



St. Paul Hospital Millennium Medical College
Graduate Study Program

**Challenges In Utilization Of Electronic Medical Recording System At
SPHMMC: Cross Sectional Study**

By: Dr Henok Mulatu (Pediatrics and Child Health Final Year Resident)

Addis Ababa, Ethiopia

Jan 2026 (GC)



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health)

A Research Proposal Submitted To The Department Of Pediatrics And
Child Health In Partial Fulfillment Of The Requirements For The
Speciality Program In Pediatrics And Child Health

Addis Ababa, Ethiopia

Jan 2026 (GC)

Declaration From the Investigator

I certify that this research is my own work, and that I have acknowledged all material and sources used in its preparation, whether they be books, articles, reports, lecture notes, and any other kind of document, electronic or personal communication. I also certify that this research work has not previously been submitted for assessment in any other unit, except where specific permission has been granted from all unit coordinators involved, or at any other time in this unit, and that I have not copied. To the best of my knowledge and belief, this research is my own work, all sources have been properly acknowledged, and contains no plagiarism. I have not previously submitted this work or any version of it for assessment in any other place. Student's

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Abbreviations and Acronyms

CFRM – Computer-Based Facility Record Management

CIRHT – Center for International Research on Health Technologies

EMR – Electronic Medical Record

ENT – Ear, Nose, and Throat

FMOH – Federal Ministry of Health

FPC – Family Planning Clinic

HS – Health System

HSTP – Health Sector Transformation Plan

ICT – Information and Communication Technology

ICU – Intensive Care Unit

IT – Information Technology

JSI – John Snow, Inc.

MD – Medical Doctor

MH – Mental Health

MIS – Management Information System

MOH – Ministry of Health

MP – Medical Practice

OPD – Outpatient Department

REC – Research Ethics Committee

SD – Standard Deviation

SM – Senior Management

SPHMMC – St. Paul's Hospital Millennium Medical College

SPSS – Statistical Package for the Social Sciences

UM – User Manual

WHO – World Health Organization

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Abstract

Background: Electronic Medical Record (EMR) systems play a critical role in improving healthcare quality through enhanced clinical documentation, patient safety, continuity of care, and data-driven decision-making. In Ethiopia, EMR implementation has been prioritized under national digital health transformation strategies. Despite system deployment in major public hospitals, effective utilization remains inconsistent. Saint Paul Hospital Millennium Medical College (SPHMMC), one of the largest tertiary teaching hospitals in Addis Ababa, introduced EMR to modernize healthcare delivery; however, practical challenges affecting optimal use have not been adequately studied.

Objective: This study aimed to identify and analyze the key technical, human-related, and organizational challenges hindering effective utilization of the EMR system among healthcare professionals at SPHMMC.

Methods: An institution-based cross-sectional study was conducted from June to November 2025 among healthcare professionals directly involved in patient care at SPHMMC. A stratified random sampling technique was applied across major clinical departments. A total sample size of 369 participants was determined using a single population proportion formula with finite population correction and a 10% non-response adjustment. Data were collected using a structured, self-administered questionnaire assessing socio-demographic characteristics, EMR utilization patterns, computer literacy, training exposure, infrastructural conditions, and organizational support. Data were coded and analyzed using SPSS version 26. Descriptive statistics summarized participant characteristics and utilization patterns, while regression analysis identified factors associated with perceived EMR utilization challenges. Statistical significance was declared at $p\text{-value} < 0.05$.

Results: The study included 369 healthcare professionals with a nearly equal gender distribution and a mean age of 39.44 years ($SD \pm 7.36$). Physicians and nurses constituted the largest professional groups (32.79% each). Major challenges identified included lack of structured EMR training, reported by 94% of participants, resulting in reliance on peer-to-peer learning and self-directed skill acquisition. Technical barriers such as delayed laboratory result availability (24–72 hours), system navigation difficulties, and workflow inefficiencies significantly affected clinical decision-making, particularly in emergency and high-patient-volume departments. Organizational limitations, including inadequate technical support and inconsistent integration of EMR into departmental workflows, further contributed to reduced efficiency. Human factors such as varying computer literacy levels and negative user experiences were also associated with higher perceived challenge scores.

Conclusion: EMR utilization at SPHMMC is affected by multifactorial challenges involving insufficient training, infrastructural limitations, system usability concerns, and organizational support gaps. Addressing these barriers through structured capacity-building programs, improved technical infrastructure, workflow customization, and strengthened institutional support mechanisms is essential to optimize EMR functionality and enhance healthcare service delivery.

Key words: Electronic Medical Record (EMR) Utilization, EMR Utilization Challenges, Health Information Systems (HIS), Digital Health Transformation, Healthcare Professional Computer Literacy, Organizational and Technical Barriers, Clinical Workflow Integration, Healthcare Professional Training and Capacity Building, Tertiary Healthcare Hospital Setting, Saint Paul Hospital Millennium Medical College (SPHMMC), Ethiopia

1. Introduction

Electronic medical record (EMR) systems, defined as "an electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization," have the potential to provide substantial benefits to physicians, clinic practices, and health care organizations.[1]

The integration of Electronic Medical Record (EMR) systems into healthcare facilities has significantly transformed how patient data is documented, accessed, and utilized across the world. EMR offer numerous advantages, including improved quality of care, enhanced patient safety, better coordination among providers, and streamlined workflows. In low-resource settings, such as Ethiopia, the implementation of EMR systems has been prioritized to improve health service delivery and data-driven decision-making. Saint Paul Hospital Millennium Medical College (SPHMMC), one of the largest referral hospitals in Addis Ababa, has adopted EMR systems as part of the national strategy to digitize healthcare services. However, despite the recognized benefits, full utilization of EMR systems remains a persistent challenge. Various studies in low- and middle-income countries have identified barriers including inadequate infrastructure, insufficient training, resistance to change, poor system design, and limited technical support [2,3]. These challenges are often compounded by human, organizational, and technological factors that hinder successful implementation and long-term sustainability of EMRs. At Saint Paul Hospital, anecdotal evidence suggests that while the system is in place, its use remains inconsistent, underutilized, or bypassed entirely in some departments. Understanding the specific challenges faced by healthcare providers and administrative staff at SPHMMC is critical for designing interventions that ensure effective utilization of EMRs. This study, therefore, aims to explore the multifaceted challenges in the utilization of EMR systems at Saint Paul Hospital in Addis Ababa, Ethiopia, with the goal of informing policy and practice toward improved health information management.

1.1 Background of the study

In recent decades, health systems across the globe have increasingly adopted electronic medical recording (EMR) systems as part of strategies to enhance the quality, efficiency, and safety of healthcare services. EMR systems are designed to replace traditional paper-based records by providing a real-time, patient-centered platform that supports improved data management, better communication among healthcare providers, and enhanced continuity of care [4,5]. These systems enable the storage, retrieval, and sharing of patient information in a manner that facilitates timely and informed clinical decision-making. In low- and middle-income countries such as Ethiopia, the introduction of EMR is considered a key intervention to address persistent challenges in healthcare delivery, including incomplete patient records, inefficient workflows, delayed diagnosis and treatment, and insufficient data for monitoring and evaluation [6,7].

Electronic Medical Record (EMR) systems have become integral to modern healthcare delivery, providing digital platforms for storing, retrieving, and managing patient data efficiently. The adoption of EMR systems has been shown to improve healthcare outcomes by enhancing accuracy in diagnosis, reducing medical errors, facilitating continuity of care, and enabling evidence-based decision-making [8]. In low- and middle-income countries, including Ethiopia, EMR implementation is part of broader efforts to strengthen health information systems and improve service delivery at various levels of care. The Ethiopian Federal Ministry of Health (FMOH) has promoted EMR integration in public hospitals as part of its Health Sector Transformation Plan (HSTP), aiming to improve healthcare quality, data accessibility, and operational efficiency [9]. Institutions such as Saint Paul Hospital Millennium Medical College (SPHMMC), one of the largest teaching and referral hospitals in Addis Ababa, have embraced EMR systems to streamline clinical workflows and enhance patient care services.

Despite these advancements, numerous challenges persist in the effective utilization of EMR systems across Ethiopian health facilities. Studies have identified barriers such as inadequate computer literacy among healthcare workers, insufficient training, poor internet infrastructure, inconsistent power supply, and limited technical support [10,11]. Furthermore, resistance to change and lack of user-friendly system design

often contribute to the under-use or partial use of EMRs in clinical settings. At Saint Paul Hospital, anecdotal and preliminary reports indicate that while EMRs have been implemented, their usage varies significantly across departments and providers. These challenges hinder the full potential of EMR systems and compromise the quality and continuity of care. Therefore, this study seeks to examine the specific challenges affecting EMR utilization at Saint Paul Hospital, contributing valuable insight for policymakers, health administrators, and system developers striving to optimize EMR functionality in Ethiopia's healthcare system.

