) were laboratory technicians, and 3(2.8%) were equally mental health nurses, IT and data managers and anesthetists. By work experience for respondents, 45(41.7%) had experience between 1 to 5 years, 39(36%) had experience ranged between 6 to 10 years, 14(13%) had experience between 11 to 15, and 10(9.3) had experience ranged between 16 years and above.

Table 4.1 Socio-demographic characteristics (N=108)

Variables	n	(%)
Age of respondents (years)		
21-30	34	(31.5)
31-50	74	(68.5)
Sex of respondents		
Female	75	69.4
Male	33	30.6
Professional category		
Medical doctor (GP)	10	(9.3)

Medical doctor (Specialist)	1	(0.9)
Midwife	12	(11.0)
Nurse (General)	62	(57.4)
Mental health nurse and Psychologist	3	(2.8)
Lab technician	6	(5.6)
IT and Data manager	3	(2.8)
Cashier and Accountant	8	(7.4)
Anaesthetist	3	(2.8)
Work experience		
1-5	45	(41.7)
6-10	39	(36.0)
11-15	14	(13.0)
16 and above	10	(9.3)

4.2 Perceptions of healthcare providers on the use of EHR (N=108)

Table 4.2: The majority, 98(90.7%), agreed (agree or strongly agree) that they would like to use EHR in their work in future, 6(5.6%) disagreed and 4(3.7%) don't know. The majority of respondents, 79(73.2%), agreed that it would be ease for them to become skillful at using EHR, 16(14.8%) disagreed (disagree, strongly disagree) and 13(12%) don't know. The majority, 79(73.2%), agreed that they prefer EHR over paper charting, 12(11.2%) disagreed and 17(15.7%) don't know. The majority, 74(68.5%), agreed that patient data obtained from EHR system is more complete compared to paper based record, 17(15.7%) disagreed and 17(15.7%) don't know. The majority, 60(55.5%), agreed that their involvement at the system use phase make the EHR more useful to me, 17(15.7%) disagreed and 31(28.7%) don't know.

Table 4.2: Perceptions of healthcare providers on the use of EHR (N=108)

Variables	Strongly disagree n(%)	Disagree n(%)	Don't know n(%)	Agree (%)	Strongly agree n(%)
I would like to use EHR in my work in future	2(1.9)	4(3.7)	4(3.7)	25(23.1)	73(67.6)
It would be easy for me to become	8(7.4)	8(7.4)	13(12.0)	42(38.9)	37(34.3)

skillful at using EHR					
I prefer EHR over paper charting	6(5.6)	6(5.6)	17(15.7)	22(20.4)	57(52.8)
Patient information obtained from EHR system is more complete as compared to Paper medical record	5(4.6)	12(11.1)	17(15.7)	34(31.5)	40(37.0)
My involvement at the system usage phase make the EHR more useful to me	4(3.7)	13(12.0)	31(28.7)	32(29.6)	28(25.9)

4.3 Challenges of the health care providers for the use of EHR (N=108)

Table 4.3: The majority of respondents, 54(50%), agreed (agree, strongly agree) that smooth use is difficult, 23(21.3%) disagreed (disagree, strongly disagree) and 31(28.7%) don't know. The majority, 59(54.6%), agreed that they are not trained on how to use the system and the computer, 36(33.3%) disagreed and 17(13(12.0%) don't know. The majority, 55(50.9%), agreed that it is hard to export paper-based documents to digital records, 39(36.1%) disagreed and 14(13.0%) don't know. The majority, 69(63.9%), agreed that the technical resources are limited (technical expertise and provider supervision), 31(28.7%) disagreed and 8(7.4%) don't know. The majority, 60(55.5%), agreed that there is a frequent lack of internet connection or poor connection, 39(36.1%) disagreed and 9(8.3%) don't know. The majority, 61(56.5%), agreed that there is no data exchange between hospital or between hospital and other clinic so that we can have access to patient data, 27(25.0%) disagreed and 20(18.5%) don't know. The majority, 53(49.0%), agreed that there is an unreliable power supply/Electricity, 33(30.5%) disagreed and 22(20.4%) don't know. 29(26.9%) respondents agreed that they doubt about the efficacy and privacy protocol of system and they prefer not to change the methodology we used before, 54(50%) disagreed and 25(23.1%) don't know; 29(26.9%) agreed that it is difficult to adapt to the system, 66(61.1%) disagreed and 13(12.0%) don't know; 32(29.6%) agreed that there is a high risk for patient data leakage or cyber-attack, 51(47.2%) disagreed and 25(23.2%) don't know; 37(34.3%) agreed that there is no structural plan for EHR system use and update, 68(63%) disagreed and 8(7.4%) don't know; 24(22.2%) agreed that there is no communication between healthcare providers, IT and the patient about EHR results, 61(56.5%) disagreed and 23(21.3%) don't know; 31(28.7%) agreed that EHR system sometime blocks and affects my daily performance,

