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Facilitators and Barriers to the Implementation of Electronic Health Systems by Health Care Workers at Primary Health Care Clinics in the City of Johannesburg

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FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF ELECTRONIC HEALTH SYSTEMS BY HEALTH CARE WORKERS AT PRIMARY HEALTH CARE CLINICS IN THE CITY OF JOHANNESBURG

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A research report submitted in partial fulfilment of the requirements for the degree of Master of Public Health (MPH) in the School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg

30 September 2025

DECLARATION

I, Neo Letele-Mohajane, declare that this research report is my original work, submitted for the degree of Master of Public Health in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination, at this or any other University. I am aware that plagiarism (the use of someone else's work without their permission and /or without acknowledging the original source) is not permitted. I confirm that the work submitted for assessment for the above degree is my own unassisted work, except for instances where I have explicitly stated as such.

I have read the sections on referencing and plagiarism in the Wits Plagiarism Policy, and I have duly followed the required guidelines and standards for referencing the thoughts and ideas of others. I understand that the University of the Witwatersrand may take disciplinary action, including but not limited to suspension against me should there be suspicion that the work in this research report is not my original work, or that I have failed to sufficiently acknowledge the work of others in this paper.

Signature: 

Date: 30.09.2025

DEDICATION

I dedicate this research to the memory of my late grandmother, Lineo Laetitia ‘Mamokopu’ Mofolo-Letele, one of my greatest literary and early influences, who encouraged me to read from as early as I could read. Thank you Motaung oa Ramokhele, Lekolokotoana la ‘Makobasia’.

I thank my late mother, who always believed I could do or be anything I set my mind to. My father, my hero, who raised me as a single parent at a time when single fatherhood was unheard of, thank you for being my best friend, mentor and anchor. I am grateful to my children Lineo, Lehlohonolo, Mosa and my grandson Tebello, for being my inspiration and the reason I held on even when the odds were stacked up against me.

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I am grateful to the selfless health care workers who gave me their time amidst the challenges they experience on a daily basis. I salute you and your commitment to the patients you serve.

To my supervisor, thank you for your guidance and support in completing this research. I could not have done this without you.

ACRONYMS/ ABBREVIATIONS

CHC	Community Health Centre
CoJ	City of Johannesburg
DHIS	District Health Information System eHealth Electronic Health
EHR	Electronic Health Records
EMR	Electronic Medical Records
EPR	Electronic Patient Records
GDOH	Gauteng Department of Health
HREC	Human Research Ethics Committee
ICT	Information Communication and Technology
IPPR	Integrated Policy, Planning and Research Unit
LMIC	Low- and Middle-Income Countries
mHealth	Mobile Health
MPH	Masters in Public Health
NCD	Non-Communicable Disease
NDoH	National Department of Health
NHI	National Health Insurance
PHC	Primary Health Care
UHC	Universal Health Care
WHO	World Health Organisation

DEFINITION OF KEY TERMS

eHealth: Refers to the use of information and communication technology to treat patients, track diseases, monitor public health outcomes, conduct research, or educate students (1–3).

Electronic Health Records (EHR): An electronic version of a patient's medical history, which includes clinical data, progress notes, medications, vital signs, past medical history, immunisations, laboratory data, radiology reports, and administrative information (4,5).

Electronic Patient Record (EPR): A system that captures a patient's clinical health records from a specific clinic or hospital (1).

Electronic Medical Record (EMR): Refers to the patient information that is collected, captured, and stored in a database to assess a patient's health status and make decisions regarding their care (6).

Electronic Health Information System (EHIS): A digital version of a patient's paper chart, with the capacity to store health data such as clinical notes, test results and treatments. It is designed to enable real-time, patient-centred records that make information available instantly and securely to authorised users. The term EHIS is often used interchangeably with electronic health records (EHRs), eHealth, and electronic medical records (EMRs) (5).

mHealth: Refers to the use of cell phones and other mobile technologies to capture and share health information across the system, allowing for better data management by those responsible for handling it (7).

Interoperability: The degree to which different information systems can share information with ease (7).

Digital Health: Encompasses the use of various types of information technology to improve healthcare delivery (9).

ABSTRACT

Background: The use of electronic health systems has dominated debates regarding their usefulness in improving health systems since the advent of the internet. As with most developing countries, South Africa has implemented an electronic health strategy and digital health strategy since 2012, which have been fraught with challenges from the beginning. The most prevalent challenge relates to network infrastructure, followed by the willingness of the health care personnel to use eHealth systems. Additionally, public health care governance is fragmented in South Africa, with most provinces providing health care through the local authority/municipality as well as from the provincial governments in provinces. This has led to uneven and non-coordinated health care provisioning as seen in the case of the City of Johannesburg.

Aim: The aim of this study was to understand the status of eHealth systems within public health clinics in the City of Johannesburg, including understanding the facilitators and barriers to the implementation of eHealth from the point of view of the nurses and doctors in the public health clinics.

Methods: An exploratory qualitative research design was employed in this study. Key informant interviews were conducted with 5 operations managers, 5 professional nurses, 1 data clerk and 1 doctor within the City of Johannesburg health district's sub-districts. Two senior sub-district managers were also interviewed as key informants. In addition, a group discussion was conducted with senior district officials responsible for the implementation of research as well as electronic health systems within the City of Johannesburg. Data was transcribed verbatim and thematic analysis used to analyse the data.

Results: The findings indicated that eHealth is currently not being implemented fully in the City of Johannesburg. Although another pilot of eHealth is currently underway, there is limited awareness of it by health care workers within the City of Johannesburg. Willingness to embrace digital interventions as well as digital literacy, were the most commonly cited individual facilitating factors as well as barriers. Access to reference tools such as standard operating procedures and implementation guidelines, coupled with management support for implementation were noted as important organisational level facilitators which were also barriers where they were absent. The technological factors indicated as both facilitators and barriers related predominantly to network access and access to the tools of the trade, being the computers and hardware needed to implement eHealth. Factors related to the ease of use of

eHealth specifically relating to the design of the system, its ability to interface with other systems as its ability to mirror the clinical workflow of the clinic were indicated as the most compelling factors that contributed to either the use or the lack thereof of electronic health systems.

Conclusions: This study revealed that the implementation of eHealth within the City of Johannesburg is fragmented, with health care workers having limited knowledge and understanding of the status of implementation, which further contributes to their ability or inability to support and embrace implementation. In order to create an environment conducive to successful implementation, it is important for the officials responsible for eHealth implementation to jointly develop and implement a unified electronic health system that serves all members of the population and integrates with the provincial health department.

LIST OF TABLES

Table 1: Summary of Participants

Table 2: Summary of Group Discussion Participants

TABLE OF CONTENTS

DECLARATION ..... **ii**
DEDICATION ..... **iii**
ACKNOWLEDGEMENTS ..... **iv**
ACRONYMS/ ABBREVIATIONS ..... **v**
DEFINITION OF KEY TERMS ..... **vi**
LIST OF TABLES ..... **viii**
CHAPTER 1: INTRODUCTION **1**
1.1. Background **1**
1.2. Literature Review **2**
1.2.1 An Overview of eHealth Systems Implementation 2
1.2.2 Facilitators to the Implementation of eHealth 6
1.2.3 Barriers to the Implementation of eHealth 7
1.3. Problem Statement **10**
1.4. Study Justification **11**
1.5. Aim and Objectives **11**
1.6. Outline of the Research Report **12**
CHAPTER 2: METHODOLOGY **13**
2.1 Introduction **13**
2.2 Study Design **13**
2.3 Study Setting **13**
2.4 Study Population and sampling **14**
2.5 Data Collection: Process and Adaptations **16**
2.6 Data Processing and Analysis **19**
group discussion ..... Error! Bookmark not defined.
2.7 Ethical Considerations **19**
CHAPTER 3: RESEARCH RESULTS **22**
3.1 Introduction **22**
3.2 Existing Electronic Health Systems, their Purpose and Benefits in the City of Johannesburg **22**
3.3 Progress in the Implementation of eHealth System in the City of Johannesburg **27**
3.4 Facilitators to the implementation of eHealth **29**
3.4.1 Individual-level facilitators 30
3.4.2 Organisational and environmental factors 31
3.4.3 Technological facilitators 32
3.5 Barriers to the implementation of eHealth **34**
3.5.1 Individual-level barriers 34
3.5.2 Organisational and environmental barriers 36
3.5.3 Technological barriers 40
3.6 Conclusions **44**
CHAPTER 4: DISCUSSION **46**
4.1 Introduction **46**
4.2 Status of Implementation of eHealth in the City of Johannesburg **46**
4.2.1 The Fragmentation of eHealth Systems 47
4.2.2 Limited Awareness of New eHealth Pilots 48
4.3. Facilitators and Barriers to eHealth Implementation **48**

4.3.1 Individual-Level Factors 48
4.3.2 Organizational and Environmental Factors 51
4.3.3 Technological Factors 54
4.4 Study Limitations and Mitigation Strategies 56
4.5 Conclusions 58
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS 59
5.1 Introduction 59
5.2 Conclusions 59
5.3 Proposed recommendations 60
5.3.1 Implementation of a change management process 60
5.3.2 Enrolling public and private sector actors/stakeholders into task teams aimed at addressing system interoperability challenges 60
5.3.3 Addressing network infrastructure and uninterrupted power supply issues 61
5.3.4 Training and capacity strengthening of implementing staff 62
5.4 Implications for further research 62
LIST OF REFERENCES 64
ANNEXURES 71
ANNEXURE 1: Plagiarism Declaration 71
ANNEXURE 2A: HREC Ethics Clearance Certificate 72
ANNEXURE 2B: NHRD Ethics Clearance Certificate 73
ANNEXURE 3: Turnitin Report 74
ANNEXURE 5 (A): Participant Consent Sheet 78
ANNEXURE 5 (B) Consent Form for Audio Recording of the Interviews 80
ANNEXURE 6: Interview Schedule for District and Sub-District Managers 81
ANNEXURE 7: Interview Schedule for Doctors and Nurses 84

CHAPTER 1: INTRODUCTION

1.1. Background

At the 58th World Health Assembly of 2005, the World Health Organisation (WHO) recognised the potential that internet penetration had to revolutionise health care service delivery globally and urged member states to integrate electronic health systems into health care delivery (10). At the same assembly, the WHO agreed to the WHA66.24 resolution which further encouraged member states to develop electronic health systems that are interoperable and allow for the collection and utilisation of accurate patient records in electronic format at the point of receiving care (10).

Electronic health records, electronic medical records, electronic patient records, all belong to the field of eHealth (11). eHealth was first defined formally in 1999, with the early definitions citing eHealth as the utilisation of information technology within the health care sector to improve clinical work (12,13). The WHO further notes that Universal Health Coverage (UHC) cannot be realised without the adoption of electronic health systems as a cornerstone (14). Singh et al (15) further notes that Electronic Medical Records (EMR) and Electronic Health Records (EHR), serve the same purpose of capturing and storing patient information, with the difference lying in the fact that EMR tends to be used to refer to electronic health systems utilised within one organisation, while EHR collates information from different sources and allows for the exchange of information at different levels of the organisation.

Defining eHealth has been at the centre of the debates since its emergence (16), with Mwangi et al (17) suggesting that the dilemma facing clear definitions of electronic health systems can be attributed to the rapidly changing technological environment within which eHealth systems operate, where rapid developments make it difficult for a single definition to meet current and emerging trends (18). For the purposes of this research study, eHealth will be used to refer to all electronic health systems, unless specifically singled out.

eHealth has been said to be beneficial to the health system by improving patient outcomes and improving the efficiency of the health system (13,14) as well as providing easy access to patient records (19). Despite the long history of existence, eHealth interventions lack the evidence needed to prove their assumed benefits in practice (20). Furthermore, eHealth interventions have been reported to have low adoption and implementation by users (21), which could

account for the lack of evidence of their benefits in actual practice. Granja et al (22) take the argument further and argue that a large number of eHealth systems have been reported to have failed at the implementation phase, which could further account for the lack of evidence of their benefits.

There is a need for research into eHealth implementation in South Africa to understand the factors that contribute to its implementation as well as the barriers to the implementation thereof. This Masters in Public Health research study aims to explore the factors that have enabled the implementation of eHealth systems within the City of Johannesburg, as well as the factors that have acted as barriers to their successful implementation from the point of view of the nurses and doctors that implement the system. It is anticipated that the results of this research study will contribute to the body of knowledge regarding the factors that should be enhanced in order to facilitate the implementation of eHealth as well as the factors to be aware of and avoided or mitigated against for successful implementation.

The purpose of this chapter is to present the literature focusing on eHealth implementation globally and in South Africa, with a narrowed focus on the City of Johannesburg's electronic health systems implementation and the barriers and facilitators to the implementation thereof, followed by the aims and objectives of this study.

1.2. Literature Review

1.2.1 An Overview of eHealth Systems Implementation

Successful implementation of eHealth has been thought to improve health care provisioning, improve patient data records and improve health equity (23). Globally, the use of technology to improve patient care has been embraced by both high-income countries and low- and middle-income countries alike. High- income countries such as the United States of America and the United Kingdom as well as upper middle-income countries such as China, have made significant progress with deploying digital technology to the delivery of health care although with varying degrees of success with eHealth implementation despite being presumably wealthy. A literature review of studies conducted between 2017 and 2019 revealed that the adoption and utilisation of electronic health systems did not significantly improve the delivery of services to patients by healthcare providers in the United States, for instance (16). In the United States of America, the use of Health Information Technology has been driven by the

need to reduce clinical errors, improve the management of patient records and improve overall communication between health care providers (24). The United States government has further invested billions of dollars in implementing eHealth systems. The Health Information Technology for Clinical Health Act (also known as HITECH) provides for the incentivisation of eHealth use, as well as penalties for non-use (24). Despite these progressive provisions, eHealth adoption has not been fully achieved in the United States, with a few hospitals and health care provides choosing not to implement electronic health systems (24). The United Kingdom is another example of a high-income country where eHealth has not been fully embraced, despite having a fairly mature National Health System supported by a strong policy framework. The adoption of technology within the National Health System in the United Kingdom has been said to show a lack of digitisation (25).

China's eHealth progress provides another example where electronic health systems have struggled to achieve full scale adoption, with interoperability as the key challenge to adoption (26). The eHealth system used in China, referred to as Infectious Disease Reporting Information Management System (IDRIMS), was designed as a stand-alone, vertical system and was not connected to other electronic health systems despite its progressive design (26). Furthermore, IDRIMS was reported to offer no observable benefits to its users, which included public healthcare workers in clinics and hospitals, further hindering its effective use.

Initially, adopting EPRs faced several challenges, including high implementation costs and limited incentives for healthcare workers, dampening the enthusiasm for their use (27). Additionally, problems such as inaccurate data entries and the time-consuming nature of entering information into these systems posed significant obstacles (27). The ease of use and availability of incentives for healthcare workers has greatly increased, showing that technological progress can reduce obstacles and enhance the adoption and effectiveness of EMRs (28).

In the last decade, the use of electronic health systems in Sub-Saharan Africa has reportedly increased, primarily due to the growing penetration of information and communication technology (ICT) in developing and developed countries (29). Estimates are that 41 out of 54 countries in Africa have developed national eHealth as well as digital health strategies (12). Despite the widespread acknowledgement of the necessity for electronic health records, eHealth adoption has stalled in both developed and developing nations (16,18,26). Sub-Saharan Africa has faced similar challenges with electronic health interventions that have stalled for

various reasons (12). Countries such as Ethiopia, Nigeria, Kenya, and Ghana have seen slow progress in implementing eHealth solutions (6,29,30).

The South African electronic health landscape is characterised by numerous electronic health systems, many of which operate in isolation and lack interoperability to facilitate information sharing (31). This fragmentation limits the potential for improved patient outcomes by preventing the development of a unified, comprehensive health record (28). In 2009, Gauteng allocated R188 million to eHealth initiatives, followed closely by Limpopo with R178 million (32). The Western Cape is the only province with a unified electronic health system featuring a patient master index (PMI) that consolidates information from all electronic health systems within the province (33). The PMI is a unique patient identifier, allowing individuals receiving healthcare services—at clinics or hospitals—to be registered and tracked across different service points (33). This integration facilitates the creation of a comprehensive, easily accessible patient record, improving continuity of care (33). The variation in eHealth investments across provinces can be attributed to South Africa's decentralised health system, where provincial governments set their health priorities, resulting in significant interprovincial disparities (33). These further result in the differences in the digital health investments in different provinces.

South Africa's healthcare system is further characterised by a dual structure comprising public and private healthcare services (31), which is highly inequitable (31). The private sector, which accounts for over 50% of the country's total healthcare expenditure, serves only 14% of the population (31). It is well-resourced and primarily caters to an urban, wealthier demographic with access to medical aid (mutual health insurance) (31). Conversely, the public sector, which serves 86% of the population, is underfunded, accounting for less than half of total healthcare expenditure (31). Public healthcare primarily relies on nurse-led primary care clinics, offering free services but facing severe challenges, including resource constraints, shortages of healthcare professionals, and inadequate infrastructure (31).

Despite these challenges, private healthcare providers in South Africa have demonstrated greater efficiency in managing patient care through EPRs (33). A notable example is the UNJANI nurse-led primary healthcare model, which operates a progressive electronic health system known as Health IQ2 but later renamed WatIF (34). The UNJANI system incorporates a unique patient identifier, enabling seamless patient tracking across its nationwide network of over 100 clinics (34). This model demonstrates how integrated electronic health solutions can

enhance patient management and service delivery in South Africa's fragmented healthcare landscape (34).