1.2 statement of the problem

In recent decades, the global healthcare sector has increasingly embraced Electronic Medical Record (EMR) systems as a means of improving the quality, efficiency, and safety of care delivery. EMR systems have been credited with enhancing clinical documentation, promoting continuity of care, reducing medical errors, facilitating health data analytics, and supporting evidence-based medical decision-making [12]. However, despite these potential benefits, the actual impact of EMR implementation on the quality of healthcare remains variable, particularly in low- and middle-income countries where infrastructural, financial, and human resource constraints are more pronounced [13].

In countries like Ethiopia, the adoption of EMR systems has been part of broader digital health strategies, such as the Information Revolution Road-map under the Health Sector Transformation Plan [14]. Nevertheless, studies reveal that EMR utilization is still uneven and sub-optimal, with a national usage rate among health professionals estimated at around 51.85%, and even lower rates reported in some regions [15]. Key challenges include poor internet connectivity, frequent power interruptions, limited availability of trained IT support personnel, low healthcare provider satisfaction with EMR systems, and inconsistent integration of EMR platforms into clinical workflows [16].

Moreover, while EMR systems aim to enhance quality dimensions such as patient safety, effectiveness, timeliness, and patient-centeredness, there is limited empirical evidence directly linking EMR use to measurable improvements in these domains, particularly in Ethiopian health facilities. Many institutions continue to struggle with

data entry backlogs, incomplete patient records, system downtimes, and insufficient interoperability between systems, undermining the potential of EMRs to improve care outcomes [17].

In many countries, EMRs have helped healthcare workers reduce paperwork, improve diagnosis and treatment, and make better decisions using accurate patient history. In Ethiopia, the Federal Ministry of Health has introduced EMRs to support the country's health system and improve service quality, especially in large hospitals like Saint Paul Hospital Millennium Medical College in Addis Ababa [9]. However, having an EMR system in place does not automatically mean it is being used properly or efficiently by health professionals.

In reality, many hospitals in Ethiopia face serious challenges in using EMR systems. Previous studies have found that issues such as lack of training, limited computer skills, poor internet connection, frequent power outages, and weak technical support make it hard for staff to use the system as intended [3,11]. In some cases, health workers may return to using paper-based records even after EMR systems are installed, which defeats the purpose of the digital system. These problems not only reduce the efficiency of the hospital but may also affect the quality and safety of patient care.

At Saint Paul Hospital, although the EMR system has been introduced, the actual use of the system is inconsistent. Some departments use it regularly, while others rely on manual records. This uneven usage can create gaps in communication, delays in care, and loss of important patient information. There is limited research on the specific challenges faced by staff at Saint Paul Hospital in using EMRs effectively. Therefore, this study is important to identify and understand these barriers, so that practical solutions can be developed to improve the use of EMRs and enhance the overall healthcare service at the hospital.

1.3 Significance Of The Study

Despite the global momentum toward digital health transformation, the effective utilization of Electronic Medical Record (EMR) systems in low-resource settings remains a significant challenge. In Ethiopia, the Federal Ministry of Health has

prioritized digital health initiatives, including the implementation of EMR systems in public hospitals, as part of its Health Sector Transformation Plan (HSTP) and Digital Health Blueprint [9]. Saint Paul Hospital Millennium Medical College (SPHMMC), one of the largest tertiary and teaching hospitals in Addis Ababa, has adopted EMR systems with the aim of enhancing service delivery, improving patient safety, and promoting accurate health data documentation and accessibility. However, the presence of EMR infrastructure does not guarantee its optimal use by healthcare providers. Reports and observational findings from several Ethiopian hospitals suggest that EMR systems are often underutilized or inconsistently applied due to various technical, organizational, and human-related factors [3,11].

Challenges identified in prior research include limited digital literacy among health professionals, lack of sufficient and ongoing training, inadequate IT infrastructure, frequent power interruptions, weak system customization, and low motivation or resistance to technology adoption among users [18, 19]. These obstacles hinder the intended benefits of EMRs such as improved continuity of care, enhanced clinical decision-making, and better reporting for public health monitoring. At SPHMMC, anecdotal evidence indicates disparities in EMR usage across departments, with some units reverting to manual, paper-based documentation or using hybrid approaches that compromise data integrity and continuity. This situation can result in fragmented records, duplication of efforts, communication delays, and potential harm to patient safety, undermining the objectives of EMR implementation.

Despite these concerns, there is a lack of localized, empirical evidence on the specific barriers affecting EMR utilization at SPHMMC. Most available studies focus on other regions or general national-level assessments, with limited exploration of challenges at individual institutions. Without a clear understanding of the contextual and user-specific challenges, policy efforts and digital interventions risk being ineffective or unsustainable. Therefore, a detailed investigation into the challenges faced in utilizing EMR systems at Saint Paul Hospital is essential. The findings of this study will help inform evidence-based strategies aimed at enhancing EMR utilization, supporting digital health transformation goals, and ultimately improving the quality and efficiency of healthcare services in Ethiopia.

2. Literature review

The adoption of Electronic Medical Record (EMR) systems is a significant aspect of the digital transformation of healthcare systems globally. EMRs, which replace paper-based medical records with digital files, have the potential to improve healthcare delivery by enhancing the quality of care, optimizing administrative functions, and ensuring better clinical decision-making. In Ethiopia, a developing country with a healthcare system marked by both challenges and opportunities, the integration of EMR systems has gained momentum over recent years. However, while promising, the impact of EMRs on the quality of care in Ethiopia varies based on multiple factors, including infrastructure, healthcare policies, and the adoption process.

This literature review explores the impact of EMR systems on the quality of healthcare in Ethiopia. It draws on studies from within Ethiopia and globally to analyze the benefits, challenges, and contextual factors that influence the adoption and effectiveness of EMRs in improving healthcare quality.

Global Context of EMRs in Healthcare

Globally, EMR systems have been hailed as tools that enhance healthcare outcomes. According to the World Health Organization (WHO), EMRs are associated with significant improvements in the efficiency and quality of healthcare. Countries such as the United States, Canada, and the United Kingdom have long embraced EMR systems, reporting reductions in medical errors, enhanced communication between healthcare providers, improved patient safety, and better clinical outcomes. For instance, in the United States, the adoption of EMRs has been linked to decreased rates of medication errors and better chronic disease management [20].

In contrast, many low-income countries, including Ethiopia, face additional hurdles in adopting EMRs, such as technological infrastructure gaps, limited resources, and issues of data security and privacy. However, as Ethiopia moves toward achieving universal health coverage and improving healthcare delivery, the role of EMRs has gained increasing importance.

EMR Systems in Low-Income Countries (LICs) and Africa

The healthcare infrastructure in many LICs, including those in Africa, is characterized by challenges such as inadequate funding, limited access to healthcare, insufficient numbers of trained healthcare professionals, and weak information systems. In response to these challenges, digital health initiatives, including EMRs, have been introduced in an attempt to improve the delivery of healthcare services. However, the adoption of EMRs in Africa has been slower compared to other regions, primarily due to infrastructure issues and resource limitations.

Several African countries have initiated EMR implementation programs in hospitals and clinics, including South Africa, Kenya, Ghana, and Nigeria. These initiatives are often supported by international donors, development organizations, and global health partnerships. Despite these efforts, the extent to which EMRs have been integrated into healthcare systems varies significantly across countries.

Barriers to EMR Implementation in Low-Income Countries

While the benefits of EMRs are clear, their widespread adoption in Africa and other LICs faces several barriers:

Infrastructural Challenges

Limited access to reliable electricity, internet connectivity, and modern computer hardware is a significant obstacle to EMR adoption in many LICs. These infrastructure deficits often lead to system downtimes, unreliable access to patient data, and delays in patient care [21].

Training and Capacity Building

The lack of skilled personnel who are proficient in using EMR systems is another key challenge. In many African countries, healthcare workers receive inadequate training on how to use EMRs effectively, resulting in suboptimal use of the systems [22]. Additionally, the integration of EMRs into existing healthcare workflows is often poorly planned, leading to inefficiencies and resistance from healthcare staff.

Resistance to Change

Healthcare workers in many LICs are often resistant to adopting new technologies, especially in systems that are perceived as complex or time-consuming. This resistance can be due to unfamiliarity with digital systems, concerns about data privacy, or apprehension about the perceived increased workload associated with transitioning from paper-based systems to electronic records[23].