61(56.5%) disagreed and 9(8.3%) don't know; 31(28.7%) agreed that EHR system is hard to update if a new item arise, 56(51.9%) disagreed and 21(19.4%) don't know; 21(19.4%) agreed that they are not familiar with computer-based systems, 76(70.4%) disagreed and 11(10.2%) don't know; 24(22.2%) agreed that they are fearful to manipulate computer, 72(66.6%) disagreed and 12(11.2%) don't know; 25(23.1%) agreed that using EHR is time consuming, 64(59.2%) disagreed and 19(17.7%) don't know; and 9(8.3%) agreed that EHR use is not important in hospital, 88(81.5%) disagreed and 11(10.2%) don't know.

Table 4.3: Challenges of the health care providers for the use of HER (N=108)

Variables	Strongly disagree n(%)	Disagree n(%)	Don't know n(%)	Agree n(%)	Strongly agree n(%)
Smooth use is difficult	8(7.4)	15(13.9)	31(28.7)	24(22.2)	30(27.8)
I doubt about the efficacy and privacy protocol of system; I prefer NOT to change the methodology we used before	37(34.3)	17(15.7)	25(23.1)	13(12.0)	16(14.8)
We are not trained on how to use the system and the computer	16(14.8)	20(18.5)	13(12.0)	36(33.3)	23(21.3)
It is difficult to adapt to the system	20(18.5)	46(42.6)	13(12.0)	21(19.4)	8(7.4))
There is a high risk for patient data leakage or cyber attack	23(21.3)	28(25.9)	25(23.1)	17(15.7)	15(13.9
It is hard to export paper-based documents to digital records	13(12.0)	26(24.1)	14(13.0)	28(25.9)	27(25.0)
The technical resources are limited (technical expertise and provider supervision)	8(7.4)	23(21.3)	8(7.4)	31(28.7)	38(35.2)
There is a frequent lack of internet connection or poor connection	8(7.4)	31(28.7)	9(8.3)	47(43.5)	13(12.0)
There is no data exchange between hospital or between hospital and other clinic so that we can have access to	11(10.2)	16(14.8)	20(18.5)	30(27.8)	31(28.7)

patient data					
There is no structural plan for EHR system use and update	49(45.4)	14(13.0)	8(7.4)	19(17.6)	18(16.7)
There is no communication between healthcare providers, IT and the patient about EHR results	26(24.1)	35(32.4)	23(21.3)	22(20.4)	2(1.9)
EHR system/OpenMRS sometime block and affect my daily performance	42(38.9)	26(24.1)	9(8.3)	15(13.9)	16(14.8)
EHR system is hard to correct or edit an error if arise	16(14.8)	31(28.7)	22(20.4)	20(18.5)	19(17.6)
EHR system is hard to update if a new item arise (ex: new medication)	16(14.8)	40(37.0)	21(19.4)	16(14.8)	15(13.9)
I am not familiar with computer-based systems	39(36.1)	37(34.3)	11(10.2)	16(14.8)	5(4.6)
There is an unreliable power supply/Electricity	5(5.6)	28(25.9)	22(20.4)	14(13.0)	39(36.1)
I am fearful to manipulate computer	53(49.1)	19(17.6)	12(11.1)	17(15.7)	7(6.5)
Using EHR is time consuming	41(38.0)	23(21.3)	19(17.6)	14(13.0)	11(10.2)
EHR use is not important in hospital	77(71.3)	11(10.2)	11(10.2)	5(4.6)	4(3.7)