The COVID-19 pandemic showcased the public health system's capacity to utilise various digital health interventions, including short messaging services (SMS), WhatsApp, telemedicine, telehealth, artificial intelligence (AI), and other digital interfaces (35). These technologies were leveraged to disseminate public health information and facilitate patient registration for vaccination through the Electronic Vaccination Data System (EVDS) (35). The EVDS exemplifies South Africa's ability to respond to emerging public health threats by integrating technology into patient record management. Nevertheless, the EVDS demonstrated the potential for successfully deploying digital health solutions, providing valuable lessons for addressing barriers to eHealth implementation.

From a policy perspective, South Africa's eHealth Strategy 2012 established a framework for implementing a universal patient record accessible across all healthcare facilities (28). However, the strategy acknowledged limitations in the public sector's capacity to implement eHealth systems effectively (36). Reports indicate that implementation has been inconsistent across provinces and facilities, contributing to fragmented data management (36). The Strategy identified key issues, including poor coordination, continued reliance on paper-based records, and slow adoption of technology and automation (36). Furthermore, it noted that data quality will remain compromised as long as patient records are maintained through paper-based and electronic systems (36).

A significant milestone of the 2012 eHealth Strategy was its role in laying the groundwork for a Patient Master Index (PMI), which was intended to support the anticipated National Health Insurance (NHI) (37). However, one of the major criticisms of the strategy was its failure to guide the successful implementation of a national master patient record during its tenure from 2012 to 2016 (37). Building on this foundation, in 2019, South Africa launched the National Digital Health Strategy (2019–2024) (37). This strategy expanded upon previous eHealth initiatives and recognised the evolving digital landscape of electronic health tools beyond earlier conceptualisations of eHealth (38). A notable feature of the National Digital Health Strategy is its emphasis on developing network infrastructure to enhance interoperability, addressing one of the most pressing challenges in South Africa's electronic health system (37). The strategy aims to create a more integrated and efficient digital health ecosystem to support future healthcare demands by prioritising interconnectivity and seamless data exchange (37).

1.2.2 Facilitators to the Implementation of eHealth

A complex interplay of factors influences the successful implementation of eHealth. These factors either facilitate or hinder its adoption. A systematic review by Schreiweis et al. (13) categorised these factors into four broad domains: individual-level factors, environmental factors, organisational factors, and technological factors. These classifications provide a structured framework for understanding the enablers and challenges associated with eHealth implementation.

At the individual level, several factors contribute to the adoption and success of eHealth systems. The ease with which users can collaborate and share information, coupled with their experience using eHealth tools, also influences adoption (13). Additionally, the adaptability of eHealth systems, particularly their capacity to visualise data, detect patterns, and inform clinical decision-making, enhances their utility in improving patient care and streamlining workflows (13).

From an environmental and organisational perspective, the successful integration of eHealth depends on a clearly defined benefit to patient health, supported by a strong policy and regulatory framework (13). Well-defined policies governing eHealth adoption, data usage, and interoperability provide a structured environment that facilitates implementation (13). Furthermore, access to sustainable and flexible funding mechanisms is essential in ensuring the long-term viability of eHealth interventions, particularly in resource-constrained healthcare settings (13).

Technological factors play an equally critical role in determining the success or failure of eHealth systems (13). The ease of use and user-friendliness of eHealth platforms significantly influence uptake, while adherence to standardised operating protocols ensures consistency in implementation (13). The security and reliability of eHealth infrastructure are also paramount, as concerns over data breaches, system failures, and cybersecurity threats can undermine trust in digital health interventions (13).

Beyond the classifications provided by Schreiweis et al. (13), other scholars have expanded on these frameworks to offer additional insights into the facilitators of eHealth adoption. Gyamfi et al. (39) highlight logistical enablers, such as the availability of essential hardware, including computers, printers, and data storage devices, which directly impact the functionality of eHealth systems. Additionally, factors such as capacity building, training, and supportive

supervision contribute to the successful uptake of eHealth by equipping users with the necessary skills to navigate digital health platforms effectively (39).

Similarly, Katurura and Cilliers (40) propose a slightly different categorisation, emphasising the role of social factors, such as the availability of skilled personnel and political will, as key determinants of eHealth success. The presence of adequately trained professionals to implement and manage eHealth systems and government commitment to digital health transformation foster an environment conducive to technological adoption (41). Furthermore, their classification of technical facilitators, which includes the availability of digital infrastructure and supporting hardware, aligns with the findings of Gyamfi et al. (39), reinforcing the idea that technological readiness is a crucial enabler of eHealth integration.

An alternative perspective is provided by Ladan et al. (42), who approach eHealth adoption from the standpoint of user motivation. Their research identifies four distinct categories of eHealth users, each with unique drivers of adoption (42). The patient-focused eHealth advocate views digital health solutions as essential for improving workflow efficiency and patient care (42). The task-focused eHealth advocate on the other hand, prioritises eHealth's role in streamlining administrative and clinical tasks (42). In contrast, the traditional pragmatist adopts eHealth based on its voluntary nature and tangible impact on quality of care. The tech-focused eHealth advocate is driven by a strong affinity for technology and an innate proficiency in using digital tools (42). These classifications add a nuanced dimension to existing frameworks by demonstrating how individual attitudes and motivations shape eHealth adoption in different healthcare settings.

1.2.3 Barriers to the Implementation of eHealth

While the facilitators presented above provide a strong foundation for the expansion of eHealth, significant barriers continue to hinder its widespread implementation. According to Schreiweis et al. (13), the implementation of eHealth is often hindered by a range of individual, environmental, organisational, and technical barriers (12). These challenges present significant obstacles to the widespread adoption and integration of digital health solutions, particularly in resource-constrained settings (13).

Individual factors encompass the skills, capabilities, and perceptions of healthcare professionals at the micro level, shaping their ability to adopt EHRs effectively (13). In this

framework, personal traits, technical competencies, and prior experience can act as either barriers or enablers (11), assuming equal access to opportunities for skill acquisition. These factors influence an individual's capacity to interpret, assimilate, and integrate the use of EHPR into clinical workflows (11). However, individual-level adoption is not isolated from broader systemic influences; rather, it is shaped by the external healthcare environment and the structural disparities that characterize health systems in developing countries (11)

At the individual level, barriers are largely associated with insufficient ICT training, resistance to change, and difficulty keeping pace with technological advancements (13). Among healthcare professionals, particularly doctors and nurses, resistance to technology remains one of the most commonly cited challenges, driven by perceptions that eHealth systems are cumbersome, time-consuming, and add to administrative burdens (43). Additionally, a lack of motivation to engage with digital health tools is often linked to the perception that eHealth provides no tangible benefit to the user (43). Other psychological and behavioural barriers include distrust of digital systems and misinformation regarding the security and reliability of eHealth technologies, further complicating adoption efforts (13).

At the organizational level, EHR adoption is shaped by the institutional structures, governance frameworks, and operational culture within healthcare settings (13). Factors such as internal leadership support, management strategies, and resource allocation determine how effectively eHealth systems are integrated into routine medical practice (13). Environmental factors, on the other hand, extend beyond individual healthcare facilities to encompass regional policies, national health strategies, and broader socio-economic conditions (13). These factors include regulatory frameworks, ICT infrastructure, public funding mechanisms, and societal perceptions of digital healthcare.

From an environmental and organisational perspective, funding constraints, political uncertainties, and policy misalignment emerge as primary barriers to eHealth implementation (13). At the policy level, Desveaux et al. (44) argue that one of the most significant barriers to eHealth implementation is the failure to transition from pilot projects to large-scale integration. Many eHealth initiatives remain experimental due to a lack of policy direction and inadequate strategic frameworks, preventing broader implementation (44). This perspective aligns with the findings of Katurura and Cilliers (40) and Adebesin et al. (45), who emphasise that the absence of standardised eHealth systems leads to interoperability challenges. Furthermore, poor coordination of eHealth activities and a misalignment between national ICT policies and

digital health objectives exacerbate these challenges, reducing the overall effectiveness of eHealth strategies (40).

The availability of financial resources is crucial for procuring, maintaining, and scaling eHealth systems, yet many healthcare institutions struggle with limited and inconsistent funding streams (13). Political factors also play a pivotal role, particularly regarding whether eHealth interventions are perceived as valuable in improving patient outcomes and whether they align with existing healthcare structures and national priorities (13). Furthermore, poor coordination between different health departments and a lack of standardised regulatory frameworks hinders efforts to integrate eHealth solutions into mainstream healthcare services (40).

The extent to which eHealth technologies meet user needs, particularly ease of use and functionality, significantly influences adoption rates (28). In many cases, the absence of clear implementation standards creates confusion among healthcare providers, leading to inconsistent application and underutilisation of digital health tools (13). Additionally, concerns over data security, system reliability, and the technical complexity of eHealth platforms further deter adoption, as healthcare professionals often lack access to adequate training and ongoing technical support when challenges arise (13).

While Schreiweis et al. (13) identified 24 success factors and one unique barrier in eHealth implementation, their study was limited by the absence of perspectives from policymakers, data privacy officers, and Chief Information Officers (CIOs) due to insufficient participant representation. Furthermore, their research was conducted among European professionals in Spain and Germany, meaning their findings do not fully reflect other geographic contexts (13) in this case, the South African or broader African eHealth landscape.

Technological factors play a crucial role in shaping the usability, accessibility, and scalability of EHR systems. Licensing constraints, coupled with proprietary software limitations, further restrict data sharing and interoperability, hindering the seamless exchange of patient information across institutions (39).

Additionally, the design and usability of EHR systems significantly impact adoption. In public healthcare settings, digital tools must be intuitive, efficient, and responsive to the needs of frontline health workers. However, research indicates that many existing EHR programs are not user-friendly, leading to resistance from healthcare professionals who find these systems cumbersome to navigate in high-pressure clinical environments. Poor interface design, slow

processing speeds, and inadequate system support further complicate the effective use of EHR technologies.

Schreiweis et al. (13) emphasize that key technological considerations—including system architecture, user interface design, and hardware-software integration—directly influence how effectively digital health solutions are adopted. The Technology Acceptance Model (TAM), developed in the 1980s, provides a framework for understanding user behaviour in relation to new information systems, emphasizing that acceptance is driven by the perceived ease of use and usefulness of the technology (46). While TAM is widely used to study individual adoption patterns, it has limitations in developing countries, where factors such as infrastructure constraints, policy fragmentation, and inadequate government support significantly impact technology implementation.

Recognizing these limitations, researchers such as Modise et al. (47) advocate for broader, context-specific models that extend beyond individual user perceptions to examine institutional readiness and systemic enablers. Their findings highlight the importance of resource availability, leadership commitment, and stakeholder engagement in determining the success of digital health initiatives. EHR implementation efforts should therefore prioritize end-user involvement throughout the process, ensuring that healthcare workers are active participants rather than passive recipients of new technology.

1.3. Problem Statement

Despite South Africa's commitment to digital health transformation, the implementation of cohesive electronic health interventions remains inconsistent and sluggish (28). According to Wright et al. (28), six out of the nine South African provinces currently utilise some electronic system for capturing patient information. However, integration remains fragmented, with no standardised approach across the country (28). In Gauteng province, the eHealth@Joburg primary care EPR system was introduced in 83 healthcare facilities between 2016 and 2019, yet its success has been uneven (48). Despite adopting national strategies, including the 2012 eHealth Strategy and the National Digital Health Strategy (2019–2024), many clinics still rely on paper-based records, even in facilities where digital systems have been introduced (48).

The success of electronic health systems in South Africa is hampered by the fact that they are often designed and financed through development agencies and other international donors that support programmes such as the HIV programme (28,48). Furthermore, the diversity of eHealth

platforms across different healthcare facilities creates significant challenges for system standardization and capacity building. Many public hospitals and clinics rely on incompatible digital solutions, making it difficult to synchronize patient records, train healthcare professionals, and maintain operational efficiency (31).

1.4. Study Justification

Despite over two decades of eHealth implementation globally, limited research has been conducted on the factors influencing its adoption and sustainability (13). Understanding the barriers and enablers of electronic health systems (EHS) is crucial, as full-scale implementation could revolutionise healthcare decision-making, resource allocation, and patient management (22).A well-integrated eHealth system has the potential to provide real-time data on disease trends and population health status, thereby informing national health policies and investment decisions (38).Moreover, eHealth is poised to play a pivotal role in supporting the National Health Insurance (NHI) initiative, which South Africa is on the verge of implementing (50).

This study seeks to critically examine the facilitators and barriers hindering the implementation of Electronic Health Systems (EHS) within the City of Johannesburg. The research aims to identify key individual, organisational, and technological facilitators as well as challenges that have prevented eHealth solutions' full-scale adoption and integration. By addressing these issues, the study hopes to contribute towards developing strategic recommendations that can enhance policy implementation and system usability in South Africa’s public healthcare sector.

1.5. Aim and Objectives

This research aims to examine the facilitators and barriers influencing the implementation of electronic health systems (eHealth) by health workers in primary healthcare clinics within the City of Johannesburg.

The specific objectives of this study are:

1. To describe the current progress of eHealth system implementation in primary healthcare clinics in the City of Johannesburg.

2. To explore the facilitating factors contributing to the successful adoption and implementation of eHealth systems in primary healthcare clinics in the City of Johannesburg.
3. To explore the barriers hindering the effective implementation of eHealth systems in primary healthcare clinics in the City of Johannesburg.

1.6. Outline of the Research Report

This research report is divided into 5 chapters.

Chapter 1: Introduction examines the current state of implementation of electronic health systems in low- and middle-income countries. It also outlines the facilitators and barriers affecting the adoption of eHealth systems, Additionally, it presents the problem statement, study rationale, aim, and objectives.

Chapter 2: Methodology discusses the research design, data collection methods, sampling strategies, and analytical approaches used in the study. It also addresses ethical considerations and the study limitations.

Chapter 3: Study Findings presents the study results, detailing the facilitators and barriers to eHealth system implementation based on the data collected.

Chapter 4: Discussion integrates and contextualises the study findings by comparing them with existing literature and theoretical frameworks.

Chapter 5: Conclusions and Recommendations summarises the research findings, provides key policy, practice, and future research recommendations, and highlights potential areas for further study to improve the implementation of eHealth systems in primary healthcare clinics.

CHAPTER 2: METHODOLOGY

2.1 Introduction

This chapter presents the research methods employed to address the study's aims and objectives. It begins by outlining the study design, followed by a discussion of the study setting, participant selection, and sampling methods. The chapter further details the data collection and analysis processes, ensuring methodological rigour in exploring eHealth system implementation. Finally, the chapter reflects on the ethical considerations relevant to the study, including reflexivity, acknowledging the potential influences of the researcher's positionality on the data collection and interpretation process.

2.2 Study Design

This study adopted an exploratory qualitative design to understand how healthcare workers in primary healthcare clinics in the City of Johannesburg implement electronic health systems. A qualitative approach was deemed appropriate because it provides rich, descriptive insights into participants' experiences, perceptions, and challenges in adopting and utilising eHealth systems. Unlike quantitative methodologies, which focus on measurable variables, a qualitative approach provides a contextualised understanding of the complex factors influencing eHealth adoption, particularly in resource-constrained settings.

Through semi-structured interviews, participants were encouraged to reflect on their lived experiences with eHealth systems and discuss facilitating factors and barriers to implementation. This method provided a comprehensive understanding of eHealth implementation, grounded in the perspectives of those directly involved in its use.

2.3 Study Setting

The study was conducted in primary healthcare clinics operated by the City of Johannesburg's Local Authority within the Johannesburg Health District. The structure of healthcare service delivery in Johannesburg is characterised by a dual-management system, wherein healthcare responsibilities are divided between:

- The Gauteng Provincial Department of Health which oversees major public hospitals and delivers comprehensive primary healthcare services focusing on equitable access and health system efficiency.

- The City of Johannesburg Local Authority which manages public health programs, including immunisation, communicable disease prevention (with a particular focus on HIV/AIDS and TB), health promotion, and maternal and child health services.

This division of responsibilities has resulted in fragmented service delivery, creating challenges in integrating health programs and digital health systems. The Johannesburg Health District is further divided into seven sub-districts, labelled Sub-District A through Sub-District G. Each sub-district is responsible for healthcare services within its geographic area. The study was conducted at five purposively selected primary healthcare clinics within these sub-districts. The selection criteria for clinics were based on the status of eHealth system implementation:

- Only local authority clinics were included, as these facilities had initiated the implementation of EPR systems.
- Clinics operated by the Provincial Department of Health were excluded, as they had not yet introduced eHealth systems at the time of data collection.

At the beginning of data collection in March 2023, the implementation of eHealth in clinics within the City of Johannesburg had been temporarily suspended due to broader systemic challenges in maintaining digital health interventions. However, in May 2024, a pilot initiative was launched to reintroduce eHealth in selected clinics across the district. This development created an opportunity to examine the progress of eHealth system implementation, providing insights into past challenges and the expected outcomes of renewed efforts. The timing of the study allowed for a comparative perspective, capturing healthcare workers' experiences from both a historical context and a forward-looking viewpoint.

2.4 Study Population and Sampling

2.4.1 Study Population

The study population consisted of all the senior public health officials responsible for the design of electronic health systems within the City of Johannesburg health district, the sub-district senior officials responsible for the oversight of the implementation, the clinic level operations managers that oversee implementation at the clinic level, as well as the doctors and nursing staff responsible for implementation.