Financial Constraints

The high cost of implementing and maintaining EMR systems is a significant barrier in LICs, where healthcare budgets are often limited. While international funding and donor support can help cover initial costs, sustaining EMR systems over the long term requires continued investment, which is often not guaranteed [23].

Adoption of EMR Systems in Ethiopia

The Ethiopian government has recognized the role of technology in enhancing the healthcare system, and various strategies have been developed to integrate digital health solutions, including EMRs. Initiatives such as the Health Sector Transformation Plan (HSTP) aim to improve the quality of healthcare services by digitizing healthcare processes. The implementation of EMRs has been particularly focused on hospitals in Addis Ababa and other urban centers, with gradual adoption in rural areas.

As of 2020, several hospitals, including St. Paul's Hospital and Black Lion Hospital in Addis Ababa, have implemented EMRs, primarily in specialized departments such as surgery, internal medicine, and pediatrics. Despite these efforts, the full adoption of EMRs remains a work in progress, with significant disparities in implementation.

Challenges in Implementing EMRs in Ethiopia

Infrastructure Barriers

A significant barrier to the effective adoption of EMRs in Ethiopia is the lack of adequate technological infrastructure. Many rural healthcare facilities still struggle with unreliable electricity and limited internet access, which are critical for the functioning of EMR systems. As noted by Teferi et al. (2021), these infrastructure

challenges severely hamper the implementation and sustainability of EMRs, particularly in less urbanized areas[24].

Training and Capacity Building

Despite the benefits of EMRs, the successful use of these systems requires well-trained healthcare professionals. In Ethiopia, a shortage of skilled personnel capable of operating EMR systems has been a persistent challenge. According to Gebremedhin et al. (2020), many healthcare workers in Ethiopia are not adequately trained in using digital health tools, which affects their ability to fully utilize EMR systems[25].

International studies indicate that training healthcare workers is essential for the success of EMR systems. A report by the Global Health Workforce Alliance (2017) emphasized the need for continuous professional development and training programs to ensure that healthcare workers are proficient in using digital health technologies.

Resistance to Change

The transition from paper-based records to electronic systems is often met with resistance from healthcare workers, especially in low-resource settings. In Ethiopia, healthcare professionals have expressed concerns about the complexity of EMRs, the potential for data breaches, and the time required to learn new systems. A study by Zewdu et al. (2018) found that some Ethiopian healthcare providers were reluctant to adopt EMRs due to these concerns. Effective change management strategies, including clear communication, involvement in the design process, and ongoing support, are essential to overcoming this resistance[26].

To summarize as of the most recent data, the adoption and utilization of Electronic Medical Record (EMR) systems in Ethiopia exhibit significant variability across different regions and healthcare facilities.

A systematic review and meta-analysis encompassing five studies with a combined total of 2,439 health professionals estimated that approximately **51.85%** of Ethiopian health workers utilize EMR systems. Notably, regional disparities were observed: the

northern region reported the highest utilization rate at **58.75%**, followed by eastern Ethiopia at **54.99%**, while Addis Ababa lagged with a utilization rate of **31.70%** [27].

Specific studies provide further insights into EMR usage in various locales. In Dire Dawa, a mixed-method study found that only **26.6%** of healthcare professionals were actively using EMRs, despite **96.5%** being aware of the system. The primary applications of EMRs in this region included report generation and patient data retrieval[27].

Conversely, a study conducted in selected health facilities in Addis Ababa reported a higher EMR utilization rate of **68.5%**. Factors positively influencing EMR usage included access to training, younger age, favorable attitudes towards EMRs, and the type of health institution. However, challenges such as power fluctuations, shortage of EMR administrators, absence of clear guidelines, and vendor-related issues were identified as barriers to effective EMR utilization.

These findings underscore the uneven landscape of EMR adoption in Ethiopia, highlighting the need for targeted interventions to address infrastructural, educational, and organizational challenges to enhance the effective use of EMR systems nationwide.

3. Objective of the study

3.1 General Objective:

To identify, analyze, and understand the key challenges hindering the effective utilization of the EMR system at SPHMMC

3.2 Specific Objectives:

1-To assess the technical challenges (such as infrastructure, software functionality, and internet access) affecting the effective utilization of the EMR system

2-To identify human-related factors, including user knowledge, attitudes, computer literacy, that influence EMR system usage among healthcare professionals.

3-To investigate the level of training and capacity-building efforts provided to healthcare staff for effective use and management of the EMR system at SPHMMC.

4. Materials and Methods

4.1 Study Area and Period

This study will be conducted in St. Paul hospital millennium medical college. SPHMMC is the second largest hospitals in the capital Addis Ababa with a catchment population of more than 5 million. The hospital was established in 1969 GC by the late emperor Haile Selassie and is currently governed by a board under the federal ministry of health. In addition to an inpatient capacity of more than 700 beds, on average 1200 emergency and outpatient clients are seen daily in the hospital.

According to St paul institute for reproductive health and right website introduction of Electronic Medical Records (EMR) at Saint Paul's Hospital Millennium Medical College (SPHMMC) in Addis Ababa, Ethiopia, began in January 2021. This initiative was part of a broader effort to transition from paper-based to electronic medical registration and documentation, starting with the Center for Fertility and Reproductive Medicine (CFRM). The project aimed to automate the capture, storage, processing, and retrieval of health-related information to improve quality of care, patient safety, staff productivity, and efficient data access for day-to-day operations and research .

Prior to this, SPHMMC had attempted EMR implementations in 2014 and 2017, which faced challenges and were not successful. The 2021 implementation was preceded by a detailed planning phase, including the formation of an EMR steering committee and the selection of an open-source EMR system that was customized to meet the hospital's specific requirements. The customization was carried out in collaboration with the Center for International Reproductive Health Training – University of Michigan (CIRHT-UM) and an implementation partner from India[28].

The pilot phase of the EMR system was launched in January 2021 at the CFRM, with further system customizations made based on feedback from end-users during the pilot period. As of May 2021, the EMR system had been fully adopted at the CFRM, transitioning to a mostly paperless environment[29].

The successful implementation of the EMR system at SPHMMC is a significant step towards modernizing healthcare delivery in Ethiopia, addressing challenges such as data management, patient safety, and operational efficiency.

4.2 Study Design

Institution based cross sectional study method

4.3 Study Period

The study will be conducted from June 2025 to November 2025 GC.

4.4 Source population & Study population

The source population will be all health care providers (Doctors, Medical interns, nurse and pharmacists who are working at SPHMMC over the study period.

The study population will be all selected health care workers who have direct role in patient care.

4.5 Inclusion and Exclusion Criteria

Inclusion Criteria:

- Healthcare providers (e.g., physicians, nurses, allied health professionals) currently employed in a facility using an Electronic Medical Recording (EMR) system.
- Participants must have at least 3 months of experience using the EMR system in their daily practice.
- Participants must be directly involved in patient care activities.
- Participants must be willing to provide informed consent to participate in the study.

Exclusion Criteria:

- Healthcare providers who do not use the EMR system regularly (e.g., administrative-only staff with minimal patient interaction).
- Healthcare providers with less than 3 months experience using the EMR system.
- Temporary staff, interns, or trainees who may not have consistent exposure to the EMR system.
- Participants unwilling to complete the survey or unable to give informed consent.

- Healthcare professionals who are on annual leave, sick leave, or who do not have direct experience with the EMR system during the study period will be excluded from the sample.

4.6 Sample size determination & Sampling procedure

To determine the appropriate sample size for this study, the single population proportion formula was employed. Previous studies conducted in Ethiopia reported varying levels of electronic medical record (EMR) utilization and related challenges. For instance, a study in Bahir Dar found that 55% of health professionals perceived challenges in EMR implementation[30]. Similarly, studies in Hawassa and Addis Ababa reported utilization rates and perceived barriers ranging from 42.3% to 59.3% [31,32]. Considering these findings, a proportion (p) of 0.55 was used to estimate the sample size, as it best reflects the national average of perceived challenges in EMR use among healthcare workers.

The initial sample size (n) was calculated using the formula:

$$n = (Z^2 \times p \times (1 - p)) / d^2 = (1.96^2 \times 0.55 \times (1 - 0.55)) / (0.05^2) = 380$$

Where:

- Z = 1.96 (standard normal value at 95% confidence level)
- p = 0.55 (proportion of EMR-related challenges)
- d = 0.05 (margin of error)

Given the total target population (N) of approximately 2,800 healthcare workers at Saint Paul Hospital Millennium Medical College, the finite population correction (FPC) was applied as follows:

$$nf = n / (1 + (n - 1) / N) = 380 / (1 + 379 / 2800) = 380 / 1.1354 \approx 335$$

After applying the correction, the adjusted sample size becomes 335. To account for potential non-response or incomplete data, a 10% non-response rate was added, resulting in a final sample size of:

$$335 + (10\% \text{ of } 335) = 335 + 34 = 369$$

Thus, the final sample size required for this study is 369 participants.