4.4 Proposed solutions for the challenges met while using of EHR (N=108)

In the table 4.4: Many participants 77(71.3) has proposed to improve the network and electricity in the hospital, 69(63.9) proposed to link the health centers, clinics and hospitals and to maintain the patient's ID so that patient's information can easily be found, 54(50) proposed to avail computer for every staff, 52(48.1) proposed to train staff on the system and ICT use in general and 11(10.2) proposed to increase the number of IT for support and supervision as the solutions to EHR use challenges.

Table 4.4: Proposed solution for the challenges met while using of EHR (N=108)

Variables	n	(%)
To improve the network and electricity in the hospital	77	(71.3)

Link the health centers, clinics and hospitals and maintain the patient ID so that patient's information is easily found	69	(63.9)
To avail computer for every staff	54	(50)
To train staff on the system and ICT use in general	52	(48.1)
Increase the number of IT for support and supervision	11	(10.2)

CHAPTER FIVE: THE DISCUSSION OF RESULTS

5.0 Introduction

In this chapter, we present the major results from this research and compare them with results from related research studies. The discussion was mostly based on the study's findings that were found to have considerable importance and relevance to the goals. The relevant literature was utilized to compare the research finding and those from other studies and make analysis and conclusions.

5.1 The perceptions of healthcare providers on the use of EHR at Remera Rukoma district hospital

According to the study findings, the majority of healthcare providers (72.2%, n=108) working at Remera Rukoma hospital have a positive perception toward EHR system use as they have responded strongly agree or agree to five questions regarding the perception on the EHR system use. The highest perception scores (90.7%) was linked to perceiving that they want to employ EHR in their work in the time ahead and the least ranked perception scores (55.5%) was linked to perceiving that their involvement at the system use phase made the EHR more useful to them. These showed that the integration of EHR system in their activities is very important and they are happy to have it.

These findings are similar to many findings from different studies including a study done by Ramoo in 2018, published in 2022 about perception and satisfaction of nurses toward EMR system; a study done by Raddaha in 2018; and a study done in Rwanda(Kigali) in 2017 which all found a positive perception about EHR use.(Raddaha et Al., 2018&Ramoo et al., 2022).

5.2 Challenges of the health care providers for the use of EHR at Remera Rukoma district hospital

Findings from the Healthcare providers at Remera Rukoma hospital revealed challenges that substantially hamper attempts to deploy EHR systems.

The challenges include being unable to export paper-based documents to digital records; lack of interoperability with other systems and healthcare institution like hospital, clinics and health centers; frequent lack of internet connection or poor connection; lack of technical trainings; the smooth use is difficult; and lack of technical expertise and provider support. The challenges chosen are those with respondent rate above 50% where the highest ranked challenge scores 63.9% and the lowest ranked challenge scores 50% as they highly affect the improved use of EHR at Remera Rukoma hospital according to the respondents.

Those challenges were also found by other studies like a study done by Bisrat in 2021 and a study done by Anyango in 2017 (Anyango, 2017& Bisrat, Minda, Assamnew, Abebe, & Abegaz, 2021).

5.3 Proposed solutions for the challenges met while using of EHR

Findings from the Healthcare providers at Remera Rukoma hospital proposed the possible solutions that can hinder the EHR system use at Remera Rukoma hospital. The most proposed solution (71.3%) is improving the network and electricity in the hospital followed by linking the health centers, clinics and hospitals (interoperability) and maintaining the patient identification so that patient's information can be easily found (63.9%).