2.4.2 Study sample

The study sample evolved throughout the research process, shaped by the initial conceptualisation and the pragmatic adjustments made in response to recruitment challenges, explained in more depth in Section 2.5. The final sample ensured representation from multiple healthcare system levels, capturing perspectives from frontline healthcare providers, clinic managers, district administrators, and IT specialists involved in eHealth system implementation and oversight.

Twenty-nine participants were purposively selected to represent the various actors involved in eHealth implementation at clinic and district levels. The initial sample was designed to include one senior district program manager responsible for eHealth implementation in Johannesburg, seven sub-district deputy directors (one per sub-district), seven professional nurses (one per selected clinic), seven medical doctors (one per selected clinic), and seven operational (clinic) managers, given their role in overseeing daily clinic operations and digital health adoption. The sample was structured to ensure a balanced representation of health system users, administrators, and policymakers, providing a comprehensive view of eHealth adoption, barriers, and facilitators.

Before full-scale data collection, a pilot study was conducted to assess the interview guides' relevance and the feasibility of the recruitment strategy. The pilot included interviews with a sub-district deputy director, a medical doctor, and a professional nurse. This preliminary phase identified critical gaps in the original sampling strategy, leading to two significant adjustments. First, it became evident that clinic operational managers played a central role in ensuring eHealth system functionality at the clinic level. Given their responsibilities in overseeing patient flow, managing resources, and ensuring compliance with digital record-keeping systems, their perspectives were essential to understanding the facilitators and barriers of eHealth adoption. Based on this insight, an amendment was submitted and approved by the Human Research Ethics Committee (HREC) to expand the study sample to include operational managers formally. Secondly, refinements were made to the interview guide, incorporating additional questions on system usability, infrastructure support, and interoperability barriers.

Despite these adjustments, recruitment challenges (see limitations section in Chapter 4) emerged during data collection, necessitating further modifications to the final sample. Adjustments were made to mitigate these challenges and ensure a sufficiently diverse sample. The study incorporated a data clerk, recommended by an operations manager, who had been

directly involved in the initial eHealth system rollout. Given their role in data entry, technical support, and troubleshooting, this participant offered valuable insights into system functionality and the practical barriers encountered during implementation.

During data collection, the researcher was made aware of the Integrated Policy Planning and Research (IPPR) Unit, a department responsible for overseeing health technology development, including eHealth systems within the City of Johannesburg. Recognising the value of their expertise, an *emergent group interview* was conducted. This occurred when the researcher initially requested a one-on-one interview with the head of the IPPR Unit who then scheduled a virtual interview which was attended not only by the head of the unit but also by several senior managers from his team. During this spontaneous group discussion, I used the in-depth interview guide prepared for key informant interviews to collect the data. The participants included technical and policy specialists involved in the development and oversight of digital health infrastructure. The inclusion of this unplanned but highly informative group interaction added depth to the data, allowing for triangulation of rich, systems-level perspectives on the challenges and opportunities associated with eHealth implementation in Johannesburg. It also highlighted the value of flexibility in qualitative research, where responsiveness to field realities can yield valuable insights beyond the original study design.

2.5 Data Collection: Process and Adaptations

I designed the data collection process to ensure a comprehensive exploration of the facilitators and barriers influencing eHealth implementation within primary healthcare clinics in the City of Johannesburg. Given the multi-level nature of the study, I placed significant attention on developing appropriate data collection tools, securing ethical approvals, and engaging participants in a manner that allowed for rich, contextual insights. While the research methodology initially followed a structured approach with a predefined sample and timeline, several practical challenges, including participant availability and external disruptions, necessitated a more flexible approach. These adaptations ultimately enhanced the study, incorporating a broader range of perspectives from key stakeholders.

To ensure consistency and ethical integrity, I designed a participant information sheet (Annexure 4) to provide participants with a clear understanding of the study's purpose, scope, and objectives. Participants were required to provide written informed consent before participating in the study, with two separate consent forms issued: one for study participation

(Annexure 5A) and another for audio recording of the interviews (Annexure 5B). These ethical safeguards ensured that participants were fully aware of the study's aims, their rights, and the confidentiality measures in place.

I further developed two semi-structured interview guides to accommodate the diverse roles of participants, ensuring that each group's specific insights and experiences were captured systematically. One set of interview guides was tailored for key informants at the district and sub-district levels, while another was designed for healthcare workers in primary healthcare clinics, including medical doctors, professional nurses, and operational (clinic) managers (Annexure 6 and Annexure 7 respectively). The semi-structured format of these guides provided a structured framework for inquiry while allowing space for open-ended discussions, enabling participants to reflect on their lived experiences with eHealth. The interview guides covered four key thematic areas:

- Demographic and Employment Characteristics: capturing participants' age, gender, roles, qualifications, and years of experience.
- Understanding of eHealth: assessing participants' knowledge and perceptions of eHealth systems.
- Individual Facilitators and Barriers: exploring personal experiences, skills, and attitudes toward eHealth implementation.
- Organisational, Environmental, and Technological Factors—examining broader systemic influences, including infrastructure, policy frameworks, and system usability.

The primary mode of data collection involved face-to-face in-depth interviews at the various clinics where the participants worked, which I conducted using these semi-structured guides. The only exception to the face-to-face interview was the emergent group discussion with the IPPR unit, which was conducted through Microsoft Teams at the request of the Director of the unit. Each interview lasted approximately 30 to 40 minutes and was conducted in English. To enhance data accuracy and capture nuanced responses, all interviews were audio recorded, with detailed field notes taken during and after each interview to document contextual observations, key themes, and non-verbal cues that could contribute to data interpretation. These field notes were essential in supplementing the transcribed interviews, providing additional depth to the data analysis process.

While the emergent group discussion was not initially included in the study methodology, its inclusion significantly enriched the research by offering insights into the strategic intentions behind system design, technical barriers, and future directions for eHealth in Johannesburg's public healthcare system. This discussion allowed for a broader systems-level perspective, complementing the operational challenges discussed by clinic-based healthcare workers.

Data collection occurred over two separate phases, the first taking place between March and October 2023, and the second between March and May 2024. The extended duration was largely influenced by participant availability constraints and administrative delays in securing access to healthcare facilities. Additionally, three major public health emergencies significantly impacted the availability of clinic personnel. The Bree Street gas explosion in July 2023, followed by two building fires in August and November 2023, placed enormous strain on healthcare services, with many potential participants being involved in emergency response efforts. These incidents delayed interviews in sub-districts F, E, B, and A, as health workers prioritized patient care over research participation.

Beyond these external disruptions, another challenge emerged regarding the uneven implementation of eHealth systems across clinics. While it was acknowledged from the outset that eHealth adoption had been inconsistent, further discussions revealed that the City of Johannesburg had discontinued eHealth implementation entirely several years prior. However, during the second phase of data collection, it was discovered that a new pilot initiative was underway in select clinics, testing an updated eHealth system. This unexpected development added another dimension to the study, allowing for an analysis of both past implementation challenges and emerging facilitators shaping the reintroduction of eHealth in Johannesburg's public healthcare system.

The data collection process, therefore, evolved in response to these practical realities. While the initial intention was to conduct the study within a predefined timeframe, the flexibility to adapt to external constraints and emerging opportunities ultimately ensured a richer dataset. By integrating structured interviews, an unplanned emergent group discussion, and engagement with a diverse range of stakeholders, the study captured both the on-the-ground realities of healthcare workers and the broader strategic considerations of district-level decision-makers responsible for eHealth infrastructure and policy.

2.6 Data Processing and Analysis

I transcribed all interview data verbatim from audio recordings and manually processed it before importing into MAXQDA software for coding and analysis. All transcripts were password-encrypted and stored on a secured computer to ensure data security and confidentiality. Each transcript was assigned a unique, anonymised identifier that did not link to the participant's name or clinic. For example, transcripts from operations managers were labelled Operations Manager 01 to 05, while professional nurses from the same clinics were named correspondingly, such as Professional Nurse 01. This systematic naming convention maintained participant anonymity and ensured that personal identifiers were not linked to the results.

A reflexive thematic analysis approach was employed to analyse data. This involved repeated reading of the transcripts to ensure deep familiarity with the data, followed by inductive coding to identify patterns and themes emerging from participants' narratives. A comprehensive codebook was developed, assigning codes to specific thematic categories based on the data. To enhance the rigour and trustworthiness of the analysis, the first two transcripts from the operations managers, doctors, and nurses categories were jointly coded in collaboration with the study supervisor. This process helped identify discrepancies and refine coding consistency, ensuring a more reliable interpretation of the findings.

2.7 Ethical Considerations

This study was conducted in full compliance with ethical research principles, with formal approval from the University of the Witwatersrand's Human Research Ethics Committee (HREC) Medical under approval number M220660. Following institutional approval, permission was also sought from the City of Johannesburg's Research Committee to conduct research within primary healthcare clinics in the Johannesburg Local Municipality, granted under NHRD approval number NHRD-GP-202212-007. Ethical compliance was maintained throughout the study by the Singapore Declaration, ensuring adherence to core ethical principles such as voluntary participation, informed consent, anonymity, and confidentiality of participant information.

Due to the spontaneous nature of the emergent group discussion, it was not possible to seek ethics clearance or to develop a group discussion guide. However, since the virtual meeting

was scheduled by the IPPR unit, I requested permission/consent from all the four participants for the meeting to be recorded and for the recording to be forwarded to me for transcription purposes. All participants in the discussion agreed to being interviewed and recorded. The project manager forwarded the recording of the interview to me after the meeting.

2.8 Researcher Reflexivity

Reflexivity is described as an essential process through which researchers critically examine their positionality, subjectivities, and the influence of their own experiences on data collection, analysis, and interpretation (51–53). As a researcher who also works for a non-governmental organisation (NGO) that had previously provided technical support to some of the sampled clinics meant that I had pre-existing knowledge of the operational landscape of eHealth in the City of Johannesburg as well as eHealth implementation. This insider perspective had both potential benefits and challenges for the research process. I recognised that my prior engagement with eHealth implementation in Johannesburg positioned me as an insider within this research setting.

Being familiar with some of the study participants allowed me to establish rapport more quickly, fostering a conversational openness that might not have been possible for an entirely external researcher. I was mindful, however, of the need to maintain neutrality and ensure that my familiarity did not influence participants' responses—either by making them overly comfortable in their reflections or by prompting guarded responses based on assumptions about my prior knowledge of the eHealth system. Throughout the interviews, I consciously adopted a stance of active listening, encouraging participants to articulate their experiences without presuming shared understandings.

Beyond my positionality, methodological reflexivity was crucial in shaping the study's adaptability and responsiveness. As the research progressed, unexpected opportunities arose that required a flexible and pragmatic approach to data collection. One such instance was the interview with the data clerk, who was not part of the initial sample. Recognising the value of this perspective, I decided to include the data clerk in the study, which ultimately enriched the depth of findings by offering a previously unconsidered viewpoint on system functionality and support structures.

Another moment of reflexivity emerged during my interview with the senior director of the IPPR unit, who unexpectedly invited additional officials from his department to participate in the discussion. This led to an unplanned but highly valuable emergent group discussion that introduced policy and infrastructure perspectives that might have been overlooked had the original interview plan remained unchanged. My ability to pivot methodologically and embrace these opportunities allowed for a richer and more holistic exploration of eHealth implementation.

Finally, epistemological reflexivity shaped my approach to probing interview questions and engaging with emergent themes. While my familiarity with eHealth in Johannesburg provided a foundational understanding, I deliberately refrained from imposing predefined interpretations on participants' narratives. Instead, I approached each interview as an opportunity to expand my understanding, allowing themes to emerge from the data rather than aligning them with prior assumptions. This approach was particularly valuable in interviews with operations managers and professional nurses, who articulated challenges beyond technical limitations, encompassing workload pressures, system usability issues, and broader health governance constraints that might have been underexplored had I not remained open to participants' lived realities.

Reflexivity was not merely a theoretical exercise but an active, ongoing process that shaped how I engaged with participants, adapted my methodology, analysed the data, and interpreted my findings. This approach allowed for a nuanced understanding of the data, grounded in the context of the study and shaped by the researcher’s evolving insights. While my insider status introduced potential biases, my commitment to critical self-awareness, methodological flexibility and epistemological openness ensured that the research remained grounded in participants' voices rather than predetermined narratives.

The following chapter presents the findings from the research interviews, offering a detailed analysis of the current status of the implementation of eHealth system, as well as facilitators and barriers to eHealth implementation in the City of Johannesburg’s primary healthcare clinics.

CHAPTER 3: RESEARCH RESULTS

3.1 Introduction

This chapter explores the findings from the data collection process, as detailed in the previous chapter, providing an in-depth analysis of the current status of implementation of eHealth systems as well as the facilitators and barriers affecting the implementation of electronic health systems (eHealth) in primary healthcare clinics in the City of Johannesburg. The findings are drawn from the perspectives of healthcare workers in clinics, and senior health officials at the district level, who are responsible for system design, implementation, and strategic oversight.

By integrating these perspectives, the chapter aims to provide a nuanced analysis of the progress made towards the implementation of eHealth in Johannesburg's primary healthcare system as well as enablers and challenges. These will be discussed according to four main broad themes namely: a) *existing electronic health systems, their purpose and benefits in the City of Johannesburg*; b) *progress in the implementation of eHealth in the City of Johannesburg*; c) *facilitators to the implementation of eHealth*; and d) *barriers to the eHealth implementation*. The facilitators and barriers will further be discussed according to several sub-themes, which relate to individual, organisational and environmental factors and technological factors.

3.2 Description of the Study Participants

The final study sample comprised of 14 participants as demonstrated in Table 1. Participants' age range was between 30 to 60 years, with work experience in their respective roles spanning one to eight years. Most professional nurses held a Bachelor of Nursing degree, while two held Diplomas in Nursing. The gender distribution was predominantly female, with 11 of the 14 participants being women, reflecting broader trends in the composition of the primary healthcare workforce in Johannesburg.

Table 1: Summary of Study Key Informant Interview Participants

Participant Description	Number Interviewed
Sub-District Manager	2
Operations Manager	5
Professional Nurse	5
Doctor	1
Data Clerk	1
Total Number of Interviews	**14**

Table 2 below illustrates the participants of the emergent group discussion and their roles.

Table 2: Summary of Emergent Group Discussion Participants

Participant Description	Number Interviewed
Director – IPPR Unit	1
Project Management Officer	1
Systems IT Manager	1
Manager – IT Infrastructure	1
TOTAL	**4**

3.3 Existing Electronic Health Systems, their Purpose and Benefits in the City of Johannesburg

The study revealed a diverse range of electronic health systems currently implemented across primary healthcare clinics in the City of Johannesburg. While each serves distinct purposes, these systems operate independently rather than as a fully integrated digital health ecosystem. Respondents described several of these systems, highlighting their respective functions and the gaps in interoperability.

One of the most widely referenced systems by the respondents was Tier.Net, a digital platform dedicated to tracking HIV-positive individuals and monitoring their treatment outcomes. This system, funded by the United States Agency for International Development (USAID), is implemented at clinics with the support of development partners working in HIV/AIDS

programs. The primary function of Tier.Net is to facilitate efficient monitoring of patients on antiretroviral treatment (ART), ensuring accurate record-keeping and enabling better continuity of care for individuals living with HIV.

> *"We have Tier.Net. There are those patients who are on HAART (Highly Active Retroviral Treatment) and then those ones that are TB patients. So those ones that are initiated, we make sure that we put them in the system for the follow-ups after the sister has seen the patient. All the files go to the data capturer and then the information is captured. Also the TB patients are also captured to record whether it was initiation or follow up."* [Operations Manager 1].

> *"We are having the Tier.Net that we are using now, but it is mostly from Anova which I think is USAID funded. We are using that to capture the HIV patients."* [Operations Manager 5].

Another system mentioned by the participants was LabTrack, which facilitates tracking patient biological specimens submitted for testing at the National Health Laboratory Service (NHLS). This system enables clinics to access laboratory test results electronically as soon as they become available, eliminating delays associated with the traditional paper-based system. Respondents emphasised that LabTrack has significantly improved diagnostic turnaround times, enhancing healthcare workers' ability to make timely clinical decisions.

Additionally, some respondents referenced the Health Patient Registration System (HPRS), a nationally mandated platform to register every patient accessing public healthcare services.

> *"HPRS is the national system implemented across the board and the eHealth system, as I was saying, I think right at the beginning eHealth Interfaces with the HPRS. So for example, the service provider would have made sure that the architecture links all the systems. So you won't see HPRS standing next to the data as we capture it on the eHealth populates the HPRS or vice versa depending on to E health. You know the end user switching between systems, No. They work on the systems and then all the other systems, whether it be Tier.net, whether it be HIS, whether it be HPRS, they will work together, they interact."* [Senior District Official 1].

Although the HPRS was said to be a nationally mandated electronic health system, the respondent noted that it was not being implemented fully across the district, with the implementation being driven by the provincial department of health. As a result, the suggestion

above that HPRS fully integrates with other electronic health systems is not fully realised since it is not implemented across the district.

Beyond these individual systems, respondents consistently referred to eHealth, which they described as a comprehensive electronic patient record system. Across diverse study sites, there was a shared understanding of what eHealth represents, suggesting a high level of awareness regarding its intended functions and benefits. The system was widely recognised as a digital platform consolidating patient records, including demographics, visit histories, and clinical notes, into a single, accessible format. A senior district official described eHealth as follows:

> *"A full patient record, a full electronic health record…. a system that gets automatic results from the National Health Laboratory System automatically as soon as the nurse sends the specimen to the lab, as soon as the technician tests, the results appear on the clinical record, so time is saved, patients' queuing is saved. So the entirety of the clinical record is available and it's not available only at one clinic. It becomes available to all clinics utilising the system."* [Senior district official].