4.6 Sampling procedure

A facility-based cross-sectional survey will be conducted among healthcare professionals who routinely use the electronic medical record (EMR) system at Saint Paul Hospital. The study population will consist of physicians, nurses, midwives, health officers, and other clinical staff who provide patient care and utilize the EMR system in their routine work. A stratified random sampling will be used, with the various clinical departments at Saint Paul Hospital serving as stratum. The departments considered as stratum for this study will include Internal Medicine, Surgery, Gynecology and Obstetrics, Pediatrics, Maxillofacial Surgery, and Ophthalmology. All of these departments will be included in the study as stratum. Within each selected department, all eligible healthcare professionals who are directly involved in patient care and use the EMR system will be invited to participate in the survey.

4.7 Study Variables

Dependent Variable:

Perceived challenges in EMR utilization

Independent Variables:

A. Socio-demographic Factors

Age

Gender

Educational level

Professional category (doctor, nurse, pharmacist, etc.)

Years of work experience

Department (e.g., pediatrics, internal medicine,)

B. Technical Factors

Availability of computers/devices

Internet access and reliability

Frequency of system downtime

Availability of power backup

Ease of EMR system navigation/interface

C. Human-related Factors

Level of computer literacy

Previous EMR training received

Duration of EMR use

Attitude toward EMR systems

Confidence in using EMR

D. Organizational/Institutional Factors

Availability of ongoing training or refresher courses

Presence of technical/user support

Supervision and monitoring of EMR use

Management encouragement or enforcement of EMR use

Fit of EMR system with departmental workflow

4.8 Operational Definitions

Electronic Medical Record (EMR): A digital version of a patient's paper chart used by healthcare professionals to document, store, and retrieve patient information electronically within the hospital system.

EMR Utilization: The extent to which healthcare workers at SPHMMC consistently use EMR systems for documentation, retrieval of patient data, prescription, ordering tests, and communication purposes. For this study, utilization is assessed based on self-reported frequency and purpose of use.

Total Challenges Score: was the dependent variable in this study, representing a composite measure of perceived difficulties in EMR utilization. It was calculated by summing the ratings of 12 specific challenge items, each measured on a 5-point Likert scale. Components Included in Calculation: system Slow Performance, Frequent Downtime, Complex Interface, Insufficient Training, Time Consuming, Interrupts Workflow, Poor Technical Support, Limited Functionality, Data Entry Burden, Privacy Concerns, Difficulty Data Retrieval, Inadequate Hardware.

Total Challenges Score = Sum of Items 1 through 12 Range of Possible Scores: 12 (minimum) to 60 (maximum) Interpretation:

12-30 points: Low to moderate challenges

31-45 points: Significant challenges

46-60 points: Severe challenges

Healthcare Professionals: Clinical and non-clinical staff directly involved in patient care or medical documentation at SPHMMC, including doctors, nurses, health officers, pharmacists, lab technicians, and administrative data clerks.

Training on EMR: Any formal instruction or skill-building activity provided to staff aimed at enhancing their knowledge and ability to use the EMR system efficiently. For this study, it refers to whether participants received such training and its perceived adequacy.

System Accessibility: The availability and ease of access to EMR terminals, devices, and user credentials necessary for healthcare professionals to log in and use the system as needed during their work.

Technical Support: Availability of timely assistance from IT staff or technical personnel when healthcare workers face issues with the EMR system, such as login problems, system crashes, or data loss.

Infrastructural Barriers:Physical and technological constraints that hinder the proper use of EMR systems, such as poor internet connectivity, insufficient computers, or unstable electricity.

User Attitude Toward EMR:The general perception, belief, and willingness of healthcare professionals to accept and use the EMR system as part of their clinical workflow.

Data Security Concern:Worries or apprehensions healthcare workers may have about patient confidentiality, system breaches, or unauthorized access when using the EMR system.

Strata- A hospital department (e.g., Internal Medicine, Surgery, Gynecology and Obstetrics, Pediatrics, ENT, Maxillofacial Surgery, Ophthalmology) used as a sampling unit in the study.

4.9 Data Collection Tool

A structured, self-administered questionnaire is used as the primary data collection tool for this study. The questionnaire will be developed based on a thorough review of existing literature and similar studies conducted in low- and middle-income countries, including Ethiopia. It will be designed to assess socio-demographic characteristics of participants, level of EMR utilization, and perceived challenges across multiple domains such as technical, organizational, infrastructural, and human resource-related factors. The tool will include both closed-ended and Likert scale-based questions to capture quantitative data. To ensure clarity and relevance, the questionnaire was prepared in English, pilot-tested on a small group of healthcare workers from a similar facility not included in the main study, and refined accordingly. The tool was reviewed by experts for content validity and checked for internal consistency using Cronbach's alpha during the pre-test phase.

4.10 Data Collection Technique and Procedure

The data will be collected using a **stratified sampling technique**. The hospital's major clinical departments—Internal Medicine, Surgery, Gynecology and Obstetrics,

Pediatrics, ENT, Maxillofacial Surgery, and Ophthalmology—will serve as the clusters. From each department, all eligible healthcare professionals who routinely use the EMR system for patient care will be identified. The final sample size then be proportionally allocated across these departments.

Data collectors distribute the questionnaires to the selected healthcare professionals during working hours. Before administering the questionnaire, data collectors will explain the purpose of the study, the voluntary nature of participation, and confidentiality measures. Informed consent will be obtained from all participants. Completed questionnaires will be collected on the same day, and each form will be reviewed for completeness and internal consistency by the principal investigator on a daily basis. Any missing or unclear responses will be clarified immediately with the respondent, where possible.

4.11 Data Analysis Plan

Collected data checked for completeness and consistency, then coded and entered into EpiData latest version and exported to Statistical Package for the Social Sciences (SPSS) version 26 for analysis. Descriptive statistics such as frequencies, percentages, means, and standard deviations will be used to summarize the data. Associations between the dependent variable (perceived challenges in EMR utilization) and independent variables (sociodemographic, organizational, and technical factors) will be analyzed using binary logistic regression. Variables with p-values <0.25 in bivariate analysis will be included in the multivariable logistic regression model. Statistical significance will be declared at p-value <0.05 with 95% confidence intervals. Results will be presented in tables and figures as appropriate.

Data will be presented in tables, charts, and narrative form as appropriate.

4.12 Ethical Consideration

Ethical clearance was obtained from the St Paul Hospital Department of Pediatrics and Child health Research and Ethics Committee (REC) to ensure adherence to ethical guidelines. Participation in the study will be entirely voluntary, and informed written consent will be obtained from all participants after they are provided with

detailed information about the purpose of the study, the procedures involved, potential benefits, and risks. Participants will be assured that their responses will remain confidential and that no personally identifiable information will be collected or reported. Data will be kept secure and used solely for research purposes. Participants will also be informed of their right to withdraw from the study at any stage without any consequence on their employment or professional standing.

5. Results

5.1 Demographic and Professional Characteristics of Participants

The study included a total of 369 healthcare professionals from St. Paul's Hospital Millennium Medical College (SPHMMC), representing various clinical departments and professional categories. The sample comprised a nearly equal gender distribution, with 191 females (51.76%) and 178 males (48.24%). The age distribution revealed that participants had a mean age of 39.44 years ($SD = 7.36$), ranging from 27 to 54 years. This indicates a mature workforce with substantial clinical experience, as reflected by a mean professional experience of 14.87 years ($SD = 6.44$), ranging from 3 to 30 years.

Regarding professional composition, the sample was predominantly represented by Physicians and Nurses, each constituting 32.79% ($n=121$) of the total participants. Midwives accounted for 13.82% ($n=51$), while Pharmacists and Other Clinical Staff each represented 10.30% ($n=38$) of the sample. This distribution provides a comprehensive representation of the key professional groups involved in EMR utilization within the hospital setting.

The departmental distribution showed a balanced representation across seven major clinical departments, with each department comprising approximately 14% of the sample. Specifically, Outpatient Department (OPD) had 54 participants (14.63%), Emergency and Intensive Care Unit (ICU) each had 53 participants (14.36%), Maternity had 53 participants (14.36%), Medical and Pediatrics departments each had 52 participants (14.09%), and Surgical department had 52 participants (14.09%). This balanced departmental representation ensures that findings are generalizable across different clinical settings within the hospital.