Those solutions were also found by other studies like a study conducted by Bisrat in 2021; a research conducted in USA by Cifuentes et Al. in 2017 and the study conducted in Livingstone, Zambia by Moombo. All have found that these solutions can help successful use of EHR systems (Moombo, 2017;Cifuentes et Al., 2017&Bisrat et al., 2021).

5.4 Limitation of the study

A limitation is that the research was conducted at one hospital, and not many health facilities that comprise the various governmental and private healthcare facilities that serve the various regions of Rwanda. Again, It didn't use qualitative techniques to address the issues of culture and behavior. that impede the use of EHR system in Rwanda.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSION

6.1 Recommendations

- **To Remera Rukoma hospital**

To address the challenges that the healthcare providers met while using EHR at Remera Rukoma hospital including lack of technical expertise and technical support. To improve the network and electricity, and provide trainings to healthcare providers to successful use EHR at their hospital and enhance the quality of patient care.

- **To researchers**

Make more quantitative and qualitative researches about EHR use in different hospital and health centers to reveal out the challenges that healthcare providers met while using EHR systems so that EHR will successfully use in Rwanda.

- **To Ministry of Health**

To address the problem of lack of interoperability among EHR systems; and between hospitals, and between hospitals and health centers to improve the functionality of EHR and its use in Rwanda.

6.2 CONCLUSION

The study revealed that the healthcare providers have a positive perception towards to use of EHR which could lead to a successful and sustained use of EHR system, except the challenges met which impede this successful use including being unable to export paper-based documents to digital records; lack of interoperability with other systems and healthcare institution like hospital, clinics and health centers; frequent lack of internet connection or poor connection; lack of technical trainings; the smooth use is difficult and lack of technical expertise and provider support. They have also proposed solutions like improving the network and electricity in the hospital followed by linking the health centers, clinics and hospitals and maintaining the patient ID so that patient’s information can be easily found. Therefore the hospital managers need to address those challenges showed and to use the solutions proposed to improve the usability of EHR.

REFERENCES

Adedeji, T., Fraser, H., & Scott, P. (2022). Using Electronic Health Records in Primary Care Using the Theory of Change: Nigerian Case Study. *JMIR Medical Informatics*, *10*(8). https://doi.org/10.2196/33491

Alanazi, B., Butler-, K., & Alanazi, M. (2020). *Perceptions of healthcare professionals about the adoption and use of EHR in Gulf Cooperation Council countries : a systematic review*. 1–10. https://doi.org/10.1136/bmjhci-2019-100099

Amoroso, C. L., Akimana, B., Wise, B., & Sf, H. (2010). *Using Electronic Medical Records for HIV Care in Rural Rwanda*. 337–341. https://doi.org/10.3233/978-1-60750-588-4-337

Anyango, O. J. (2016). *Investigating challenges to electronic medical record systems adoption : a case of coast province general hospital* . 1–59. Retrieved from http://su-plus.strathmore.edu/handle/11071/4577

Azliza, N., Ismail, A., Kamaruddin, I., Kadir, A., Azliza, N., Ismail, A., & Abdul, I. K. (2018). *Use of Electronic Medical Records in Developing Countries : Challenges & Barriers Use of Electronic Medical Records in Developing Countries : Challenges & Barriers*. *7*(3), 187–199. https://doi.org/10.6007/IJARPED/v7-i3/4358

Blankemeier, M. (2021). *Mary Blankemeier Sociotechnical advisor :*

Evans, R. S. (2016). *Electronic Health Records : Then , Now , and in the Future*. 48–61.

Greiver, M., Barnsley, J., Glazier, R. H., Moineddin, R., & Harvey, B. J. (2011). Use of electronic medical records: Theory-informed qualitative study. *Canadian Family Physician*, *57*(10), 390–397.