This description was echoed by other respondents, who confirmed that eHealth functions as an electronic patient record system. Respondents consistently framed eHealth as a tool for digitising patient information, facilitating patient tracking, and supporting data management for clinic services, as illustrated below:

> *"eHealth is a collection of patient data. That's how I understand it, it's like putting them [patient data] on the system and then like having numbers of patients that are coming to our clinic knowing…. so as to be able to say so many were women, so many were men, just the general profile. Profiling and then also the breakdown of categories like babies, mothers."* [Professional Nurse 3].

> *"I know it's a system where patients will be captured on the computer and they will be consulted on the computer, and then I think they will use their identity, their ID numbers or passport, to track, like it's basically a file on a computer."* [Operations Manager 3].

Across all interviews, respondents consistently highlighted two primary objectives that drove the implementation of eHealth: reducing patient waiting times and transitioning away from paper-based records. Many respondents, particularly operational managers, emphasised that eHealth was introduced to address inefficiencies related to long patient queues caused by delays

in retrieving paper-based patient records. One operations manager explained it in the following manner:

> "*When it was implemented, the main idea that was highlighted to us was, because the filing system is in a mess, patients wait long because we are not finding the file or something and misfiling there was the main thing. So introducing an electronic health file was said to be a better way because in a click of a biometric, you are able to access the patient information and then you head on.*" [Operations Manager 4].

This view was reinforced by a senior district official as well as a data clerk, who saw reducing patient waiting times as a key driver for the eHealth initiative:

> *"The intended purpose of eHealth is to reduce your waiting times to improve your patient record and to ensure confidentiality of the information. It also assists us with the addressing space issues because if you go to our clinics, we don't have enough space to have all the filing… big filing cabinets."* [District senior official].

> *"The other main point of eHealth was to save time, so that patients don't spend much more time in the clinic while you are still busy looking for their file and you can't find the file. So automatically the information will be in the system so that the queue will flow quicker."* [Data Clerk].

Beyond improving efficiency, respondents also emphasised that eHealth was introduced to eliminate the risks associated with paper-based records, which often led to lost patient files, duplicate records, and treatment disruptions. An operations manager noted that:

> *"The purpose of eHealth was to say you must go paperless…and reducing patient waiting time. Okay. Because it was a problem."* [Operations Manager 1].

Another operations manager elaborated on the risks of paper-based files as follows:

> *"The intended purpose was to reduce waiting times... number one. And number two, there's a challenge of files getting lost. So people will be doing duplicates. So you'll find…. when I come this time, I get another duplicate. Next time next visit I get another one. So at least eHealth was meant for us to have one single file for one patient. So whatever stream of care that you are coming for, you will be able to use that one file for this person. And because we are not using paper, you know that your information is not going to go and if you go to any other clinic, they will be able to retrieve your information."* [Operations Manager 2].

For instance, some respondents noted that the implementation of eHealth improved service efficiency and addressed fraudulent practices related to medication collection. Multiple healthcare workers indicated that, before the implementation of eHealth, some patients visited multiple clinics to obtain extra medication, which was either sold or sent to family members in rural areas. Respondents described how the introduction of eHealth served as a control measure to detect and prevent these occurrences:

> *"I think the intended purpose was to see the patients coming to the clinic and not clinic hopping that was the main intention for the eHealth because now if a patient comes to us today, seen today and go to another clinic tomorrow and where they work on the same system, they could pick up that you were in another clinic yesterday"* [Professional Nurse 3].

> *"The difference now between the new system and the old system is that the intention is also to curb issues of double-dipping by patients when it comes to medication. Previously, patients could collect medicine at one clinic and then move on to the next without it being detected. eHealth now allows us to track these instances."* [District Senior Official 3].

Some healthcare workers also recalled experiences where patients provided misleading symptoms to obtain medication. One nurse described how eHealth enabled clinic staff to detect such cases:

> *"We had patients who would fabricate symptoms, saying they had a rash or some condition just to get medication. Before eHealth, we had no way of confirming whether they had already consulted at another clinic. Now, we can see their last visit, and if they were treated elsewhere for the same issue, we can ask why they are back*." [Professional Nurse 2].

3.4 Progress in the Implementation of eHealth System in the City of Johannesburg

The implementation of eHealth in the City of Johannesburg has been inconsistent, with respondents indicating that the system is currently not fully operational across clinics. A senior district official confirmed that eHealth is presently undergoing its second pilot phase, but its implementation remains confined to only three clinics within the district. The decision to relaunch a pilot was driven by the need to develop a system where ownership and intellectual property rights would reside with the City of Johannesburg, as opposed to the previous iteration, which the contracted service provider controlled. Reflecting on the system's initial rollout and subsequent termination, one senior district official stated:

> *"This is the second time that the City of Johannesburg is implementing an eHealth system. We used the system; we developed the system, but the ownership, the intellectual property (IP), remained with the service provider."* [District Senior Official 1]

The first pilot phase of eHealth was operational for an estimated two years before being discontinued due to contractual and ownership disputes. Despite this premature termination, respondents noted that some clinics had achieved considerable success during this initial phase, particularly in transitioning away from paper-based records. The decision to select specific clinics for the second pilot was based on several factors such as ICT readiness and infrastructure, internet connectivity, access to power and others as explained by another senior district official below:

> *"We looked at a number of criteria. Firstly, we assessed ICT readiness and infrastructure—so the clinic needed a minimum level of internet connectivity, access to power, and backup power. Secondly, we considered the clinic's patient headcount to ensure that the selected clinics could sustain a digital transition. Lastly, we reviewed the reception of the previous system—one of the chosen clinics had already been operating almost paperless, with most of its records being processed electronically."* [District Senior Official 2].

While senior officials highlighted a structured approach to relaunching eHealth, healthcare workers at the clinic level expressed confusion and uncertainty about the system's discontinuation and future implementation. Many respondents, including professional nurses, operational managers, and the one doctor interviewed, reported that the system ceased operation around 2019. However, they had not been provided with clear communication regarding its discontinuation or plans for reintroduction. Some respondents described their experience with the system's initial rollout, citing connectivity issues as a key barrier that prevented full-scale implementation:

> *"The problem is that the implementation never actually got off the ground. We have computers in our rooms that were supposed to be used for eHealth, but they were never connected to the network due to Wi-Fi issues. So, we never actually got to a point where we processed even a single patient on the system."* [Professional Nurse 5].

> *"We don't have access to it anymore. When I started in 2017, there was an eHealth system, but we never really used it because the network was usually down."* [Doctor 1].

Others recalled how the system was abruptly discontinued without any explanation:

> *"It was paused—or they wanted to pause and then come back. I'm not sure, but we stopped using it."* [Professional Nurse 4].

Operational managers also reflected on the unfulfilled promises of eHealth, noting that despite its potential, the system never achieved its intended goals due to a combination of logistical, technical, and administrative challenges which will be discussed in the subsequent sections:

> *"The system didn't achieve what it was meant to do because, suddenly, it was no longer in use. When I returned from leave, even before I went to primary healthcare, the system had already been discontinued due to so many challenges".* [Operations Manager 1].

With the discontinuation of eHealth, respondents emphasised that clinics have reverted entirely to paper-based patient record management. This shift has reintroduced longstanding inefficiencies, including lost records, duplicate files, and storage constraints, all of which the eHealth system was initially designed to address.

In addition to their comments regarding the status of implementation of eHealth patient record systems, respondents indicated that patient records are currently being captured on paper-based files in the absence of an electronic health system for capturing patient records. Respondents noted that paper-based records are particularly frustrating due to the loss of paper files, duplication of files where records are misplaced, as well as the lack of storage space within clinics for filing cabinets.

3.5 Facilitators to the implementation of eHealth

The main themes identified in the data could be classified according to *individual level factors*, *environmental and organisational factors* as well as *technical factors*. The sub-themes that emerged from the data were therefore categorised according to their alignment to the three broad themes identified above. These will be presented in detail below.

3.4.1 Individual-level facilitators

Age as a facilitator

A theme that came up in the interviews with the users of the first eHealth pilot was that the younger generation, specifically younger nursing staff, have an affinity to technology and therefore did not struggle to use eHealth. This sentiment was described well by a professional nurse in one of the clinics below:

> *"…with the younger generation you know, we know certain things. We know once you started writing cough, it's going to finish it up for you."* [Professional Nurse 5].

Eagerness to use the system

Eagerness to use the eHealth system was described by both the district officials responsible for designing the system and the users of the system, as being an important facilitator towards its use. In the words of a district senior official, he said:

> "*…you need people who are eager to use the system because if you go a clinic and the nurses are not interested, that is very difficult."* [District Senior Official 1].

According to the users of the system, the willingness to use the system was based on a number of factors, such as how the system is presented, the benefits of using the system, not just for the management, but for the users as well, especially focusing on how the system can benefit the user and make their work easier in the consulting room.

An operations manager in one of the clinics indicated that willingness to embrace change was one of the factors that led to the successful implementation of the first eHealth pilot. She narrated the story of a 76-year-old nurse, with limited computer literacy skills, who was able to use the eHealth system efficiently and ended up being a champion of the system, who helped others to know how to navigate the system.

> *"For example, there was one nurse, the one who ended up being a champion. She was initially clueless about computer. She was just willing to go all out. So she's the one who was taking us through to say whether you know or you don't know, it is possible. So those employees that were around, they were of help. Yeah. The fact that they took her from here to there … they helped her to understand how the system works, whether she's computer illiterate or not…..Because everything is written in English. She knows English."* [Operations Manager 4].

In addition to the willingness to embrace the eHealth system, a key factor that enabled users to adopt the system was the manner in which it was presented to the clinics. An operations manager in one of the clinics interviewed indicated that the system was presented as a tool that would make their work easier and improve patient management, especially using technology.

In addition, participants also shared their perceptions about the factors that should be integrated into the implementation of eHealth in order to improve its adoption. As indicated below, an important factor related to how the system should be presented to potential users is to focus on how the system, if implemented properly, can improve the work of the nurse, and not focus on presenting the system as being useful to management functions.

> *"OK, so if when they come and present these things, they concentrate more on the macro plan of it or how they will benefit from the system being live whereas they should try and get to the micro part of it and get more benefits for the nurse, because like I said, with the drop down menu and how it actually tells you the medication. If you're going to sell it to a nurse like that already, you're thinking, OK, that's going to halve a bit of my time. ……. So, you see, if you are presenting it in a way that will be beneficial to them. Then they will take it, it'll be easier for them to actually embrace it. But if you're going to be presenting it that we're going to be able to get stats …. we don't really care about the stats, but it's not our end point at the end of the day*." [Professional Nurse 5].

A key illustration of the point above is seen in the quote below, which shows that the eHealth system that was previously piloted did have a positive impact on some users, and that there is still a willingness to use it due to its usefulness in improving patient care.

> "*They must just bring it. ... Once they bring it, people will embrace change. Because I know it will be difficult because, you know, change is not always welcomed. People will always say, this and that but if they can bring it, I think that would help really. Because in most cases you see these people here. ... You see the same patient three times a week. You know when someone walks in you're like, not again. And that's not nice*" [Professional Nurse 2].

3.4.2 Organisational and environmental factors

At the organisational level, several factors relating to the operating environments, access to guidelines and standard operating procedures as well as management support, were said to have significantly contributed to the acceptance and use of eHealth when it was first implemented.

Some respondents felt that the eHealth system was a good system which made their work easy by simply translating the existing manual files that they use into electronic format, with no special skills needed as seen below:

> *"There are no special skills that are needed. But then I think you just need to have your basic computer courses, like your short courses, so that you just capture using MS Word, knowing your keyboard. That is what is important because if you can look at it it's actually your manual file that you open for your patient. But then now it's just being digital. But then whatever that you're doing manually now you're just doing it electronically"*. [Data Clerk].

Access to guidelines and standard operating procedures

Some respondents, reported that they had access to the standard operating procedures and guidelines that contained the necessary information to use the eHealth system, which they reported as an important facilitating factor for the use of eHealth.

> *"(the developer of the eHealth system) when they were developing this thing because they were working with some of the people from the health department. They had their own guidelines for using the system ... They also had the guide, clinical guidelines that we use in the primary health care settings. Yeah. So all the information was there. It was just a matter of you knowing that it is there and where to find it".* [Operations Manager 4].

The guidelines and standard operating procedures were said to be user friendly particularly in relation to the fact that they reflected existing policies and were therefore aligned to what users were used to in the clinic.

3.4.3 Technological facilitators

Access to unlimited network and computers

When eHealth was first implemented, implementing clinics were provided with the necessary computers, scanners, printers and network access to facilitate the use of the system. This was notably before loadshedding became a problem in the country.

> *"We had computers that were from City of Johannesburg that were allocated for room one for instance. All the rooms had a computer. We were having the…tools and then City of Johannesburg had a Wi-Fi.* [Operations Manager 1].

The design of the eHealth system as a facilitating factor to its use

The manner in which the system was designed was cited as an important factor in facilitating its adoption and implementation. Respondents indicated that the accessibility of the system on their electronic devises was very important because they often had a lot of applications on their electronic devices, which meant that their devices were cluttered. Being able to access the system easily was a major facilitator as indicated below:

> *"It had its own folder. There on the desktop you just click, then you search your patient, then the patient pops. To access it, it was not a struggle".* [Professional Nurse 4].

The eHealth system was also said to have been designed in a manner that ensured that it reflected the patient's journey through the clinic, following the flow of service points that they would follow from the point of registration upon entering the clinic, until they exited the clinic. This was said to be one of the key factors that made the users of the system enjoy using eHealth, as can be seen below:

> "*For me, I enjoyed it. For me, it was because, like, from one point to the next until the patient walks out, everything was linked together. At the end of the day, you just click a button and your patient' records would come…But the system on its own was... proper…proper. Because it would even remind you, you know, now patient will be seen. Don't forget TB screening. So, with the system, you can't move to the next step without doing that screen. So, all the screenings you could do and it could tell you've screened so many patients at the end of the day*." [Professional Nurse 2].

The design of the eHealth system was therefore experienced positively by some respondents, particularly in relation to the extent to which it improved the flow of their interaction with patients as well as the capturing of patient information during the consultation process.

An operations manager in one of the clinics reflected on the fact that the design of the system not only facilitated the work but also addressed the long waiting times at the clinics since the consultation with the patients would flow quicker, and as such reducing the length of time patients spend in the clinic. Below is an example of how the eHealth system facilitated clinic flow in one clinic and reduced waiting times.

> "*With the Well-baby clinic, there's a lot of things that are supposed to be done, but for whatever reason, with eHealth, it*

> *was making things much easier. I think that's maybe I'll say the only part that was designed better than others, because everything that you needed to do with the kids, it was in one space. You wouldn't find kids sitting here up until 11:00. No. The queue was moving better than any other.*" [Operations Manager 4].

Access to technical support

Access to technical support was said to be a key factor in assisting users to be able to implement the eHealth system properly.

> *"…we had our technical assistant who was very good. Yeah, he used to, you know, he was stationed here most of the… most of the time he would come four times a week. Okay. Unless he's needed somewhere else, you know"* [Operations Manager 2].

3.6 Barriers to the implementation of eHealth

The barriers to the implementation of eHealth systems were reviewed in relation to the *individual level barriers* that impede implementation, the *technical factors* that contribute to the lack of or poor implementation of eHealth as well as the *organisational and environmental factors* that also contribute to eHealth implementation as experienced by the users of the eHealth system. It is also worth noting that the sub-district senior official and the district senior officials also provided their perceptions based on their experiences as the designers of the eHealth system as well as based on feedback from users of the system. These findings are presented in this section.

3.5.1 Individual-level barriers

Age related technophobia, resistance to computers and lack of computer skills

The age of the users of electronic health systems was cited as an important barrier impacting on whether eHealth systems are utilised or not utilised, particularly in relation to their resistance to computers or their lack of computer skills to be able to use them routinely in their work.

> *"…at the time, older sisters [nurses]…they were not really computer literate. They were very resistant to the computer."* [Professional Nurse 3].

> *"You know, in nursing we don't do computers, we learn this computer ourselves. So in time we got used to typing."* [Professional Nurse 4].

> *"…a lot of nurses and other staffing categories saying they're not technologically equipped to be able to do all of this, they need to go on computer classes."* [Professional Nurse 5].

The age-related technophobia is a challenge that was also acknowledged by senior officials within the City of Johannesburg's Public Health department. In the words of one senior district official:

> *"…. I believe the average age of nurses is 50. Maybe these days the younger ones are coming. The older the people, except maybe you and me …, the more afraid of technology they are"* [District Senior Official 1].

A professional nurse at one of the clinics also made a similar comment about age-related technophobia.

> *"…especially with the older generation it's mainly because they're not used to computers, they're not used to having to log everything down in computers and when you think about it practically it would cause a problem because if you are not used to dealing with the computer and now you have to write everything that the patient has.*" [Professional Nurse 5].

The same sentiment was echoed by a senior sub-district official, who had the following to say about nurses in clinics and their comfort levels with technology and computers:

> *"…remember the clinicians are trained to look after the patients. They don't have time for the computer. Some are not computer literate."* [Senior sub-district official].

> *"Definitely have to be computer skills, that you need to know. Computers, definitely. There's no way that you can work on the system without being computer literate"* [Professional Nurse 3].

> *"I mean, you should know how to use a computer, to use Word and Windows, then you should be fine. I don't think you want a system that everybody has to be extremely savvy*." [Doctor 1].