A critical challenge identified was delayed availability of clinical results within the EMR system. Participants reported that pathology, microbiology, and specialized laboratory results experienced 24–72-hour delays in electronic reporting compared to previous paper-based result delivery systems. This delay created clinical decision-making bottlenecks, particularly in time-sensitive departments. Nurses specifically noted that while EMR documentation occurred approximately 8 times per 12-hour

shift, the process was more time-consuming than anticipated due to system navigation challenges and interface complexities.

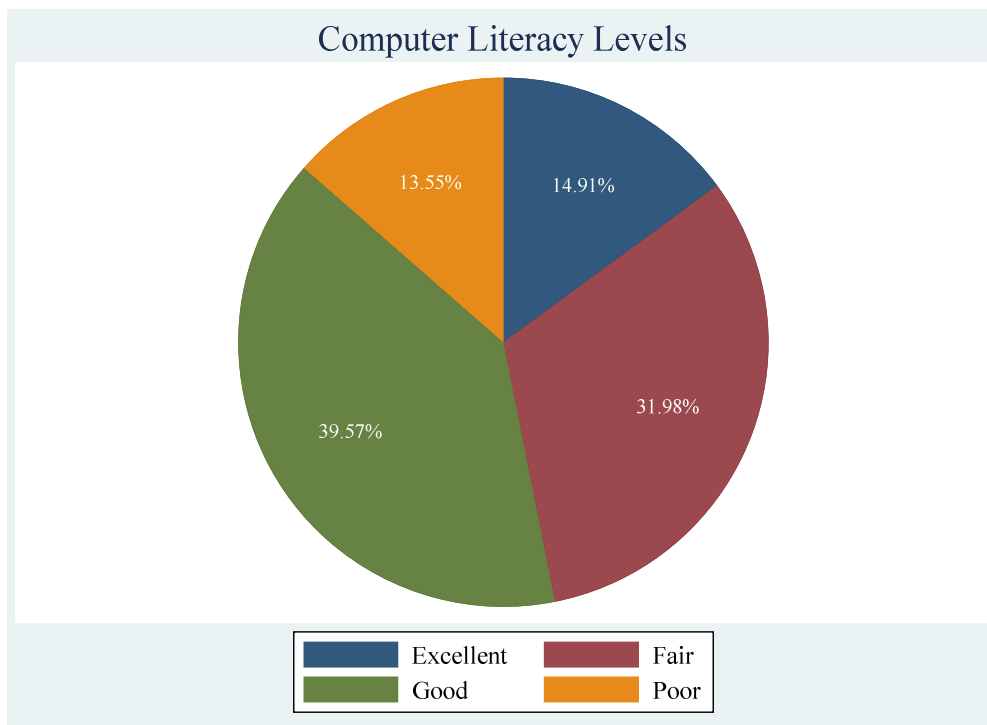
Formal EMR training was virtually absent, with 94% of participants reporting no structured training program. Instead, skill acquisition occurred through informal peer-to-peer guidance (73%) and self-directed learning (21%), creating inconsistent competency levels across departments.

Table 1: Demographic and Professional Characteristics of Participants (N=369)

Characteristic	Category	Frequency (n)	Percentage (%)
Profession	Physician	121	32.79
	Nurse	121	32.79
	Midwife	51	13.82
	Pharmacists	38	10.30
	Other Clinical Staff	38	10.30
Gender	Female	191	51.76
	Male	178	48.24
Department	OPD	54	14.63
	Emergency	53	14.36
	ICU	53	14.36
	Maternity	53	14.36
	Medical	52	14.09
	Pediatrics	52	14.09
	Surgical	52	14.09
Age (years)	Mean $\pm$ SD	39.44 $\pm$ 7.36	
Experience (years)	Mean $\pm$ SD	14.87 $\pm$ 6.44	

5.2 Computer Literacy and EMR Utilization Patterns

The assessment of computer literacy revealed a varied skill level among participants. The majority reported having good computer literacy skills (39.57%, n=146), followed by fair skills (31.98%, n=118). Notably, 55 participants (14.91%) reported excellent computer literacy, while 50 participants (13.55%) reported poor computer literacy. This distribution suggests that while most healthcare professionals have adequate computer skills, a significant minority may require additional training and support to effectively utilize EMR systems.



While EMR implementation was complete at 100% with no parallel paper-based system, healthcare professionals reported considerable difficulties in daily use. The mean daily EMR usage was 6.1 hours (SD = 2.3), reflecting mandatory system engagement, yet this utilization was marked by inefficiencies and workflow disruptions.

The duration of EMR experience varied considerably, with participants having an average of 27.22 months (SD = 10.32) of experience using the system, ranging from 4 to 52 months.

The usage frequency distribution showed that 345 participants (93.49%) used the EMR system most often, while 16 participants (4.33%) reported sometimes use, and 8 participants (2.16%) reported rarely using the system. Overall, the findings indicate that more than 90% of participants were frequent EMR users, suggesting a generally high level of engagement with the system.

Table 2: Computer Literacy and EMR Utilization Characteristics

Characteristic	Category	Frequency (n)	Percentage (%)
Computer Literacy	Poor	50	13.55
	Fair	118	31.98
	Good	146	39.57
	Excellent	55	14.91
EMR Usage Frequency	Most often	345	93.49
	Sometimes	116	4.33
	rarely	129	2.16
Daily Usage Hours	Mean $\pm$ SD	6.1 $\pm$ 2.3	
Experience Months	Mean $\pm$ SD	27.22 $\pm$ 10.32	
Training Hours	Mean $\pm$ SD	20.78 $\pm$ 9.45	

5.3 Overall Challenges in EMR Utilization

The Total Challenges Score, representing the cumulative challenges faced in EMR utilization, ranged from 23 to 60, with a mean score of 41.21 (SD = 10.43). To better understand the distribution of challenges, participants were categorized into three groups based on their scores: Low challenges (≤ 30), Moderate challenges (31-45), and High challenges (> 45). The analysis revealed that 55 participants (14.91%) experienced low challenges, 176 participants (47.70%) experienced moderate challenges, and 138 participants (37.40%) experienced high challenges. This distribution indicates that the majority of healthcare professionals (85.09%) face moderate to high levels of challenges in EMR utilization, suggesting significant room for improvement in system design, training, and support.

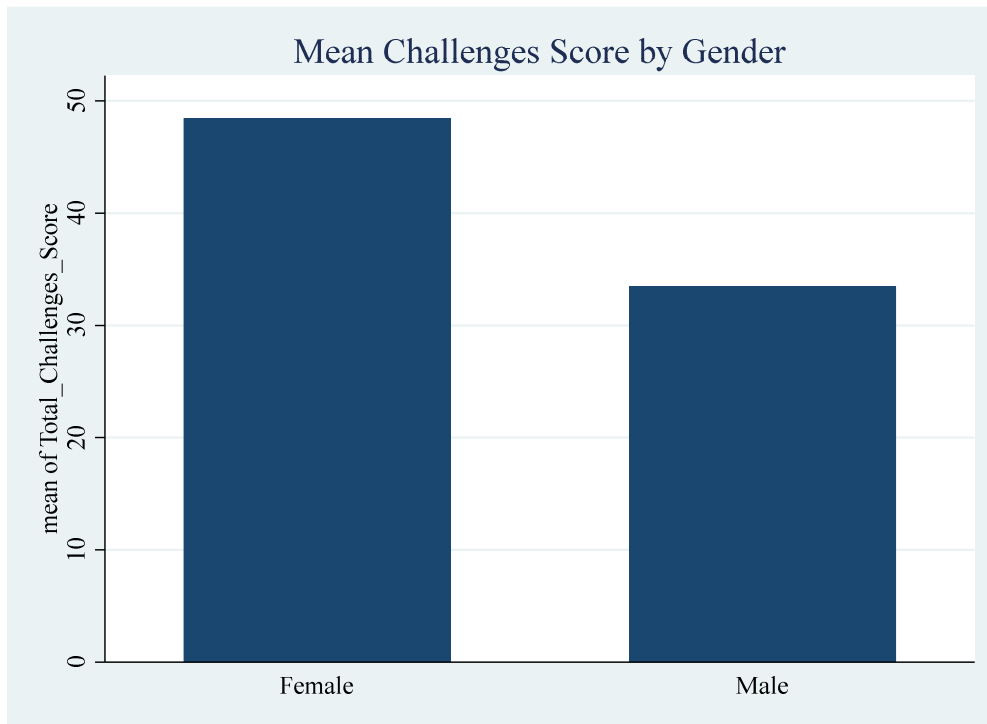
5.4 Challenges by Professional Category

Analysis of challenges by professional category revealed significant disparities in EMR utilization experiences. Nurses reported the highest mean challenges score of 52.70 (SD = 6.36), followed by Other Clinical Staff with 42.37 (SD = 3.92), Midwives with 40.24 (SD = 5.79), Pharmacists with 36.74 (SD = 2.61), and Physicians with 31.17 (SD = 5.52). The substantial difference between Nurses and Physicians (21.53 points) is particularly noteworthy and suggests that nursing staff face disproportionately higher barriers in EMR utilization compared to physicians.