Maribel Cifuentes, RN, BSN, Melinda Davis, PhD, Doug Fernald, MA, Rose Gunn, MA, Perry Dickinson, MD, Deborah J. Cohen, P. (2017). Electronic Health Record Challenges, Workarounds, and Solutions Observed in Practices Integrating Behavioral Health and Primary Care. *Physiology & Behavior*, *176*(3), 139–148. https://doi.org/10.1053/j.gastro.2016.08.014.CagY

Mensah, N. K., Boadu, R. O., Adzakpah, G., Lasim, O. U., Amuakwa, R. D., Taylor-Abdulai, H. B., & Chatio, S. T. (2022). Electronic health records post-use challenges in selected hospitals: A qualitative study in the Central Region of southern Ghana. *Health Information Management Journal*, (May). https://doi.org/10.1177/18333583221096899

Middle, S., Publishers, E., Emirates, U. A., & Shabnum, S. (n.d.). *Nursing Perceptions of Electronic Documentation*. 926–935. https://doi.org/10.21276/sjmps

Moombo, K. (2017). *PERCEPTIONS AND EXPERIENCES OF HEALTH CARE WORKERS ON THE*. (May).

Ngusie, H. S., Kassie, S. Y., Chereka, A. A., & Enyew, E. B. (2022). Healthcare providers ' readiness for electronic health record adoption : a cross - sectional study during pre - use phase. *BMC Health Services Research*, 1–12. https://doi.org/10.1186/s12913-022-07688-x

Odekunle, F. F., Odekunle, R. O., & Shankar, S. (n.d.). *Why sub-Saharan Africa lags in electronic health record adoption and possible strategies to increase its adoption in this region*. 59–64.

Raddaha, A. H. A., Obeidat, A. A., & Hayudini, J. (2018). *Opinions , perceptions and attitudes toward an electronic health record system among practicing nurses*. (March). https://doi.org/10.5430/jnep.v8n3p12

Ramoo, V., Kamaruddin, A., Nor, W., Wan, F., Che, C. C., & Kavitha, R. (2022). *Fnjn njn*. https://doi.org/10.5152/FNJN.2022.22061

Sadoughi, F., Khodaveisi, T., & Ahmadi, H. (2019). The used theories for the adoption of electronic health record: a systematic literature review. *Health and Technology*, *9*(4), 383–400. https://doi.org/10.1007/s12553-018-0277-8

Uwambaye, P., Njunwa, K., Nuhu, A., Kumurenzi, A., & Isyagi, M. (2017). *Health care consumer ' s perception of the Electronic Medical Record (EMR) system within a referral hospital in Kigali , Rwanda Health Care Consumer ' s Perception of the Electronic Medical Record (EMR) System within a Referral Hospital in Kigali , Rw*. (May). https://doi.org/10.4314/rj.v4i1.7F

Woldemariam, M. T., & Jimma, W. (2023). Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: A systematic review. *BMJ Health and Care Informatics*, *30*(1), 8–10. https://doi.org/10.1136/bmjhci-2022-100704

Yitayew, Y. A., Aitaye, E. B., Lechissa, H. W., & Gebeyehu, L. O. (2020). Neonatal Hypothermia and Associated Factors among Newborns Admitted in the Neonatal Intensive Care Unit of Dessie Referral Hospital, Amhara Region, Northeast Ethiopia. *International Journal of Pediatrics (United Kingdom)*, *2020*. https://doi.org/10.1155/2020/3013427

APPANDICES

I. Data collection tool

A questionnaire developed to collect information about the perceptions and challenges of healthcare providers on the use of Electronic Health Record (EHR/ OpenMRS) at Remera Rukoma Hospital.