<u>Willingness to embrace change</u>

As stated in the previous section by Professional Nurse 3, nurses' fear of technology made them resistant to change, especially older nurses. A senior district official articulated this sentiment in the following manner:

> *"...you need people who are eager to use the system because if you go a clinic and the nurses are not interested, that is very difficult."* [District Senior Official 1].

3.5.2 Organisational and environmental barriers

Lack of training on how to use eHealth

The majority of respondents felt that they had no recollection of being trained formally to use the eHealth system. One of the reasons presented for this was that the system at the time was not being implemented across the district in all clinics.

> "*…they were only piloting certain clinics. They didn't give training for everyone. So they just decided they were piloting in 4 clinics and then they trained those people"* [Professional Nurse 5].

As a result, not all the clinics received training on how to use eHealth.

> *"No, I wasn't trained. I think I came into the system after the training was done. So everything I did was... Intuitive, going on, checking."* [Doctor].

The lack of proper training was also cited as a key reason for the resistance from clinic staff as seen below:

> *"There wasn't buy-in to move to electronic... ...I don't think people felt adequately trained to use it. I think it wasn't a simple program either, so it was a bit difficult to use."* [Doctor 1].

Linked to the above statement that the training was not deemed adequate to equip users to begin implementation, respondents also indicated that the depth of the training was another factor that contributed to the training not being effective. It was felt that the training was based on the assumption that everyone that uses a computer is computer literate, which was said to be an erroneous assumption as illustrated below.

> *"I think with the training as well, it wasn't properly done when it comes to training because like there are nurses who can use the computer but not necessarily 'computer literate'. So with those people, it needed thorough, thorough, thorough training to say, like, where are you going to go? How are you going to do this? And then it wasn't like that. It was just the computer. If you are*

> *computer literate, obviously you will have to just navigate, go through like and then say like, okay, if it's like this, I'll have to do this for me to end up seeing the patient. I think the proper training as well will be needed by somebody who will be knowing the clinical side of work"* [Professional Nurse 1].

An operational manager in one of the clinics felt that the training provided was inadequate and although it provided all the basic skills necessary to be able to operate the system, it assumed that users had basic computer skills, which was not always the case. Some respondents therefore felt that the training itself should have been accompanied by basic computer skills training to ensure that everyone, especially people with no computer skills, were equipped to utilise the system.

> *"The training was provided, but it was just basic training that you go from this page. If let's say I come as a chronic patient, they will show you… that okay… for you to access the chronic documents. You go, there you go, there you go. You see. But in terms of a… let's say, maybe a basic course on Ms. [Microsoft] word and literacy, okay, that was not done. It was just assumed that if you use your phone, then you're able to use it."* [Operations Manager 2].

In terms of who provided the training, the responses varied. Some respondents recalled that they were trained by the company that was contracted to roll out the system, while others said that they were trained by the technical assistants that were deployed to support the clinics. Some respondents further felt that their training was adequate and was rolled out over several days and allowed them to fully grasp the training content and apply the concepts learned. Other respondents on the other hand, felt that the training they received could not be classified as training, as it consisted of someone coming to their desk to check if they were struggling with anything.

> *"It was that thing of showing you when you are a sister during the consultation. Because when you search a patient, the patient would appear then they show you, sister goes to this and then you enter your notes for consultation and your prescription here."* [Professional Nurse 4].

> *"The training? Not enough. Remember there was one, IT specialist that came and she trained the nurses, me, the admin and everyone. So what she supposed to do today? It's me. 20 minutes. Then it's them, you know, like that. I would say that if a patient because we wanted the circle, like if a patient would come and like you were explaining, then she supposed to see if the flow*

> *goes, you know, but she's supposed to be here and then she's supposed to be there. I think the training was not enough. You know, the staff was not enough for training purposes, you know."* [Operations Manager 5].

Lack of Policies, Guidelines and Standard Operating Procedures

Respondents, particularly nursing staff and operations managers reported that they did not receive any guidelines or standard operating procedures to help them navigate the eHealth system.

> *"The SOPs weren't readily available. Maybe they were, but … I never saw them"* [Doctor].

In some cases, the guidelines and standard operating procedures were available but reportedly not user-friendly as seen in the statement below:

> *"Yeah, we did have those documents with a big policy and a* standard operating procedures *(SOP), you see. But then when you think of reading through this thick SOP, you know you know SOP…... But that one, it was a very… it was very comprehensive. When you go through it like the challenge of going from here to there to there, it was explained. It was explained, you see, but having the time to sit there and read, you know, they could have come up with something user-friendly. The user guides visual, something that you can paste on your diary*." [Operations Manager 2].

Lack of Management Support

One of the biggest barriers expressed by the nurses that used the eHealth system when it was piloted was that it was not an easy system to use due to the fact that the information required by the system did not match with the information which was regularly captured by clinicians during the course of a normal patient consultation. The conclusion by nurses was therefore that they ought to have been consulted when the system was designed in order to ensure the relevance and accuracy of the information being solicited through the system.

> *"The only problem is… with the eHealth is that I think they didn't consult nurses when they started this… because it was a problem to us. We were giving them, like telling them to say, hey, with this, maybe this can be done, but sometimes it's still the same throughout."* [Professional Nurse 1].

> *"…it was designed in such a way that it wasn't matching our daily document that we are using in the clinic whereby we thought maybe nurses were not consulted when like designing the program."* [Professional Nurse 1].

Some doctors however, were consulted in gaining feedback on what worked and what did not work with the previous eHealth system. According to one doctor that was interviewed, she and other doctors were consulted when the eHealth system was re-designed to determine if it was user friendly and addressed the shortcomings that were experienced by implementers of the system. In her words:

> *"…the Director …, who was looking to see a new electronic health system because he did ask for our opinion, us doctors and two of us went there and looked at it and that looked more user friendly in terms of the interfacing and all of the EDL (Essential Drugs List) where we expected to get our guidance."* [Doctor].

Despite being consulted however, she commented that a long time had elapsed between the present and when their opinion was sought, without any visible progress being made to bring the eHealth system back.

<u>Lack of Commitment to Implementation from Management</u>

A few respondents highlighted the fact that the management did not appear to be committed to the implementation of eHealth, citing observations such as the fact that implementation appeared to constantly be at pilot stage, with no indication of progressing to full implementation.

> "*I don't think they were sure that it was going to be fully implemented especially because they were just doing pilots. So they were like. You will see when that happens, and that's what we are used to such is our life."* [Professional Nurse 5].

Some respondents indicated that there was often no communication flowing from the management regarding the status of implementation as a whole, which they found frustrating. When the initial pilot project which ended at or around 2017 came to an end, there was no communication regarding the reasons for its termination, leaving implementing staff to speculate about the reasons for its termination. In addition to the perceived lack of communication, implementing staff felt that senior management, although visible at clinics through support visits, were not interested in implementation challenges or suggestions around how these challenges could be mitigated.

> *"I can say like visibility was here, but when we had to, like, give them the barriers, I think they were not attended to like I couldn't. Yes. Because, like, these are the things that they, I can say they are aware of because like we once had meetings and then we're telling them, like, if you can correct this or fix this, I think like it helps us to continue So like, yeah, they were visible. We will see them like now and then, like the eHealth people coming to check on us, ask about like the challenges. But when we lay them down, tell them, this is what we are facing I think they were not hearing properly."* [Operations Manager 1].

When asked if they were aware of the current status of piloting of the eHealth system, this is what respondents had to say:

> *"I don't have much more information about that because it is being handled by our managers. They just gave us feedback that we are in phase two. Uh, but then we have never… I've never even seen the actual app of the eHealth. How does it look like now? Is it the same as previous or it has been modified or what. I have not yet seen it."* [Data Clerk].

Furthermore, implementing staff were told that they had to make the eHealth system work because the senior management had instructed them to make it work.

> *"I got the information from the subdistrict management that the district will be doing this. You understand? Because I remember at some point because in the meetings, they would go like no… you are failing us and you're supposed to be pushing this thing harder than what you are doing."* [Operations Manager 4].

In addition to the pressure from management to make the system work and conduct patient consultations on the eHealth system, respondents also reported that there was no management support for implementation. Management themselves did not appear to know or understand how the eHealth system works and could not provide guidance to implementers.

3.5.3 Technological barriers

The technological barriers highlighted by respondents related primarily to the design of the eHealth system itself, network and connectivity related issues, and the lack of computers and other tools needed to be able to access and utilise the eHealth system.

<u>System design related barriers</u>

Although some respondents expressed their satisfaction with the way the system was designed in the previous section, the sentiment expressed by some of the implementers of the system (the nurses, operations managers and the doctor), was that the eHealth system was not user-friendly. The system was said to be time consuming, with too many pages that needed to be completed before getting to the actual reason for the patient's visit to the clinic.

> *"...it was so long, whereas when I'm trying to finish with this patient, there's no way to see if this patient is discharged from the system now. I've seen her, I'm done with her. No, she stays on the system as a patient for the day. ... what I found also was that when the patient comes in for ANC (Ante Natal Care), I feel that once I click in ANC room on the patient that is here for ANC, the system should take me directly to the ANC part of the file. Not through the whole... Oh... Yes, because she's here for ANC, she's registered as ANC. It should take me directly to the ANC part of the file, where I deal with the ANC. Not dealing with everything else before I get to ANC."* [Professional Nurse 3].

> *"When I started working in 2017, there was an eHealth. But we never used to use it because the network was usually down. That was our barrier. That was our biggest barrier, but they did try for us to use electronic health records there. Unfortunately, that was the way that one was...set up they had taken literally. They had literally taken. Let's say your Clinical Stationery and they put it on the system, so it wasn't very user-friendly in terms of drop downs. It actually took longer than writing notes and I think that was one of the barriers. It wasn't an easy system to use."* [Doctor].

In addition to being time consuming and not being designed in a manner that was seamless with regards to the flow of information, there were concerns from respondents that the eHealth system was designed in a way that did not match the clinical stationery used by clinicians in the consulting room. The system was reported to have been designed in a manner that required repetitive information and also did not align with the types of questions that nurses would request from the patient at the point of consultation. These are some of the comments that respondents had regarding the design of the system.

> *"...we thought it wasn't user friendly. In which sense the program itself, it was designed in such a way that it wasn't matching our daily, document that we are using in the clinic. Whereby we thought maybe nurse clinicians were not consulted when designing the program. Sometimes, somehow, we felt that it required a lot of information whereby with us, once the patient with the stationery that we are using, some of the things like we*

> *don't like request from the patient. And then sometimes it was just a duplication. It wasn't able to populate the information throughout. You will be writing same thing, same thing, same thing throughout."* [Professional Nurse 1].

The system was also reported to not be aligned to the medication that clinicians regularly dispense to patients in the consulting room.

> *"…the other problem that we had with eHealth when you have to go to the medicine site where you want to like… choose the medication. Sometimes you cannot find the specified medication that the child will need. It was a challenge on that and then sometimes the coding they were coded according to the diagnosis, even you cannot…. Sometimes you cannot find them it was a struggle to go into the system."* [Operations Manager 1].

Another example of the lack of user friendliness of the system was the fact that it was slow, and as a result it ended up increasing the amount of time that patients waited in the clinic for service, thereby defeating the very purpose for which it was designed which was to reduce patient waiting times.

> *"…the system itself, the way it was designed, it was not, user-friendly. Remember, we are having a stipulated average time for patient waiting in the facility, you understand? And you were having this big elephant that you need to eat by the end of the day. You must have finished it. You can't eat it bit by bit. So it was a bit of a challenge there."* [Operations Manager 4].

The system was also reportedly easy to manipulate and bypass certain sections and proceed to completion without completing some information.

> *"it will allow you to bypass the information. For example, you log in with your details, and if I don't really want to do it, I can just put in the vital data and say complete. It will allow if you have forgotten something, let's say you are on the clinical notes filling in the information and stuff and then because there are so many pages that you need to open, you don't need to open them. You go straight to the sections you want. There's no pop ups to say.. you've forgotten to do this. I think its because they did not integrate everything."* [Operations Manager 4].

<u>Network related barriers</u>

Network challenges were the most commonly reported barriers to the implementation of eHealth. In some clinics, such as clinic 5, the eHealth system reportedly never got to be implemented because there was no network. One of the biggest challenges resulting from the

network challenges related to the interruption to the patient flow process in the clinic, which would lead to nurses defaulting back to using paper-based record keeping, contradicting the main purpose of eHealth, which was to reduce the use of paper-based files.

> *"Challenges. It was network… network. At some point it will load forever. And then now it's time consuming. And then now patients needs to come back to the reception. Now we need to open manual files so that they can be seen so that they can go. And then it will also create a backlog. Now when this network comes we need to back capture all of that and then it's time consuming"* [Data Clerk].

> *"Poor network connectivity. It was the worst. Because like with that, if ever I've seen a patient today, maybe I want to review that patient who was seen using the e-health whereby we're saying we are paperless. Nothing was recorded on a paper if like there's no network, it means the whole information is in the computer. We have to redo everything all over again. And then of which, like with us, it was a bit frustrating. So like if ever this e-health can be like have proper backup when it comes to network and then, proper backup, as in like, information be stored in such a way that whether we've got network challenges or whatsoever, we would be able to retrieve this information that has been stored there."* [Professional Nurse 1].

The frustration indicated above was acknowledged by the district team responsible for eHealth implementation in the quote below:

> *"I think one of the most frustrating things if I was a clinician would be to say I see you now today and make a diagnosis and like you come back next week, I don't have a clue. My notes are gone. The record is gone. I can't. There's no continuity of treatment. You know, it's only dependent on your memory. And I think that compromises the… the… the quality of care."* [District Senior Manager 1].

In response to the network related challenges, the senior district team indicated that they were aware of the challenges related to network accessibility as a foundational component of the implementation of any electronic system. To mitigate against these challenges the senior district team responsible for eHealth implementation indicated that as part of the second pilot phase of eHealth which is currently in progress in the City of Johannesburg, all clinics would be fitted with generators, solar panels and other technical equipment such as the 'microwave' which provides back-up storage of information to ensure that in the event of a power failure, information does not get lost and can be uploaded to the cloud storage once power is restored.

Lack of computers, printers, scanners and other hardware

Access to the hardware and tools needed to implement the eHealth system was indicated as an important factor which affected the successful implementation of eHealth.

> *"The important thing was the computers. Okay. Because that's what we used in the system, the biometric system. But then also our patients without IDs and passports, it was difficult to register them in the system because you don't have any way to scan their documents if they don't have a document because you have to scan them in order for you to register them. So, that was one of the things that was a barrier towards the eHealth system."* [Professional Nurse 3].

In some clinics, theft of computers was said to be a factor which prevented the staff from implementing eHealth. In two of the clinics, there were incidences of theft where the clinics were burglarised, and equipment stolen. In other cases, the computers were provided but they were never connected to the network, making it difficult to use them as can be seen below:

> *"We have new computers. I only saw computers come in and then that's about it. I think we also have a computer that's specifically for it. But it's not working as yet."* [Operations Manager 3].

3.6 Conclusions

In conclusion, the eHealth system is currently not being fully implemented in the City of Johannesburg but is being piloted for a second time within three (3) clinics in the district. However, operations managers and their staff within the clinics appear not to be aware of the current status of eHealth, with clinic staff relying on rumours related to the current status of implementation. In addition, clinic staff expressed frustrations about the perceived lack of communication from senior management, including their reported feedback about the previous eHealth system.

In terms of the facilitators and barriers to the implementation of the eHealth systems, the views of the respondents appear to be divided although there appear to have been more frustrations than enablers in relation to the eHealth system, which the designers of the eHealth system appear to have been aware of and have somehow attempted to address in the current pilot of the eHealth system.

The following chapter will build on these findings by situating them within the existing literature and examining how the experiences of healthcare workers in Johannesburg compare to broader research on digital health implementation in resource-limited settings.

CHAPTER 4: DISCUSSION

4.1 Introduction

This chapter critically examines the study's findings about existing literature and the conceptual framework of eHealth implementation. The study aimed to evaluate the status of eHealth implementation in the City of Johannesburg, identifying the extent to which eHealth has been implemented, the level of awareness among healthcare workers, and the key facilitators and barriers influencing its success or failure.

The findings reveal that awareness of eHealth among healthcare workers was inconsistent, with many frontline staff unaware of the status of new pilot projects or long-term implementation plans. Additionally, although various EHR systems, such as Tier.Net, LabTrack, and HPRS, are operational in some clinics, these systems function in silos, lacking interoperability and a unified patient information system. The currently discontinued eHealth@Joburg pilot serves as a key case study of the challenges faced in scaling eHealth beyond initial pilot phases, largely due to policy fragmentation, governance issues, and intellectual property constraints.

Beyond assessing the current landscape of eHealth, this chapter explores the factors that have either facilitated or hindered its implementation. The discussion is structured into two key areas:

1. Status of Implementation of eHealth Systems in the City of Johannesburg
2. Facilitators and Barriers to eHealth Implementation: – Analyzing the individual, organisational, and technological factors influencing implementation.

This chapter provides critical insights into the strengths and weaknesses of eHealth in Johannesburg by systematically analysing these findings. It also lays the groundwork for the policy recommendations presented in Chapter 5.

4.2 Status of Implementation of eHealth in the City of Johannesburg

This study's findings confirm that eHealth has not been fully implemented across all local authority clinics in Johannesburg. Following a brief pilot phase between 2017 and 2019, implementation was halted, primarily due to intellectual property constraints that prevented the City of Johannesburg from continuing its use after the service contract expired. The discontinuation of the system left healthcare workers uncertain about its future, with some

expressing frustration over the lack of communication from senior management regarding potential plans for a new eHealth system.