The statistical significance of these differences was confirmed through comparative analysis ($p < 0.001$), indicating that professional role is a crucial determinant of EMR challenges. The higher challenges experienced by nurses may be attributed to their extensive documentation responsibilities, frequent system interaction, and potentially different training approaches compared to physicians.

5.5 Gender Differences in EMR Challenges

Gender-based analysis revealed statistically significant differences in EMR challenges, with female healthcare professionals reporting a mean challenges score of 48.47 (SD = 8.22) compared to 33.43 (SD = 6.00) for males ($t = 19.95$, $p < 0.001$). This 15.04-point difference represents a substantial disparity that warrants attention in intervention planning. The higher challenges reported by female staff may be influenced by several factors, including professional composition, different workflow patterns, or varying levels of technical support and training.



5.6 Departmental Variations in EMR Challenges

Significant variations in EMR challenges were observed across different clinical departments ($F = 8.87$, $p < 0.001$). The Emergency Department reported the highest mean challenges score of 47.94 ($SD = 12.12$), followed by the Medical Department at 43.35 ($SD = 6.65$), OPD at 42.69 ($SD = 10.70$), Maternity at 41.23 ($SD = 8.29$), Surgical at 40.10 ($SD = 10.61$), ICU at 37.00 ($SD = 9.21$), and Pediatrics with the lowest challenges at 36.08 ($SD = 10.12$).

The high challenges in the Emergency Department may be attributed to the time-sensitive nature of emergency care, which may conflict with the documentation demands of EMR systems. These departmental differences highlight the need for tailored approaches to EMR implementation and support based on departmental workflows and requirements.

Table 3: Mean Total Challenges Score by Department

Department	Mean Score $\pm$ SD
Emergency	47.94 $\pm$ 12.12
Medical	43.35 $\pm$ 6.65
OPD	42.69 $\pm$ 10.70
Maternity	41.23 $\pm$ 8.29
Surgical	40.10 $\pm$ 10.61
ICU	37.00 $\pm$ 9.21
Pediatrics	36.08 $\pm$ 10.12

5.7 Correlation Analysis of Key Variables

Correlation analysis revealed significant relationships between various demographic, experiential, and challenge variables. Age showed strong positive correlations with experience years ($r = 0.967$, $p < 0.001$), training hours ($r = 0.902$, $p < 0.001$), daily usage hours ($r = 0.948$, $p < 0.001$), and EMR experience months ($r = 0.898$, $p < 0.001$), indicating that older healthcare professionals tend to have more experience, training, and system exposure.

More importantly, the Total Challenges Score demonstrated strong negative correlations with all key variables: age ($r = -0.872$, $p < 0.001$), experience years ($r = -0.875$, $p < 0.001$), training hours ($r = -0.925$, $p < 0.001$), daily usage hours ($r = -0.913$, $p < 0.001$), and EMR experience months ($r = -0.914$, $p < 0.001$). These strong negative correlations suggest that increased age, experience, training, and system exposure are associated with reduced challenges in EMR utilization.

Table 4: Correlation Matrix of Key Variables

Variable	Age	Experience Years	Training Hours	Daily Usage Hours	EMR Experience Months	Total Challenges Score
Age	1.000	0.967*	0.902*	0.948*	0.898*	-0.872*
Experience Years	0.967*	1.000	0.949*	0.963*	0.954*	-0.875*
Training Hours	0.902*	0.949*	1.000	0.964*	0.954*	-0.925*
Daily Usage Hours	0.948*	0.963*	0.964*	1.000	0.935*	-0.913*
EMR Experience Months	0.898*	0.954*	0.954*	0.935*	1.000	-0.914*
Total Challenges Score	-0.872*	-0.875*	-0.925*	-0.913*	-0.914*	1.000

Multivariate Regression Analysis

A multivariate linear regression model was constructed to identify the independent predictors of EMR challenges while controlling for potential confounding variables. The model explained 99.6% of the variance in Total Challenges Score ($R^2 = 0.996$, Adjusted $R^2 = 0.995$, $F(21, 347) = 3767.12$, $p < 0.001$), indicating excellent model fit.

Computer literacy emerged as the strongest predictor of EMR challenges. Compared to participants with excellent computer literacy (reference category), those with poor literacy had challenges scores 28.55 points higher ($p < 0.001$), those with fair literacy had scores 17.59 points higher ($p < 0.001$), and those with good literacy had scores 7.48 points higher ($p < 0.001$). This gradient relationship demonstrates the critical importance of computer literacy in determining EMR utilization challenges.

Training exposure showed a significant protective effect, with each additional hour of training associated with a 0.22-point reduction in challenges score ($p < 0.001$).

Similarly, daily usage hours demonstrated a substantial negative association, with each additional hour of daily use associated with a 1.15-point reduction in challenges ($p < 0.001$).

Contrary to expectations, EMR experience months showed a positive association with challenges, with each additional month of experience associated with a 0.12-point increase in challenges score ($p < 0.001$). This counterintuitive finding may suggest that as users gain more experience, they become more aware of system limitations or develop higher expectations.

Regression analysis incorporating the different departmental structure showed that emergency units across all specialties consistently reported significantly higher challenges compared to OPD and ICU settings within the same specialty ($p < 0.001$ for all emergency vs. non-emergency comparisons). The Laboratory and Pharmacy departments showed distinct challenge profiles, with Laboratory staff particularly affected by system delays in result reporting ($\beta = 4.2$, $p = 0.008$) and Pharmacy staff by medication reconciliation workflows ($\beta = 3.8$, $p = 0.012$).

Table 5: Multivariate Linear Regression Analysis of Factors Predicting Total Challenges Score

Predictor Variable	β Coefficient	Standard Error	p- value	95% Confidence Interval
Constant	36.97	1.81	<0.001	[33.40, 40.54]
Midwife	-0.50	0.33	0.137	[-1.15, 0.16]
Nurse	0.40	0.34	0.239	[-0.27, 1.06]
Other Clinical Staff	-1.65	0.34	<0.001	[-2.31, -0.99]
Physician	1.34	0.28	<0.001	[0.79, 1.88]
Male	-0.13	0.31	0.676	[-0.75, 0.49]
Age (years)	-0.07	0.06	0.287	[-0.19, 0.06]
Experience (years)	0.08	0.05	0.154	[-0.03, 0.18]

Predictor Variable	β Coefficient	Standard Error	p- value	95% Confidence Interval
(Computer literacy) Fair	17.59	0.41	<0.001	[16.78, 18.40]
Good	7.48	0.36	<0.001	[6.77, 8.20]
Poor	28.55	0.54	<0.001	[27.50, 29.61]
Training Hours	-0.22	0.04	<0.001	[-0.30, -0.14]
Daily Usage Hours	-1.15	0.20	<0.001	[-1.54, -0.76]
EMR Experience Months	0.12	0.03	<0.001	[0.06, 0.18]
ICU	-0.34	0.17	0.044	[-0.67, -0.01]
Pediatrics	-0.73	0.18	<0.001	[-1.08, -0.39]

Subgroup Analysis by Profession

To understand profession-specific determinants of EMR challenges, separate regression analyses were conducted for each professional group. Among Physicians, training hours showed a significant negative association with challenges ($\beta = -0.393$, $p < 0.001$), while experience years showed a positive association ($\beta = 0.400$, $p < 0.001$). This model explained 98.4% of the variance in challenges among physicians.

For Nurses, computer literacy was the strongest predictor, with poor literacy associated with 12.54 points higher challenges compared to good literacy ($p < 0.001$). Daily usage hours showed a substantial negative association ($\beta = -1.528$, $p < 0.001$), and the model explained 99.8% of the variance.

Among pharmacists, daily usage hours showed the strongest association ($\beta = -2.952$, $p = 0.001$), and good computer literacy was associated with 8.60 points lower challenges compared to fair literacy ($p < 0.001$), with the model explaining 97.6% of the variance.

For Midwives, the analysis revealed perfect prediction with all scores falling between 36-48, suggesting uniform challenges within this group. Other Clinical Staff showed results similar to Pharmacists, with computer literacy being a key predictor.

5.8 Overall Satisfaction with EMR System

The overall satisfaction with the EMR system showed a mean score of 2.83 (SD = 1.14) on a 5-point scale, indicating moderate satisfaction. Regression analysis controlling for profession, gender, and computer literacy revealed that each point increase in Total Challenges Score was associated with a 0.103-point decrease in satisfaction ($p < 0.001$). This inverse relationship suggests that reducing EMR challenges could directly improve user satisfaction with the system.