General instruction

The data collector should tick in the box corresponding to the best alternative among the alternatives proposed to complete this questionnaire. If you have another alternative that is not listed, write it in a place cold **other** and describe it. **The information given in this study will be confidential**

SECTION 1: Socio-demographic information

Name of the institution: …………………………

Nº	**Variables**	**Alternatives**
1.1	Age of respondent in years	a. 21-30 ☐ b. 31-40 ☐ c. 41-50 ☐ d. 51-60 ☐ **e.** 61 < ☐
1.2	Professional category	a. GP ☐ b. Specialist ☐ c. Midwife ☐ d. Nurse ☐ e. Mental health nurse ☐ f. Lab technician ☐ g. Pharmacist ☐ h. IT ☐ i. Cashier ☐ j. Administrative staff ☐

1.3	Service year	a. 1-5 ☐ b. 6-10 ☐ c. 11-15 ☐ d. 15< ☐
1.4	Sex of the respondent	a. Female ☐ b. Male ☐

I use an Electronic medical record in the course of my work? YES ☐ NO ☐

SECTION 2: Perceptions on the use of EHR /OpenMRS

(Select the number that represents how you feel about EMR)

Nº	Variables	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
1	It would be easy for me to become skillful at using EHRs	1	2	3	4	5
2	I prefer EHR over paper charting	1	2	3	4	5
3	Patient information obtained from EHR system is more complete as compared to Paper medical record	1	2	3	4	5
4	My involvement at the system use phase make the EHR more useful to me	1	2	3	4	5
5	I would like to use EHRs in my work in future	1	2	3	4	5

Other:……………………………………………………………………………………………
…………………………………………………………………………………………………

SECTION 3: Challenges for using EHR /OpenMRS

Nº	Variables	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
1	Smooth use is difficult	1	2	3	4	5
2	I doubt about the efficacy and privacy	1	2	3	4	5

	protocol of system; I prefer **NOT** to change the methodology we used before					
3	We are **not** trained on how to use the system and the computer	1	2	3	4	5
4	It is difficult to adapt to the system	1	2	3	4	5
5	There is a high risk for patient data leakage or cyber attack	1	2	3	4	5
6	It is hard to export paper-based documents to digital records	1	2	3	4	5
7	The technical resources are limited (technical expertise and provider supervision)	1	2	3	4	5
8	There is a frequent lack of internet connection or poor connection	1	2	3	4	5
9	There is **no** data exchange between hospital or between hospital and other clinic so that we can have access to patient data	1	2	3	4	5
10	There is **no** structural plan for EHR system use and update	1	2	3	4	5
11	There is **no** communication between healthcare providers, IT and the patient about EHR results	1	2	3	4	5
12	EHR system/OpenMRS sometime block and affect my daily performance	1	2	3	4	5
13	EHR system is hard to correct or edit an error if arise	1	2	3	4	5
14	EHR system is hard to update if a new item arise (ex: new medication)	1	2	3	4	5

15	I am **not** familiar with computer-based systems	1	2	3	4	5
16	There is an unreliable power supply/Electricity	1	2	3	4	5
17	I am fearful to manipulate computer	1	2	3	4	5
18	Using EHR is time consuming	1	2	3	4	5
19	HER use is **not** important in hospital	1	2	3	4	5

Other:……………………………………………………………………………………………

……………………………………………………………………………………………………

SECTION 4: Proposed solutions for the challenges met while using EHR /OpenMRS

4.1 What are the solutions can you propose for the challenges you meet while using EHR/OpenMRS? (List all that can apply)

II. Consent form

Introduction

I, MUGAMBINUMWE Didace, I am conducting the study about healthcare providers' perceptions, challenges and proposed solutions for the use of Electronic Health Records (EHR) in Rwandan rural hospitals: case of Remera Rukoma hospital, for obtaining a Master of Science in Public Health, track of Health Informatics in the University of Rwanda.

Purpose of the Study

To determine the challenges and perception of healthcare providers on the use of Electronic Health Records in Rwanda.

Voluntary Participation

Your participation in this research is entirely voluntary and there are no incentives for participating in this research. If you choose not to continue participating in this research project, you may withdraw at any time without any risk of penalty.

Confidentiality

The information that we are collecting in this research project will be kept confidential. If you choose to participate, the information from you will be given a code instead of your names and none will be able to link your code and your names except the researcher who is collecting it and that information will not be shared with or given to anyone except who will have access to the information. The knowledge that we get from doing this research will be shared with Remera Rukoma Hospital staff in order to improve the use of Electronic Health Records and confidential information will not be shared.