The failure of eHealth@Joburg to transition beyond the pilot phase mirrors previous unsuccessful digital health initiatives in South Africa. Participants in this study recalled that Gauteng Province had previously attempted to introduce EHRs through an IBM-related system, which also failed to achieve full implementation. This observation is consistent with findings from Zharima et al. (50), who described South Africa's electronic health environment as one where numerous digital health interventions fail to transition into sustainable, long-term solutions due to funding uncertainties, policy misalignment and leadership gaps.

The challenge of pilot projects failing to transition into full-scale implementation is not unique to South Africa. Studies from Ontario, Canada (44) highlight similar obstacles, where digital health innovations have been characterised by short-lived pilot projects that fail to gain long-term governmental support. The Ontario experience suggests that strong policy frameworks, dedicated leadership, and clear funding commitments are essential for ensuring the sustainability of eHealth programs. These lessons reinforce the need for a cohesive, well-funded, and government-backed strategy for eHealth implementation in Johannesburg.

4.2.1 The Fragmentation of eHealth Systems

A recurring theme in the findings is the lack of a unified and interoperable eHealth framework. Although multiple digital health platforms—such as Tier.Net, LabTrack, and the HPRS are in operation, they function independently rather than as an integrated system. Study participants, particularly those in managerial positions, raised this fragmentation as a key concern, highlighting the inefficiencies caused by siloed digital systems.

The findings indicate that while eHealth systems were introduced to streamline patient records and improve clinical workflows, the lack of interoperability among existing platforms has led to redundancy, inefficiencies, and additional administrative burdens for healthcare workers. This aligns with research by Adenuga et al. (32), who argued that the proliferation of uncoordinated eHealth systems in Africa often hampers information sharing, disrupts continuity of care, and leads to data fragmentation.

In Zharima et al's study (50), a participant emphasised that South Africa lacks a unified electronic health record system, stating that "there actually isn't an electronic health record of any description in the public sector. Certainly, there is no unifying one. The systems in place are at best patient inventories and accounting systems." This sentiment was echoed by several respondents in the present study, who cited difficulties in navigating multiple, unlinked digital health systems that failed to provide a comprehensive view of patient information.

4.2.2 Limited Awareness of New eHealth Pilots

A significant challenge identified in Chapter 3 was that some healthcare workers were aware of a new eHealth pilot being tested in select clinics but lacked clarity regarding its objectives, timeline, and expected impact. Senior district officials confirmed that a new pilot was underway, incorporating feedback from previous implementations. However, most frontline healthcare workers felt uninformed and excluded from decision-making processes. This lack of communication and change management has been identified as a key barrier to digital health adoption, as it fosters uncertainty, disengagement, and resistance among end users (39)

The limited transparency surrounding new eHealth implementations mirrors past challenges. Participants in this study recalled the eHealth@Joburg system, which was previously piloted in clinics operated by the Local Municipality. eHealth@Joburg failed to progress beyond the pilot stage, and findings from Chapter 3 indicate that healthcare workers were largely unaware of the reasons behind its discontinuation. This lack of government control over critical digital infrastructure underscores a broader issue in South African digital health governance, where eHealth initiatives are often outsourced without ensuring long-term sustainability. Desveaux and colleagues (44) describe this pattern as a "plague of pilots," where multiple digital health interventions are introduced but fail to transition into sustainable, long-term solutions due to funding uncertainties, policy misalignment, and leadership gaps.

4.3. Facilitators and Barriers to eHealth Implementation

4.3.1 Individual-Level Factors

The success or failure of eHealth implementation is often shaped by individual factors, particularly healthcare workers' skills, attitudes, and behaviours. This study revealed that

facilitators and barriers exist at the individual level, with some professionals embracing digital transformation while others resisted. The findings highlighted age-related differences in adoption, digital literacy gaps, and the role of champion users as key themes influencing the uptake of eHealth systems.

Willingness to Embrace Technology

One of the strongest facilitators of eHealth adoption was the willingness of healthcare workers to engage with technology. Participants in this study noted that those with a positive attitude toward digital tools found integrating eHealth into their daily workflows easier. This observation is consistent with Cilliers and Mahoney's study (5), who emphasises that staff attitudes toward digital health are often more influential than prior experience in determining adoption success. Similarly, younger professionals in Johannesburg clinics were found to adapt more quickly to digital systems, demonstrating greater confidence in navigating eHealth platforms than their older colleagues. Yafouri et al. (54) observed a similar pattern in the United States, where younger physicians were more likely to integrate EMRS into their clinical practice fully. A recent study on the challenges and benefits of digital health interventions in South Africa by Kgashwane and Chukwuere (55) revealed similar findings where they found that lack of willingness to change was the most frequently cited barrier towards the adoption of eHealth systems.

Age-Related Differences in eHealth Adoption

However, the relationship between age and eHealth adoption is not always linear. A notable counterexample in this study was the case of a 76-year-old nurse who, despite minimal prior exposure to computers, actively embraced the eHealth system and became a champion user within her clinic. Her enthusiasm for learning and willingness to mentor colleagues challenged the assumption that older healthcare workers inherently resist digital tools. This finding supports Schreiweis et al. (13), who argue that individual motivation and peer support play a more decisive role in digital adoption than age alone. When individuals receive encouragement and structured guidance, they are more likely to overcome technological apprehension and engage with eHealth systems effectively.

The presence of champion users and early adopters was crucial in driving eHealth adoption among hesitant colleagues. In some clinics, these individuals served as informal trainers,

helping others navigate the system and troubleshoot basic issues. This aligns with findings from Wright et al. (28), who argue that peer-to-peer learning significantly enhances digital adoption in healthcare settings. The influence of champion users can be particularly valuable in contexts where formal training opportunities are limited, as they create a supportive environment that encourages hesitant staff to gradually build confidence in using digital tools.

Despite these positive examples, many barriers at the individual level still hindered the widespread adoption of eHealth. A major challenge reported by participants was age-related resistance to change, particularly among older healthcare workers who felt more comfortable with traditional paper-based records. Many expressed concerns about the complexity of digital systems, stating that they found manual documentation faster and more reliable. This finding is consistent with Wright et al. (48) who found that older clinicians in South Africa often defaulted to paper-based workflows when faced with unfamiliar digital platforms.

Digital Literacy and Technological Confidence

Another major barrier was limited digital literacy, which emerged as a significant obstacle to eHealth adoption. Many healthcare workers, particularly those with minimal prior computer experience, struggled with the technical aspects of data entry, system navigation, and troubleshooting basic errors. Some respondents reported that the system's interface was overwhelming, leading to delays in patient record-keeping and a dependency on colleagues for assistance. The study found that many staff members abandoned digital records altogether when faced with system challenges and reverted to paper-based documentation. This behaviour was further reinforced by frequent system downtimes caused by poor internet connectivity and load shedding, making manual records seem more practical and reliable. Similar patterns have been observed in Ghanaian hospitals, where Mensah et al. (56)reported that clinicians frequently reverted to manual processes when faced with unreliable digital systems.

These findings underscore the importance of structured digital literacy training and ongoing user support. While younger professionals and champion users demonstrate the potential for successful eHealth integration, the lack of formal training programs and the persistence of digital skill gaps continue to hinder adoption among many healthcare workers. Health facilities must invest in comprehensive capacity-building programs catering to all skill levels, ensuring that healthcare workers have the knowledge and confidence to engage with digital health systems effectively.

4.3.2 Organizational and Environmental Factors

Beyond individual attitudes and digital literacy, the implementation of eHealth systems is heavily influenced by organisational structures, management practices, and broader health system governance. This study found that organisational factors played a crucial role in either facilitating or hindering the adoption of eHealth in the City of Johannesburg's clinics. Key themes that emerged include the role of leadership, the availability of standard operating procedures (SOPs), training programs, and intergovernmental coordination.

Key findings relating to the environmental factors affecting the implementation of eHealth include crime and theft as well as loadshedding.

Leadership and Managerial Support

One of the strongest facilitators of eHealth adoption was the presence of strong leadership and managerial support. Respondents in Chapter 3 noted that when senior management actively championed the system, healthcare workers were more likely to engage with it. In clinics where managers prioritised digital transformation, staff felt a greater sense of accountability and commitment to eHealth implementation. This aligns with Gyamfi et al. (39), who found that supportive supervision significantly influences the adoption of digital health tools in African healthcare settings. Leaders who provided clear guidance, technical assistance, and reinforcement of eHealth policies played a pivotal role in creating a culture of digital engagement.

However, inconsistent managerial support was a recurring barrier in this study. Many healthcare workers reported that senior management focused more on data collection than supporting system usability. Several participants noted that managers primarily demanded eHealth-generated reports but showed limited concern for frontline workers' challenges when navigating the system. This disconnection between management expectations and the user experience resulted in frustration and disengagement among healthcare workers. Zharima et al. (50) similarly found that in South Africa, managers often prioritise statistical reporting over the operational effectiveness of digital health tools, leading to low system adoption rates among end users.

Availability of Standard Operating Procedures (SOPs) and Implementation Guidelines

Another critical facilitator was the availability of standard operating procedures (SOPs) and clear implementation guidelines. Study participants noted that clinics where well-documented workflows and reference materials were provided experienced smoother system adoption. SOPs helped standardise data entry processes, reducing confusion and errors. Wright and colleagues (28) emphasise that well-structured implementation frameworks improve compliance and ease the transition from paper-based to digital workflows. However, the lack of SOPs in some facilities led to inconsistent data entry practices, further contributing to low system uptake and errors in patient records.

Training and Capacity Building

Training and capacity-building emerged among the most significant organisational barriers to eHealth implementation. While some healthcare workers received structured training, many reported that their training was inadequate or non-existent. Several study participants stated that they were expected to learn the system independently, leading to frustration, inefficiencies, and a reliance on informal peer training. This aligns with Tsai et al. (16), who argue that digital health initiatives often fail due to inadequate investment in user training and long-term skill development. Many healthcare workers in this study expressed a need for ongoing refresher courses and mentorship programs to ensure they could effectively navigate the eHealth system without resorting to workarounds or reverting to paper-based records.

Fragmentation Between Municipal and Provincial Health Authorities

The fragmentation between municipal and provincial health authorities was another major challenge identified in this study. The City of Johannesburg operates independently from the Gauteng Provincial Health Department, and this division has led to the implementation of separate, non-integrated eHealth systems. Study participants noted that while municipal clinics were piloting eHealth@Joburg, provincial facilities were implementing the HPRS. This lack of coordination resulted in disparities in service delivery and inconsistencies in digital record-keeping, as patient information was not shared seamlessly between facilities.

This fragmentation is not unique to Johannesburg. Adenuga et al. (32) highlight that siloed digital health implementations are a common challenge in African healthcare systems, where different government agencies introduce separate eHealth systems without ensuring

interoperability. The result is duplicated efforts, wasted resources, and inefficiencies in patient care delivery (57). Similar challenges have been reported in Kenya (6) and Uganda ((49)), where the absence of a centralised eHealth framework has led to multiple parallel systems that do not communicate.

Awareness and Communication Gaps in eHealth Implementation

The limited awareness of new eHealth system rollouts further compounded these organisational barriers. Several healthcare workers in this study stated that while they had heard rumours about a new eHealth pilot, they were not formally informed about its objectives or implementation plan. Senior district officials confirmed that a new system was being piloted, but frontline workers were not engaged in the planning process. This lack of communication and change management contributed to uncertainty and scepticism, reducing the likelihood of system uptake. Gyamfi et al. (39) argue that when healthcare workers are not included in decision-making, they are more likely to resist digital transformation, as they feel disempowered and disconnected from the process.

The findings indicate that strong leadership, structured training, and clear policy alignment are critical organisational facilitators of eHealth adoption. However, major barriers include managerial disconnect, lack of training, fragmentation between government agencies, and the absence of long-term policy continuity.

Broader socio-political factors affecting implementation of electronic health systems

Some of the key findings arising from this study relate to the broader socio-political factors within the South African environment, which negatively impact on the implementation of electronic health systems. Issues such as crime and theft of equipment at clinics as well as loadshedding and irregular electricity supply challenges were cited by several clinic personnel in the study. Crime and its impact on the delivery of health care was reflected on by community members interviewed in a research study on the challenges faced by the public health system in the Free State province (58), where study participants commented that clinics often do not have adequate alarm or security systems to safeguard clinic personnel, patients as well as the equipment and property within the clinics.

Loadshedding and irregular power supply has been a plague that has severely affected South Africa's economy in the current decade, a factor that has been quoted as an important barrier towards the successful implementation of electronic health systems of any nature, including mHealth interventions (55,59)

4.3.3 Technological Factors

The successful implementation of eHealth systems depends heavily on digital health platforms' technological infrastructure, system design, and interoperability. This study found that technological factors were decisive in enabling and hindering eHealth adoption in Johannesburg. While some aspects of system design and connectivity supported implementation, healthcare workers faced significant challenges related to poor system usability, unreliable network infrastructure, and a lack of interoperability between digital health platforms.

System Usability and Design Challenges

Poor system usability was one of the most frequently cited technological barriers in this study. Many healthcare workers reported that the first version of eHealth@Joburg was difficult to navigate, with an interface that did not align with clinical workflows. Study participants noted that the system allowed for incomplete records, creating inconsistencies in patient data management. These usability issues led to inefficiencies in clinical practice, as staff members often had to spend additional time correcting errors or searching for misplaced patient information. These findings align with Wright et al. (28) who argue that eHealth systems in South Africa often fail because they do not mirror traditional clinical workflows, making it difficult for healthcare providers to integrate them into daily operations.

Network Connectivity and Infrastructure Limitations

In addition to system design flaws, network connectivity issues posed a significant barrier to eHealth adoption. Poor network infrastructure and connectivity was indicated as a key frustrating factor hampering the implementation of EHR systems in South Africa (55). Many healthcare workers reported frequent system downtime due to load shedding and unstable internet connectivity, forcing them to revert to paper-based records. Furthermore, loadshedding and the unpredictability of power outages made it difficult for healthcare providers to rely on real-time digital record-keeping, leading to patient data entry and retrieval gaps. This challenge is not unique to Johannesburg. Studies in Ghana (56) and in Uganda (49) highlight that poor infrastructure is one of the most significant barriers to eHealth adoption in African healthcare settings, as many hospitals lack stable electricity and high-speed internet to support digital systems effectively.

Lack of Interoperability Between eHealth Systems

Another major challenge identified in this study was the lack of interoperability between different eHealth systems. Healthcare workers expressed frustration over the fact that existing platforms—such as Tier.Net, LabTrack, and HPRS—operated in silos, preventing the seamless exchange of patient information across clinics. This lack of integration resulted in duplicated data entry, inconsistent medical records, and delays in patient care as providers had to transfer information between systems manually. Studies by Kgashwane and Chukwuere (55), as well as Mbunge et al (35), also confirm that the fragmentation of multiple unintegrated electronic health systems in South Africa hinders the seamless sharing of patient information. This lack of interoperability poses a significant barrier to efforts aimed at consolidating data into a unified and comprehensive patient health record. Adenuga et al. (32) highlight that fragmented eHealth ecosystems are widespread in LMICs, where multiple uncoordinated digital health platforms coexist without standardised interoperability frameworks.

Access to Technological Hardware and IT Support

Beyond interoperability challenges, limited access to technological infrastructure further hindered eHealth adoption. Many clinics reported insufficient hardware resources, including a shortage of computers, printers, and scanners, making it difficult for healthcare workers to utilise the eHealth system fully. Some facilities had only one computer per consultation room,

forcing staff to wait in line to input patient data. In cases where computers malfunctioned, technical support was slow or unavailable, leading to delays in service delivery. These findings align with research by Boore et al. (6) who found that inadequate access to hardware and IT support services significantly reduces the effectiveness of digital health systems in resource-limited settings.

Offline Capabilities and Data Loss Risks

Despite these barriers, some technological factors facilitated eHealth adoption. Healthcare workers with user-friendly digital platform experience found it easier to navigate eHealth@Joburg and were more likely to adopt the system. Study participants noted that they could provide patient care more efficiently when the system was well integrated into their clinical workflow. Additionally, some clinics with stable internet access and backup power solutions were less affected by network disruptions, allowing for smoother system functionality.

The findings indicate that technological factors played a critical role in shaping the success of eHealth adoption. While some clinics benefitted from stable connectivity and user-friendly system design, poor system usability, frequent network disruptions, a lack of interoperability, and insufficient infrastructure were major challenges.

4.4 Study Limitations and Mitigation Strategies

Access to research participants emerged as one of the most significant challenges during data collection. The process was particularly affected by concurrent public health emergencies in the City of Johannesburg, which diverted the attention of key public health officials targeted for participation. As stated in Chapter 2 (section 2.5 – Data Collection Process and Adaptations) the Johannesburg city centre gas explosion in July 2023, followed by two building fires in August and November 2023, placed additional strain on healthcare services. These incidents required urgent intervention from health officials and clinic staff, particularly in facilities closest to the Johannesburg CBD, making their interview availability highly constrained.

As a result, data collection was successfully conducted in only five of the seven sub-districts, where operations managers and professional nurses were available for participation. In the remaining two sub-districts, the operations managers were either on sick or annual leave or had

competing professional priorities, limiting access to potential participants. At the district level, five of the seven sub-district deputy director positions were vacant due to retirements or were occupied by acting officials on a rotational basis. This instability in leadership made it difficult to secure committed participants, and ultimately, only two sub-district managers were available for interviews. At the clinic level, scheduling interviews proved difficult due to high patient volumes and workload pressures. While operations managers facilitated interview scheduling for professional nurses, doctors posed a particular challenge. The study initially aimed to include multiple doctors, but as many worked seasonally and rotated between facilities, only one was available for participation during the data collection period.