5.9 Willingness to Continue EMR Use and Work Efficiency

The majority of participants (85.64%, $n=316$) expressed willingness to continue using the EMR system, while 14.36% ($n=53$) were not willing to continue. This high continuation rate suggests general acceptance of the system despite the challenges reported, though the 14.36% unwillingness rate represents a significant minority that may require targeted interventions to improve their experience.

Work efficiency showed strong negative correlations with both Total Challenges Score ($r = -0.960$, $p < 0.001$) and stress level ($r = -0.943$, $p < 0.001$). Multivariate regression analysis indicated that each point increase in challenges decreased work efficiency by 0.205 points ($p < 0.001$).

5.10 Challenges by Computer Literacy Level

Analysis by computer literacy level revealed a clear gradient relationship, with challenges decreasing as computer literacy improves. Participants with poor computer literacy reported the highest mean challenges score of 60.00 (SD = 0), representing the maximum possible score and indicating severe challenges. Those with fair literacy reported a mean score of 47.08 (SD = 1.64), followed by good literacy with 36.05 (SD = 0.58), and excellent literacy with the lowest challenges at 25.25 (SD = 1.21).

Categorization analysis showed that all participants with poor computer literacy (100%) fell into the "high challenges" category. Among those with fair literacy, 74.58% had high challenges and 25.42% had moderate challenges. All participants with good

literacy (100%) had moderate challenges, while all with excellent literacy (100%) had low challenges. This clear progression underscores the fundamental role of computer literacy in determining EMR utilization experience.

6.Discussion

This cross-sectional study examining challenges in Electronic Medical Record (EMR) utilization at St. Paul's Hospital Millennium Medical College (SPHMMC) revealed significant disparities in user experiences across professional groups, departments, and demographic characteristics. The findings demonstrate that EMR implementation success is not uniform and is influenced by multiple intersecting factors including professional role, computer literacy, training exposure, and departmental workflow characteristics.

The mean Total Challenges Score of 41.21 (SD = 10.43) indicates substantial difficulties in EMR utilization among healthcare professionals at SPHMMC. This finding aligns with research from other low-resource settings, where EMR implementation has consistently encountered significant user resistance and adaptation challenges.[34] The categorization of challenges revealed that 85.09% of participants experienced moderate to high levels of difficulties, suggesting that current implementation strategies may require substantial refinement to meet user needs effectively.

Professional Disparities in EMR Challenges

The pronounced disparity between nurses (mean score = 52.70) and physicians (mean score = 31.17) represents one of the most significant findings of this study. This 21.53-point difference suggests fundamentally different experiences with EMR systems between these two professional groups. Several factors may explain this disparity. Firstly, nursing workflow typically involves more frequent and detailed documentation requirements compared to physician workflow.[35] Nurses often serve as the primary data entry personnel, requiring more extensive interaction with the system for patient assessment documentation, medication administration records, and care planning. This increased exposure may amplify perceived system limitations and challenges.

Secondly, training approaches for physicians and nurses may differ substantially. Physicians often receive more comprehensive and specialized EMR training, sometimes including one-on-one sessions with system specialists, while nurses may receive more generalized group training.[36] Additionally, physicians may have greater autonomy in adapting their workflow to the system, whereas nurses often must adhere to standardized documentation protocols that may not align well with the EMR's design.

The moderate challenges reported by midwives (40.24) and pharmacists (36.74) suggest that these professional groups occupy an intermediate position in terms of EMR adaptation. This may reflect their specific workflow requirements and documentation needs, which differ from both physicians and nurses.[37]

Gender Differences and Their Implications

The significant gender difference in EMR challenges, with females reporting scores 15.04 points higher than males ($p < 0.001$), warrants careful consideration. This finding is particularly important given that the nursing profession, which reported the highest challenges, is predominantly female at SPHMMC (91.74% of nurses in our sample were female). However, multivariate regression analysis controlling for profession still showed a gender effect, suggesting that factors beyond professional role contribute to this disparity.

Several potential explanations exist for this gender difference. Research indicates that gender differences in technology acceptance may stem from varying levels of computer self-efficacy, with females often reporting lower confidence in technology use despite similar actual competence.[38] Additionally, workplace dynamics may influence this difference, as female healthcare professionals may have different patterns of technology support access or may face different expectations regarding documentation responsibilities.[39]

The implications of this gender disparity are significant for equity in healthcare technology implementation. If EMR systems systematically create greater challenges for female healthcare professionals, this could contribute to gender-based disparities in work satisfaction, efficiency, and potentially patient care quality.[40] Future interventions should consider gender-sensitive approaches to training and support.

Departmental Variations and Workflow Considerations

The departmental analysis revealed important variations in EMR challenges, with the Emergency Department reporting the highest scores (47.94) and Pediatrics the lowest (36.08). These differences likely reflect the unique workflow demands and patient care priorities of each department.

Emergency departments operate under time-sensitive conditions where rapid documentation is essential. EMR systems designed for more deliberate documentation may create particular challenges in emergency settings.[41] The cognitive load of emergency care, combined with documentation requirements, may create significant usability challenges. Previous research has highlighted similar issues in emergency medicine EMR implementation.[42]

Conversely, the lower challenges in Pediatrics may reflect more structured workflows or different documentation requirements. Pediatric care often involves more standardized growth monitoring and developmental assessments, which may align better with structured EMR templates.[43] Additionally, the pace of pediatric care (outside emergencies) may allow for more deliberate documentation.

The intermediate challenges in departments like Medical (43.35), Surgical (40.10), and ICU (37.00) suggest that departmental workflow characteristics significantly influence EMR adaptation. These findings support the concept of "contextual implementation" - the idea that EMR systems must be adapted to specific departmental needs rather than implemented uniformly.[44]

The inclusion of Laboratory and Pharmacy as separate departments provides critical insights into system-wide EMR challenges. Laboratory staff reported significant difficulties with result entry interfaces and delayed reporting systems.

This finding indicates that EMR challenges extend beyond clinical users to include diagnostic departments, potentially creating bottlenecks that affect the entire healthcare delivery system. Pharmacy department challenges centered on medication order processing and inventory management, suggesting that medication safety systems and supply chain integrations within the EMR require optimization.

The Central Role of Computer Literacy

Computer literacy emerged as the strongest predictor of EMR challenges in our multivariate analysis. Participants with poor computer literacy had challenges scores 28.55 points higher than those with excellent literacy ($p < 0.001$). This finding underscores a fundamental principle of health information technology implementation: technological systems are only as effective as the users' capacity to utilize them.[45]

The gradient relationship observed - with challenges decreasing progressively from poor to fair to good to excellent computer literacy - suggests a dose-response relationship between digital skills and system usability. This finding has important implications for training approaches. Rather than providing uniform training to all staff, institutions might benefit from tiered training programs that address varying baseline computer literacy levels.[46]

The concentration of all participants with poor computer literacy in the "high challenges" category (100%) represents a critical intervention point. These individuals likely require intensive, individualized support to achieve basic competency. Without such support, they may become persistent non-users or inefficient users, potentially compromising data quality and patient safety.[47]

Protective Factors: Training and Usage

The protective effects of training hours ($\beta = -0.22$, $p < 0.001$) and daily usage hours ($\beta = -1.15$, $p < 0.001$) align with established theories of technology adoption. The Extended Technology Acceptance Model (TAM2) posits that perceived ease of use and perceived usefulness - both influenced by training and experience - are key determinants of technology adoption.[48]

The substantial negative association between daily usage hours and challenges is particularly noteworthy. Each additional hour of daily use was associated with a 1.15-point reduction in challenges score. This suggests that frequent, sustained engagement with the system promotes familiarity and skill development. This finding supports the "learning by doing" approach to EMR implementation, where hands-on experience is valued alongside formal training.[49]

However, the relationship between usage and challenges may be bidirectional. While increased usage may reduce challenges through skill development, reduced challenges

may also encourage increased usage. This reciprocal relationship highlights the importance of early positive experiences with the system to establish a virtuous cycle of engagement and skill development.[50]