If you have any question, you may ask it now to the researcher or ask it later by contacting the researcher any time at mdidasafi2@gmail.com or 0785397739/0780312684.

Consenting

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it, and I have been answered to my satisfaction. So, I voluntarily choose to participate, as a participant, in this research.

Name of Participant or his legal guardian: ___________________

Signature: ____________________ Date __________________________

III. Ethical clearance

UNIVERSITY of RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DIRECTORATE OF RESEARCH & INNOVATION

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 14/11/2022
Ref: CMHS/IRB/525/2022

MUGAMBINUMWE Didace
Health Informatics Program,
Center of Excellence in Biomedical Engineering and E-Health (CEBE)
CMHS, UR

Dear MUGAMBINUMWE Didace,

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance for the study entitled ***"Healthcare providers' perceptions on the implementation of electronic health records (EHR) in Rwandan Rural hospitals: case of Remera Rukoma hospital. (A qualitative study)"***.

Having reviewed your application and been satisfied with your protocol, your study is hereby granted ethical clearance. The ethical clearance is valid for one year starting from the date it is issued and shall be renewed on request. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

Assoc. Prof. Stefan Jansen (PhD)
Acting Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate studies, UR

Email: researchcenter@ur.ac.rw P.O Box 3286 Kigali, Rwanda www.ur.ac.rw

IV. Final Masters Thesis Submission Form

UNIVERSITY of RWANDA

CEBE

Regional Centre of Excellence in Biomedical Engineering and e-Health (CEBE)

COLLEGE OF MEDICINE AND HEALTH SCIENCES

FINAL MASTERS THESIS SUBMISSION FORM

Names of Student	MUGAMBINUMWE Didace	**Reference Number:**	220017065
Research Title	Healthcare Providers' Perceptions, Challenges and Proposed Solutions for the Use of Electronic Health Records in Rwandan Rural Hospitals: Case of Remera Rukoma Hospital.		
Programme	Health Informatics		
Degree (Master)	Master of Sciences in Health Informatics		

APPROVAL:

Evaluator number 1: Dr. BUGINGO Emmanuel

SIGNATURE:

DATE: 29th August, 2023

ANY COMMENT: The author has tried his best to address the provided comments.

Evaluator number 2: Dr. MUTUNGIREHE Sylvestre

SIGNATURE:

DATE: 29th August, 2023

ANY COMMENT:

V. Approval from the hospital

Re ceived by
Didace MUGAMBINUMWE

EGLISE PRESBTERIENNE AU RWANDA

REMERA RUKOMA DISTRICT HOSPITAL
BP 201 KIGALI

Rukoma, on 29th November 2022

To Mr MUGAMBINUMWE Didace

RE: Acceptance for permission to conduct research

I am pleased to inform you that your request of permission to conduct a study entitled "**Healthcare provider's perception and challenges for the implementation of Electronic Health Records(HER) in Rwanda rural hospital: Case of Remera Rukoma Hospital** " has been accepted.

Thank you for your time to choose this Hospital , I look forward to be with you during fixed time of your research .

Yours Sincerely,

EGLISE PRESBYTERIENNE AU RWANDA
HOPITAL DE REMERA RUKOMA

Dr JARIBU Théogène

Director General of Remera Rukoma District Hospital

VI. Turnitin Report

Date :14/09/2023

Note

The Study Entitled "HEALTHCARE PROVIDERS' PERCEPTIONS, CHALLENGES AND PROPOSED SOLUTIONS FOR THE USE OF ELECTRONIC HEALTH RECORDS IN RWANDAN RURAL HOSPITALS: CASE OF REMERA RUKOMA HOSPITAL", is approved by the Directorate of Research and Innovation for submission in UR_CMHS Library . The plagiarism report is 12% with the following paramettes :

Exclude quote:on

Exclude bibliography :on

Exclude matches : <5words

Sincerely

Emile Nisingizwe

Research and Innovation Officer,CMHS