In addition to structural and workforce-related challenges, unforeseen public health emergencies further impacted participant availability. During the data collection period, Johannesburg experienced three major crises that directly affected clinic staff: a gas explosion on Bree Street in July 2023 and two building fires in August and November 2023. These incidents significantly strained primary healthcare facilities, as clinic personnel were diverted to emergency response efforts, making research participation a lower priority.

Another limitation arose following the interview with the IPPR department, during which arrangements were made to interview one of the three clinics currently piloting eHealth. However, the interview did not take place as planned due to scheduling conflicts. The proposed interview coincided with the department’s monthly and quarterly reporting period, during which staff availability was severely limited. The inability to conduct this interview represented a missed opportunity to gain deeper insights into eHealth implementation's current status and assess whether barriers encountered in the initial pilot phase had been addressed in the ongoing pilot.

While these challenges limited the study's breadth, the research remained methodologically rigorous. Including a group discussion with IPPR officials provided valuable insights from key stakeholders responsible for eHealth system development, offering perspectives that complemented the findings from clinic-based participants. The study’s ability to capture multi-level insights—from healthcare workers to policymakers—ensured a comprehensive understanding of the systemic and operational challenges affecting eHealth implementation in Johannesburg.

Another limitation related to the inability to meet the anticipated study sample. Despite falling short of the original number of anticipated participants, the final sample remained methodologically robust, ensuring a rich and varied perspectives. By integrating perspectives from frontline healthcare workers, clinic managers, district administrators, and technical specialists, the study provided a nuanced understanding of the barriers and facilitators shaping eHealth adoption in Johannesburg's public healthcare system. While the recruitment process required adaptability, including strategic participants—such as the IPPR group discussion and the data clerk—ensured that the study maintained depth and comprehensiveness in its findings.

4.5 Conclusions

The findings of this study indicate that while eHealth has been introduced in Johannesburg's public healthcare system, it remains fragmented and inconsistently implemented. Healthcare workers' awareness of existing digital health systems varies significantly, with many unsure about ongoing pilot projects, future implementation plans, and the role of different eHealth platforms in clinical practice. The lack of a single, unified electronic health record (EHR) system has further contributed to inefficiencies, record duplication, and challenges in continuity of care.

Despite these challenges, the study identified several facilitators that could support successful eHealth implementation. These include engagement from younger professionals, championing users who advocate for digital adoption, structured training programs, and improved managerial support. However, technological challenges such as system usability, unreliable network infrastructure, and lack of adequate IT resources remain significant barriers that must be addressed for eHealth to reach its full potential.

The findings emphasise the urgent need for a coordinated eHealth strategy that focuses on policy alignment, sustainable funding, and investment in interoperability. Without stronger leadership and long-term planning, eHealth in Johannesburg risks remaining in a cycle of pilot-phase stagnation, preventing it from transforming healthcare service delivery.

These insights provide a foundation for the recommendations in Chapter 5, which propose practical steps to address the challenges identified and strengthen eHealth implementation in the City of Johannesburg.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Adopting electronic health (eHealth) systems is crucial in modernising healthcare service delivery and achieving Universal Health Coverage (UHC). In the context of South Africa's National Health Insurance (NHI) reform, establishing a unified patient health record is essential for improving clinical efficiency, patient data management, and continuity of care across different healthcare system levels. This chapter builds upon the findings discussed in Chapter 4, which examined the status of eHealth implementation in the City of Johannesburg, the level of awareness among healthcare workers, and the key facilitators and barriers influencing adoption. While Chapter 4 provided a thematic discussion of these factors, this chapter synthesises those insights into concrete conclusions and actionable recommendations.

The conclusions section summarises the current state of eHealth in Johannesburg, highlighting the challenges of fragmented implementation, poor system interoperability, and gaps in change management. The recommendations section then proposes practical steps for policymakers, healthcare managers, and system designers to strengthen eHealth adoption, focusing on policy alignment, training, infrastructure investment, and interoperability solutions. By providing a structured roadmap for eHealth advancement, this chapter aims to support the transition from pilot projects to sustainable, fully integrated digital health systems that enhance efficiency, accessibility, and patient-centred care within the Johannesburg public healthcare sector.

5.2 Conclusions

The findings of this study indicate that eHealth adoption in Johannesburg's public healthcare system remains fragmented and stalled in the pilot phase. While some digital health systems, such as Tier.Net, LabTrack, and HPRS, are operational in select facilities, they function in silos, lacking interoperability and a unified patient record system. Additionally, frontline healthcare workers reported limited awareness of new eHealth pilot projects, highlighting gaps in communication, stakeholder engagement, and change management.

The case of eHealth@Joburg, which registered a substantial number of patients before being discontinued, exemplifies the governance, funding, and policy alignment challenges hindering eHealth from progressing beyond pilot implementation. Key findings from this study align with

broader experiences in low—and middle-income countries (LMICs), where infrastructure constraints, leadership gaps, and inconsistent policy frameworks have impeded full-scale digital health transformation.

Despite these challenges, several facilitators were identified, including positive attitudes toward digital health, the presence of champion users, structured training programs, and improved managerial support. However, these remain insufficient without policy cohesion, long-term investment in infrastructure, and a commitment to system interoperability. For eHealth to succeed, it is essential to move beyond pilot projects and establish a clear roadmap for full-scale implementation. The next section outlines key recommendations to address these challenges.

5.3 Proposed recommendations

5.3.1 Implementation of a change management process

Implementing a change management process is considered one of the most efficient ways of ensuring that staff embrace and implement proposed changes. Elements of managing change related to implementing eHealth include consultation and communication with staff regarding proposed changes to their work, working environment, structure, and tools of the trade, in this case, eHealth (60).

5.3.2 Enrolling public and private sector actors/stakeholders into task teams aimed at addressing system interoperability challenges

At the heart of the technological barriers levelled at the senior leadership responsible for the design and implementation of electronic health systems lay the challenges of lack of interoperability of the various systems operating within the City of Johannesburg. While the number and function of the various systems that are currently operational within the City of Johannesburg did not appear to be problematic, their inability to talk to each other and pull information for the nurses and doctors in the consulting rooms to be able to have a comprehensive profile of the health status of the patient was the biggest challenge.

The proposal to have a comprehensive task team at the provincial level is aimed at ensuring that:

1 There is adherence to the norms and standards for interoperability that are spelt out in the National Digital Health Strategy of 2019 to ensure that all proposed digital health interventions pass the basic requirements for network interoperability before being permitted to operate within the public health sector
2 Improving consultation and congruence between the provincial department of health and the City of Johannesburg's local authority responsible for public health, particularly about implementing similar standards of care across all clinics within the City of Johannesburg. At present, anecdotal reports indicate that the general public thinks that Local Authority clinics are more efficiently managed and offer a better standard of care than provincial clinics; this situation is further perpetuated when patients observe digital health interventions implemented in some clinics and not others across the same district.
3 There is strengthened governance and leadership for implementing electronic health interventions within Johannesburg. In light of the impending implementation of NHI, the rollout of a single patient record becomes imperative. To avoid the existing fragmented approach to implementing the HPRS, for instance, versus the previous eHealth@joburg, where the former appears to have less impetus than the latter, it is important to have strong, unified governance driving electronic health systems implementation in the district. These recommendations are particularly relevant to the City of Johannesburg's senior leadership responsible for designing electronic health systems.

5.3.3 Addressing network infrastructure and uninterrupted power supply issues

Addressing the poor network infrastructure and power supply challenges experienced by study participants will require substantial investment in IT infrastructure, system upgrades, and standardised interoperability frameworks, ensuring that eHealth systems are both functional and sustainable in the long term.

Senior district officials responsible for eHealth within the City of Johannesburg health district indicated that the current pilot of eHealth was layered on a strong ICT infrastructure, with uninterrupted power supply systems, diesel powered generators as additional power back-up to provide additional power in the event of loadshedding. While these measures have been put in place for the few clinics that are currently piloting eHealth, the investment in ensuring that all clinics that will be implementing eHealth in the district are fully resourced and accommodated is a critical one.

5.3.4 Training and capacity strengthening of implementing staff

Investing in the training and capacity strengthening of implementing personnel for successful adoption and implementation of eHealth is a key factor that cannot be overemphasised. As seen in the study findings, poor computer literacy and inadequate training of the nurses resulted in resistance and lack of confidence in using the system. This recommendation aligns with studies by other researchers such as Lekalakala-Mokgele and colleagues (18), who concluded from their research that integrating continuous training greatly improves the likelihood of consistent and correct use of digital health interventions by health care workers.

To increase the chances of success of the electronic health system, investments in routine, continuous training and on-site mentorship, including refresher training, will increase the confidence of the implementing staff, and increase the rates of adoption and use of the system. The availability of job aids such as user friendly, guided, visual operating manuals will further enhance the ability of users to effectively utilise the system.

At the macro level of the health system, digital and computer literacy needs to be integrated within health training programmes, focusing on more than disease management, and extending to digital literacy to align to the changing nature of health care given that the world is in the 4th industrial revolution.

Moving forward, a coordinated eHealth strategy that includes cross-agency collaboration, comprehensive training programs, and sustained government commitment will ensure successful implementation and long-term adoption.

5.4 Implications for further research

This study has highlighted significant gaps in the implementation, adoption, and sustainability of eHealth systems in Johannesburg, pointing to the need for further research to strengthen digital health integration in South Africa. One critical area for future study is comparative research across different provinces to understand how regional infrastructure, governance, and digital literacy disparities impact eHealth adoption. Additionally, longitudinal studies are necessary to assess the long-term effects of digital health on clinical efficiency, patient outcomes, and system-wide cost-effectiveness, ensuring that eHealth investments deliver tangible improvements in healthcare delivery.

Beyond healthcare providers, patient perspectives on digital health adoption remain largely unexplored. Future research should examine public trust in eHealth, perceptions of data privacy, and accessibility of digital health services, particularly in underserved communities. Additionally, evaluating the effectiveness of various training and change management strategies would help identify the most effective models for building digital literacy and increasing system uptake among healthcare workers. These insights would enable more user-centred eHealth implementations, reducing resistance and improving engagement at the frontline of healthcare delivery.

Finally, the lack of interoperability between South Africa's existing digital health platforms remains a major technical and policy challenge. Research should focus on developing scalable data integration frameworks that allow seamless exchange of patient records between different health systems. Investigating best practices in interoperability and governance from other countries could offer valuable lessons for creating a unified, nationally integrated eHealth system. Future studies can help shape a cohesive, sustainable digital health strategy that ensures equitable, efficient, and patient-centred healthcare across South Africa by addressing these research gaps.

LIST OF REFERENCES

1. Boonstra A, Broekhuis M. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. BioMed Central [Internet]. 2010 [cited 2025 Mar 31];10(231). Available from: http://www.biomedcentral.co/1472-6963/10/231

2. Olufadewa II, Iyiola OP, Nnatus J, Fatola K, Oladele R, Olufadewa T, et al. National eHealth strategy frameworks in Africa: a comprehensive assessment using the WHO-ITU eHealth strategy toolkit and FAIR guidelines. Oxford Open Digital Health [Internet]. 2024 Jan 1;2. Available from: https://academic.oup.com/oodh/article/doi/10.1093/oodh/oqae047/7905772

3. Blaya BJA, Fraser HSF, Holt B. E-Health Technologies Show Promise In Developing Countries. Health Aff. 2010 Feb;2(29):244–51.

4. Bostan S, Johnson OA, Jaspersen LJ, Randell R. Contextual Barriers to Implementing Open-Source Electronic Health Record Systems for Low- and Lower-Middle-Income Countries: Scoping Review. Vol. 26, Journal of Medical Internet Research. JMIR Publications Inc.; 2024.

5. Cilliers L, Wright G. Electronic Health records in the cloud: Improving primary health care delivery in South Africa. In: Studies in Health Technology and Informatics. IOS Press; 2017. p. 35–9.

6. Boore C, James NM. STRATEGIC ISSUES IN E-HEALTH IMPLEMENTATION IN DEVELOPING COUNTRIES: THE KENYAN HEALTHCARE SECTOR [Internet]. Vol. 5, www.globalscientificjournal.com GSJ. 2017. Available from: www.globalscientificjournal.com

7. Sibuyi IN, De la Harpe R, Nyasulu P. A Stakeholder-Centered mHealth Implementation Inquiry Within the Digital Health Innovation Ecosystem in South Africa: MomConnect as a Demonstration Case. Vol. 10, JMIR mHealth and uHealth. JMIR Publications Inc.; 2022.

8. Iroju O, Soriyan A, Gambo I, Olaleke J. Interoperability in Healthcare: Benefits, Challenges and Resolutions [Internet]. Vol. 3, International Journal of Innovation and Applied Studies. 2013. Available from: http://www.issr-journals.org/ijias/

9. Olu O, Muneene D, Bataringaya JE, Nahimana MR, Ba H, Turgeon Y, et al. How Can Digital Health Technologies Contribute to Sustainable Attainment of Universal Health Coverage in Africa? A Perspective. Front Public Health. 2019 Nov 15;7.

10. Peterson CB, Hamilton C, Hasvold P, World Health Organization. Regional Office for Europe. From innovation to implementation : eHealth in the WHO European region. 98 p.

11. Derecho KC, Cafino R, Aquino-Cafino SL, Isla A, Esencia JA, Lactuan NJ, et al. Technology adoption of electronic medical records in developing economies: A systematic review on physicians' perspective. Vol. 10, Digital Health. SAGE Publications Inc.; 2024.

12. Odekunle FF, Odekunle RO, Shankar S. Why sub-Saharan Africa lags in electronic health record adoption and possible strategies to increase its adoption in this region. Int J Health Sci (Qassim) [Internet]. 2018;11(4):59–64. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29085270%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC5654179

13. Schreiweis B, Pobiruchin M, Strotbaum V, Suleder J, Wiesner M, Bergh B. Barriers and facilitators to the implementation of eHealth services: Systematic literature analysis. J Med Internet Res. 2019 Nov 1;21(11).

14. Ojo A, Tolentino H, Yoon S. Strengthening eHealth Systems to Support Universal Health Coverage in sub-Saharan Africa. Online J Public Health Inform. 2021 Dec 24;13(3).

15. Singh B. Factors Affecting the Adoption of Electronic Health Records by Nurses. World Appl Sci J. 2013;28(11).

16. Tsai CH, Eghdam A, Davoody N, Wright G, Flowerday S, Koch S. Effects of electronic health record implementation and barriers to adoption and use: A scoping review and qualitative analysis of the content. Life. 2020 Dec 1;10(12):1–27.

17. Mwangi C, Mukanya CM, Emily G, Faulx D, Green B, Sarah A. Mapping The Benefits And Limitations Of The Global Advancements In Ehealth : A Scoping Review the last decade has immensely contributed to the uptake and. 2017;4(12).

18. Lekalakala-Mokgele E, Lowane MP, Mogale NM. Knowledge, Perceptions and Attitudes of eHealth and Health Technology among Nursing Students from Gauteng Province, South Africa. Healthcare (Switzerland). 2023 Jun 1;11(12).

19. Kavuma M. The usability of electronic medical record systems implemented in Sub-Saharan Africa: A literature review of the evidence. JMIR Hum Factors. 2019;6(1).

20. Enam A, Torres-Bonilla J, Eriksson H. Evidence-based evaluation of ehealth interventions: Systematic literature review. J Med Internet Res. 2018;20(11).

21. Schreiweis B, Pobiruchin M, Strotbaum V, Suleder J, Wiesner M, Bergh B. Barriers and facilitators to the implementation of eHealth services: Systematic literature analysis. J Med Internet Res. 2019;21(11):1–12.

22. Granja C, Janssen W, Johansen MA. Factors determining the success and failure of ehealth interventions: Systematic review of the literature. Vol. 20, Journal of Medical Internet Research. JMIR Publications Inc.; 2018.

23. Mamuye A, Nigatu AM, Chanyalew MA, Amor L Ben, Loukil S, Moyo C, et al. Facilitators and Barriers to the Sustainability of eHealth Solutions in Low- And Middle-Income Countries: Descriptive Exploratory Study. JMIR Form Res. 2023;7.

24. Kruse CS, Kristof C, Jones B, Mitchell E, Martinez A. Barriers to Electronic Health Record Adoption: a Systematic Literature Review. J Med Syst. 2016 Dec 1;40(12).

25. Asthana S, Jones R, Sheaff R. Why does the NHS struggle to adopt eHealth innovations? A review of macro, meso and micro factors. BMC Health Serv Res. 2019 Dec 21;19(1).

26. Huang F, Blaschke S, Lucas H. Beyond pilotitis: Taking digital health interventions to the national level in China and Uganda. Vol. 13, Globalization and Health. BioMed Central Ltd.; 2017.

27. Evans RS. Electronic Health Records: Then, Now, and in the Future. Yearb Med Inform. 2016 May 20;S48–61.

28. Wright G, Mahony DO, Cilliers L. Electronic health information systems for public health care in South Africa : a review of current operational systems. Journal of Health Informatics in Africa. 2017;4(Helina):51–7.

29. Akanbi MO, Ocheke AN, Agaba PA, Daniyam CA, Agaba EI, Okeke EN, et al. Use of Electronic Health Records in sub-Saharan Africa: Progress and challenges.

30. Kesse-Tachi A, Asmah AE, Agbozo E. Factors influencing adoption of eHealth technologies in Ghana. Digit Health. 2019;5.