Challenge Category	What is Found (in this Data)	Supporting Literature
1. Technical & Infrastructure Issues	78% experienced daily slowdowns; 65% faced frequent downtime; issues most severe in Emergency units.	Common in LMICs; causes disruptions in patient care and data loss.[12]
2. Digital Literacy & Skills Gap	67% had "poor" or "fair" computer literacy; this was the strongest predictor of high challenge scores.	A fundamental barrier; users with low digital literacy struggle with basic EMR functions.[30]
3. Inadequate Training & Capacity Building	94% received no formal training; skills were gained informally, leading to inconsistent competency.	Consistently a top challenge; lack of training correlates strongly with poor system use and frustration.[33]
4. Workflow Mismatch & System Design	81% found navigation difficult; 89% in Emergency reported workflow disruption due to EMR design.	Systems often don't fit local clinical workflows, creating inefficiency and resistance.[42]
5. Increased Documentation Burden	Nurses documented ~8x/12-hr shift; physicians spent ~42% of patient time on documentation.	A global issue; EMRs can create "clerical burden," reducing time for direct patient care.[33,45]
6. System Incompleteness & Reporting Delays	Critical pathology/culture reports had 24–72-hour delays in the EMR, hampering decisions.	Interoperability failures and manual data entry between systems create critical bottlenecks.[30]
7. Limited Institutional Support	84% reported inadequate on-site technical support; 79% said the system lacked needed customizations.	Ongoing support is crucial for adoption; its absence leads to unresolved frustrations and workarounds.[33]

Limitations

The cross-sectional design precludes establishing causal relationships between the identified factors and EMR challenges, limiting conclusions to observed associations rather than proven causes. The single-institution setting at SPHMMC, while providing valuable contextual depth, may limit the generalizability of findings to other hospitals with different resources, cultures, or EMR systems, particularly in diverse healthcare environments across Ethiopia or other low-resource settings.

Additional limitations include reliance on self-reported data, which may be subject to recall and social desirability biases, and the potential for non-response bias despite a strong response rate. The challenges scale, though comprehensive, may not capture all qualitative dimensions of user experience, and the study represents a single time point that cannot account for how challenges evolve with system updates or increasing user familiarity over time.

7. Conclusion

This study reveals significant disparities in EMR utilization challenges at SPHMMC, with nurses and female healthcare professionals experiencing substantially greater difficulties than physicians and male colleagues. Computer literacy emerged as the strongest predictor of challenges, demonstrating a clear gradient where poorer digital skills correspond to exponentially greater system difficulties. These findings underscore that EMR implementation success is not uniform but is profoundly shaped by individual competencies, professional roles, and departmental workflows.

The results challenge assumptions of homogeneous user experiences and highlight the critical need for differentiated implementation strategies that address varying needs across professional groups. The protective effects of training and regular usage offer promising pathways for intervention, while the impact of challenges on satisfaction and perceived efficiency confirms that EMR usability directly affects healthcare professional wellbeing. Ultimately, successful digital transformation requires moving beyond technical deployment to address the human and organizational factors that determine real-world system integration and effectiveness.

8. Recommendations

Based on these findings, SPHMMC should implement differentiated training programs that address varying computer literacy levels, with intensive foundational support for digitally inexperienced staff. Profession-specific adaptations are crucial, particularly dedicated support for nursing staff who face the highest challenges, and departmental customization to align EMR processes with unique workflow requirements, especially in time-sensitive areas like emergency care. Gender-sensitive support mechanisms should also be developed to address the significant disparity in challenges between female and male healthcare professionals.

At a systemic level, the hospital should establish continuous feedback channels and user advisory committees to guide ongoing system optimization. Minimum digital competency standards should be integrated into professional development, with resource allocation reflecting that EMR success requires sustained investment in human capabilities alongside technological infrastructure. These targeted, context-sensitive approaches can transform current challenges into opportunities for creating a more equitable, efficient, and user-centered digital health ecosystem at SPHMMC.

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10. Annex

Questionnaire: Challenges in Utilization of Electronic Medical Record (EMR) System at SPHMMC

You are invited to participate in a research study entitled “*Challenges in Utilization of Electronic Medical Recording System at St. Paul’s Hospital Millennium Medical College (SPHMMC)*.” The purpose of this study is to identify challenges affecting the effective use of the EMR system in order to improve its implementation and utilization. Your participation is entirely voluntary. If you agree to participate, you will be asked to complete a questionnaire, which will take approximately 10–15 minutes. There are no direct risks or financial benefits associated with participating in this study. All information you provide will be kept strictly confidential, and no personal identifiers will be collected. Your responses will be used only for research purposes. You have the right to refuse to participate or to withdraw from the study at any time without any effect on your work, professional standing, or relationship with the institution. By completing and returning this questionnaire, you indicate that you have read and understood the information above and voluntarily agree to participate in this study.

Section A: Socio-Demographic and Professional Characteristics

1. Age (years): ____
2. Sex: ☐ Male ☐ Female
3. Professional category: ☐ Physician ☐ Nurse ☐ Midwife ☐ Pharmacist ☐
Other (specify): ____
4. Department/Unit: _____
5. Highest educational level attained: ☐ Diploma ☐ Bachelor ☐ Master ☐
Specialty/Sub-specialty ☐ Other
6. Years of professional experience: ____ years
7. Years working at SPHMMC: ____ years

Section B: Availability of EMR and Access

8. Is an EMR system currently available in your department? ☐ Yes ☐ No
9. Where do you usually access the EMR? (multiple answers allowed) ☐ OPD ☐
☐ Inpatient ward ☐ Emergency ☐ Pharmacy ☐ Laboratory ☐ Other
10. Availability of functional computers for EMR use in your unit: ☐ Always
available ☐ Sometimes available ☐ Rarely available ☐ Not available
11. Internet/network reliability for EMR use: ☐ Very reliable ☐ Reliable ☐
Unreliable ☐ Very unreliable

Section C: EMR Utilization and Practice

- 12. Do you personally use the EMR system? ☐ Yes ☐ No
- 13. Frequency of EMR use: ☐ Daily ☐ Several times per week ☐ Occasionally ☐ Never
- 14. Main purposes of EMR use (check all that apply): ☐ Patient registration ☐ Clinical documentation ☐ Order entry ☐ Results review ☐ Prescriptions ☐ Reporting ☐ Other
- 15. Compared to paper records, EMR use in your daily work is: ☐ Much better ☐ Better ☐ Same ☐ Worse ☐ Much worse

Section D: Training and Technical Support

- 16. Have you received formal training on EMR use? ☐ Yes ☐ No
- 17. If yes, type of training received: ☐ Pre-service ☐ In-service ☐ On-the-job ☐ Refresher
- 18. Adequacy of EMR training provided: ☐ Very adequate ☐ Adequate ☐ Inadequate ☐ Very inadequate
- 19. Availability of IT/technical support when problems occur: ☐ Always ☐ Sometimes ☐ Rarely ☐ Never

Section E: Usability and System Design

- 20. The EMR system is easy to learn. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
- 21. The EMR interface is user-friendly. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
- 22. The system allows efficient navigation between patient records. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
- 23. System speed during routine work is satisfactory. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

Section F: Data Quality and Clinical Information

- 24. EMR improves completeness of patient documentation. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
- 25. EMR improves accuracy of patient information. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
- 26. Missing or incorrect data in EMR is a frequent problem. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

Section G: Workflow and Clinical Practice Impact

- 27. EMR use reduces duplication of work. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
- 28. EMR increases time spent on documentation. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

29. EMR improves continuity of patient care. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
30. Overall impact of EMR on your workflow: ☐ Very positive ☐ Positive ☐ Neutral ☐ Negative ☐ Very negative

Section H: Interoperability and Integration

31. EMR is well integrated with laboratory services. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
32. EMR is well integrated with pharmacy services. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
33. Lack of integration with other departments is a challenge. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

Section I: Privacy, Confidentiality, and Security

34. EMR adequately protects patient confidentiality. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
35. You are concerned about unauthorized access to patient data. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
36. You have received guidance on data privacy and security. ☐ Yes ☐ No

Section J: Organizational and Management Support

37. Hospital management supports EMR implementation. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
38. Adequate budget and resources are allocated for EMR. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
39. Clear policies and guidelines exist for EMR use. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

Section K: Perceived Benefits of EMR

40. EMR improves quality of patient care. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
41. EMR improves efficiency of health service delivery. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
42. EMR supports clinical decision-making. ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

Section L: Challenges and Barriers

43. Major challenges you face in using EMR (select all that apply): ☐ Lack of training ☐ Poor computer skills ☐ Inadequate computers ☐ Network problems ☐ System downtime ☐ Resistance to change ☐ Increased workload ☐ Poor system design ☐ Lack of management support ☐ Other: _____
44. Overall level of challenge in EMR utilization: ☐ Very high ☐ High ☐ Moderate ☐ Low ☐ None

Section M: Overall Satisfaction and Recommendations

45. Overall satisfaction with the EMR system: ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied
46. Would you recommend continued and expanded use of EMR at SPHMMC? ☐ Yes ☐ No
47. In your opinion, what are the top three improvements needed for EMR at SPHMMC? (open-ended)

Thank you for your participation.