31. Abbott SG, Sigamoney C. The Current Healthcare Industry in South Africa. International Journal of Health and Psychology Research [Internet]. 2024 Mar 26;12(3):11–36. Available from: https://eajournals.org/ijhpr/vol12-issue-3-2024/the-current-healthcare-industry-in-south-africa/

32. Adenuga OA, Kekwaletswe RM, Coleman A. eHealth integration and interoperability issues: Towards a solution through enterprise architecture. Health Inf Sci Syst. 2015 Dec 1;3(1).

33. Boulle A, Heekes A, Tiffin N, Smith M, Mutemaringa T, Zinyakatira N, et al. Data centre profile: The provincial health data centre of the western cape province, South Africa. Int J Popul Data Sci. 2019 Nov 20;4(2).

34. Rudner Daniela, TLynda, and SNao. Unjani nurses lead the way; How eHealth can improve access to healthcare in rural South Africa. In: Bachle TChristian, and WA, editor. The futures of eHealth: Social, ethical and legal challenges. July 2019. Germany: Alexander von Humboldt Institute for Internet and Society; 2019. p. 109–14.

35. Mbunge E, Batani J, Gaobotse G, Muchemwa B. Virtual healthcare services and digital health technologies deployed during coronavirus disease 2019 (COVID-19) pandemic in South Africa: a systematic review. Vol. 6, Global Health Journal. KeAi Communications Co.; 2022. p. 102–13.

36. South Africa ND of H. National eHealth Strategy, South Africa 2012/13-2016/17. 2016;1–36.

37. National Department of Health. national-digital-strategy-for-south-africa-2019-2024-b. National Department of HEalth; 2019.

38. national-digital-strategy-for-south-africa-2019-2024-b.

39. Gyamfi A, Mensah KA, Oduro G, Donkor P, Mock CN. Barriers and facilitators to Electronic Medical Records usage in the Emergency Centre at Komfo Anokye Teaching

Hospital, Kumasi-Ghana. African Journal of Emergency Medicine. 2017 Dec 1;7(4):177–82.

40. Katurura MC, Cilliers L. Electronic health record system in the public health care sector of South Africa: A systematic literature review. Afr J Prim Health Care Fam Med. 2018;10(1).

41. Cilliers L, Katurura M. 3 . A review of the implementation of electronic health record systems on the African continent. In: 1 African Conference On Information Systems & Technology (ACIST) - CAPE TOWN, SOUTH AFRICA, 10th – 11th July 2017. 2017.

42. Ladan MA, Wharrad H, Windle R. eHealth adoption and use among healthcare professionals in a tertiary hospital in Sub-Saharan Africa: a Qmethodology study. PeerJ [Internet]. 2019 Apr 19;7:e6326. Available from: https://peerj.com/articles/6326

43. Niazkhani Z, Toni E, Cheshmekaboodi M, Georgiou A, Pirnejad H. Barriers to patient, provider, and caregiver adoption and use of electronic personal health records in chronic care: A systematic review. Vol. 20, BMC Medical Informatics and Decision Making. BioMed Central Ltd; 2020.

44. Desveaux L, Soobiah C, Bhatia RS, Shaw J. Identifying and overcoming policy-level barriers to the implementation of digital health innovation: Qualitative study. J Med Internet Res. 2019 Dec 1;21(12).

45. Adebesin F, Kotz P, Greunen D Van, Foster R. Barriers and Challenges to the Adoption of E-Health Standards in Africa Barriers and Challenges to the Adoption of E-Health Standards in Africa. 2013;(June 2014).

46. Ami-narh JT, Williams PAH. A revised UTAUT model to investigate E-health acceptance of health professionals in Africa. 2012;3(10):1383–91.

47. Jantjies ME, Mavetera N. iJNwu ® Electronic Health Records Adoption in South African Healthcare Providers: A Case of North West Province TK Modise.

48. Wright G, Yogeswaran P, Govere F, Sisulu W, Africa S, Africa S, et al. Knowledge and attitudes of nurses in community health centres about electronic medical records. Curationis. 2012;37(1):1–6.

49. Kiberu, M., Mars, Maurice., Scott, Richard E. Barriers and opportunities to implementation of sustainable e-Health programmes in Uganda : A literature review. Afr J Prim Health Care Fam Med. 2017;9(1).

50. Zharima C, Griffiths F, Goudge J. Exploring the barriers and facilitators to implementing electronic health records in a middle-income country: a qualitative study from South Africa. Front Digit Health. 2023;5.

51. Olmos-Vega FM, Stalmeijer RE, Varpio L, Kahlke R. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. Med Teach. 2023;45(3):241–51.

52. Palaganas EC, Sanchez MC, Molintas MVP, Caricativo RD. Reflexivity in qualitative research: A journey of learning. Qualitative Report. 2017 Feb 12;22(2):426–38.

53. Reid AM, Brown JM, Smith JM, Cope AC, Jamieson S. Ethical dilemmas and reflexivity in qualitative research. Perspect Med Educ. 2018 Apr 1;7(2):69–75.

54. El-Yafouri R, Klieb L, Sabatier V. Psychological, social and technical factors influencing electronic medical records systems adoption by United States physicians: a systematic model. Health Res Policy Syst. 2022 Dec 1;20(1).

55. Kgashwane TE, Chukwuere JE. Investigating the challenges, benefits, and applications of digital health in South Africa: A PRISMA process. Indonesian Journal of Information Systems (IJIS. 2025 Aug;8(1).

56. Mensah NK, Adzakpah G, Kissi J, Abdulai K, Taylor-Abdulai H, Johnson SB, et al. Health professionals' perceptions of electronic health records system: a mixed method study in Ghana. BMC Med Inform Decis Mak. 2024 Dec 1;24(1).

57. Ibeneme S, Ukor N, Ongom M, Dasa T, Muneene D, Okeibunor J. Strengthening capacities among digital health leaders for the development and implementation of national digital health programs in Nigeria. In: BMC Proceedings. BioMed Central; 2020.

58. Malakoane B, H, KNG, KH. Public health system challenges in the Free State South Africa - a situation appraisal. BMC Health Serv Res [Internet]. 2020 [cited 2025 Sep 28];58(20). Available from: https://doi.org/10.1186/s12913-019-4862-y

59. Johnson Ensa, MKhetsiwe, NStefan, BJuan, KArine. The feasibility of the PicPecc application as an mHealth tool-reflections from SA children. Rehabilitation Advances in Developing Health Systems. 2024 Jul 17;1(1).

60. Msomi M, Kalusopa T, Luthuli LP. Change management in the implementation of electronic health records (EHR) systems at Inkosi Albert Luthuli Central Hospital, South Africa. SA Jnl Libs & Info Sci [Internet]. 2021(2). Available from: http://sajlis.journals.ac.za

ANNEXURES

ANNEXURE 1: Plagiarism Declaration

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Neo Letele - Mohajane (Student number: 0218509K) am a student registered for the degree of Masters in Public Health in the academic year 2018.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: Letele Date: 22/10/2021

ANNEXURE 2A: HREC Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Ms N Letele-Mohajane

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220660

NAME: (Principal Investigator)	Ms N Letele-Mohajane
DEPARTMENT:	School of Public Health Medical School University
PROJECT TITLE:	*Facilitators and barriers to the implementation of electronic health systems by health care workers at primary health care clinics in the City of Johannesburg*
DATE CONSIDERED:	2022/06/24
DECISION:	Approved unconditionally
CONDITIONS:	Previous condition (permission to use primary healthcare clinics) satisfied on 2023/02/20
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Dr P Ditlopo
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/12/02

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. I agree to submit a yearly progress report. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **June** and therefore reports and re-certification will be due in the month of **June** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

24.02.2023
Date

ANNEXURE 2B: NHRD Ethics Clearance Certificate

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Joburg
a world class African city

Research Committee of Johannesburg Health District

Enquiries: Prof S. Moosa | 0824466825 (WhatsApp) | shabir@profmoosa.com

DATE: 9th February 2023

ATT: Human Research Ethics Committee

Dear Sir/Madam

STUDY TITLE: FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF eHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE CLINICS IN THE CITY OF JOHANNESBURG

NHRD REF. NO.: GP_202212_007

PROVISIONAL APPROVAL

The Johannesburg District Research Committee (DRC) has reviewed the above application.

The Jhb DRC hereby provides **PROVISIONAL** approval to conduct the study in facilities of the Johannesburg Health District as listed below. The Jhb DRC OFFICIAL APPROVAL will **ONLY** be issued subject to the Jhb DRC being provided the FINAL ethics approval.

This letter DOES NOT serve as a final approval letter for this study and no data collection may happen without the JHB DRC FINAL PERMISSION LETTER.

Regards,

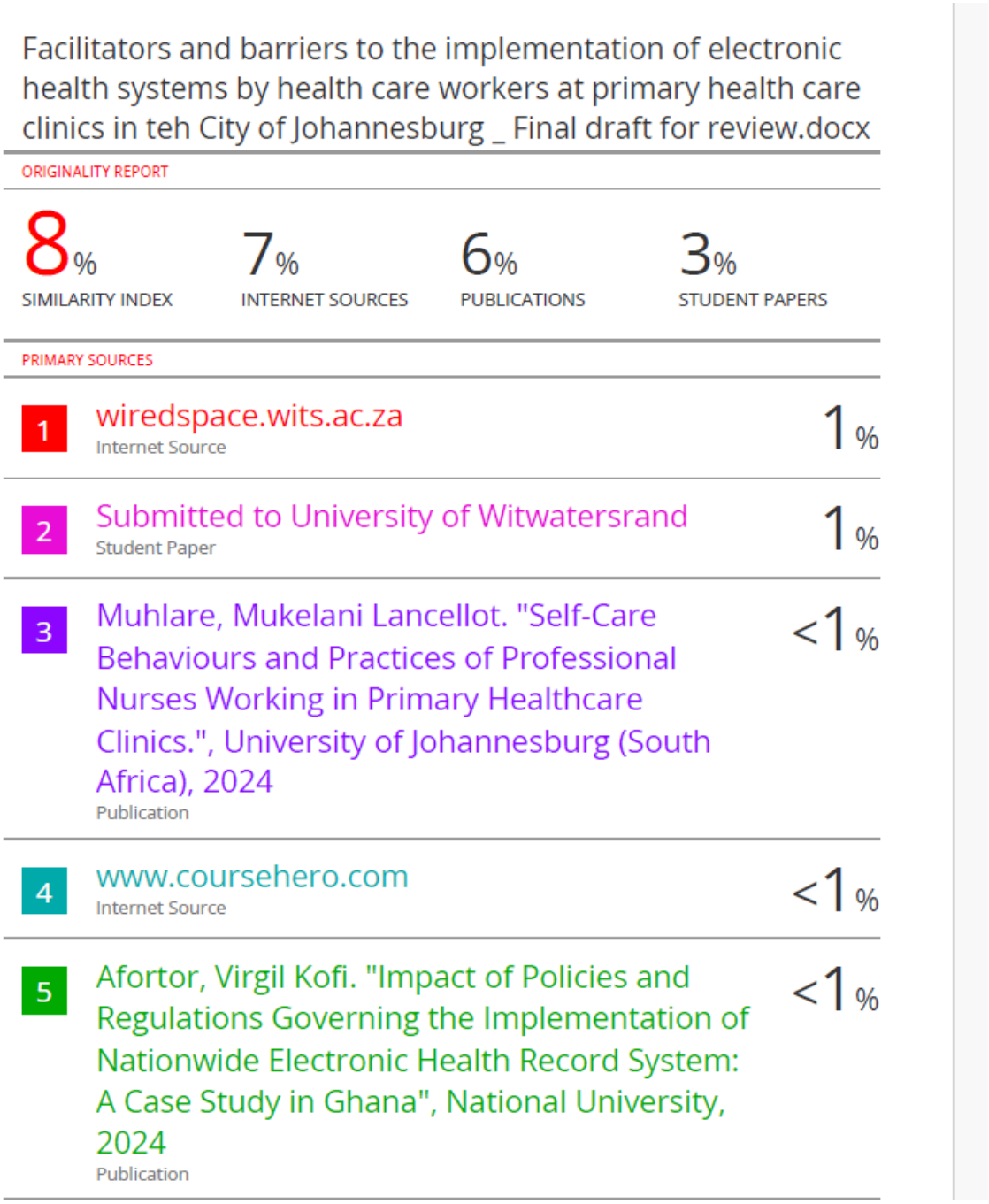
Prof S. Moosa
Chairperson: District Research Committee
Johannesburg Health District

List of Facilities Approved

- 17 Esselen Street Clinic
- Alexandra 8th Avenue Clinic
- **Chiawelo CHC**
- Eldorado Park Ext 2 Clinic
- Halfway House Clinic
- Randburg Clinic
- Weltevreden Park Clinic

1

ANNEXURE 3: Turnitin Report



Facilitators and barriers to the implementation of electronic health systems by health care workers at primary health care clinics in teh City of Johannesburg _ Final draft for review.docx

ORIGINALITY REPORT

8%	7%	6%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	wiredspace.wits.ac.za Internet Source	1%
2	Submitted to University of Witwatersrand Student Paper	1%
3	Muhlare, Mukelani Lancellot. "Self-Care Behaviours and Practices of Professional Nurses Working in Primary Healthcare Clinics.", University of Johannesburg (South Africa), 2024 Publication	<1%
4	www.coursehero.com Internet Source	<1%
5	Afortor, Virgil Kofi. "Impact of Policies and Regulations Governing the Implementation of Nationwide Electronic Health Record System: A Case Study in Ghana", National University, 2024 Publication	<1%

ANNEXURE 4: PARTICIPANT INFORMATION SHEET

Study title:

FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF EHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE CLINICS IN THE CITY OF JOHANNESBURG

Good day:

Introduction:

I, Neo Letele-Mohajane, a student in the School of Public Health at the University of the Witwatersrand, am pursuing a Masters Degree in Public Health. As part of the requirements of my degree, I am doing research on the **FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF EHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE CLINICS IN THE CITY OF JOHANNESBURG**

Research is a process used in seeking new knowledge. In this study we want to learn about your experiences of the facilitators and barriers to the implementation of eHealth systems currently being implemented within the City of Johannesburg.

Invitation to Participate: We are asking / inviting you to take part in this research study.

What is involved in the study?

1. The participant will be requested to participate in a 45 minute interview with the researcher.
2. The interview will utilize a semi-structured interview guide, with open ended questions designed to draw out participant opinions about the subject being researched on.
3. The researcher will schedule the interview at a date, time and venue convenient to you.

Risks of being involved in the study: there are no anticipated risks in being involved in the study. However, should any of the research questions evoke traumatic emotions, arrangements will be made for the participant to receive free and confidential counselling.

Benefits of being in the study: There is no direct benefit to the participant. However, by participating in this study, the participant may be contributing to the improvement of the electronic health record system within the City of Johannesburg, which once improved, should result in positive health outcomes for the population of the City of Johannesburg.

The Participant will be given pertinent information on the study while involved in the project and after the results are available.

Participation is voluntary, Refusal to participate will involve no penalty or loss of benefits to which the Participant is otherwise entitled, as, for example, a hospital patient; that the Participant may discontinue participation at any time without penalty, or loss of benefits to

which the Participant is otherwise entitled; there is no requirement to provide a reason for withdrawing and any data collected on such a person will in default be destroyed, unless the Participant specifically consents to its retention.

Reimbursements for "out of pocket" expenses - there is no payment or cost associated with participation, *e.g.* travel expenses and refreshments.

Confidentiality: Normally personal information will be treated in the strictest confidence and will only be available to the Principal Investigator (PI) and his/her Supervisor, in the case wherein the PI is a postgraduate student. The only exceptions - and all of them are rare - would normally be:

1. Personal information may be disclosed if required by law
2. the Human Research Ethics Committees of the University may exceptionally require personal data to respond to a formal complaint, or for a compliance audit

If results are published, this may, exceptionally, lead to cohort, or more rarely, individual identification. All data collected in the course of the study will be securely retained for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Anonymity can usually only be guaranteed in questionnaires, whether in hard copy or online.

Contact details of researcher/s: to enable prospective or actual Participants to get further information, or report adverse events, the researcher's details and supervisor's details are below:

Ms Neo Letele, Researcher - telephone no. 082 976 3612, or by e-mail at neo.mohajane@gmail.com,

Dr Prudence Ditlopo, Supervisor - telephone no. 011-717 3433 or by e-mail at Prudence.Ditlopo1@wits.ac.za.

Outputs

The output of this study will be a research document which will be shared with all participants after the completion of the study.

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you want any information regarding your rights as a research participant, or complaints regarding this research study, you may contact **Prof Paul Ruff**, Chairperson of the University of the Witwatersrand, Human Research Ethics Committee (HREC), which is an independent

committee established to help protect the rights of research participants at (011) 717 2301. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za.

Thank you for reading this Study Information Sheet. A copy of this information sheet will be availed to you for your records.

Updated August 2023

ANNEXURE 5 (A): Participant Consent Sheet

PARTICIPANT CONSENT SHEET

FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF EHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE FACILITIES IN THE CITY OF JOHANNESBURG

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study I am free to speak to any of these contacts.

Contact details:
Ms Neo Mohajane (nee Letele), Principal Investigator, telephone no. 082 976 3612, or by e-mail at neo.mohajane@gmail.com,

Dr Prudence Ditlopo, Supervisor, on telephone no. 011-717 3433 or by e-mail at Prudence.Ditlopo1@wits.ac.za.

If you want any information regarding your rights as a research participant, or complaints regarding this research study, you may contact **Prof Paul Ruff**, Chairperson of the University of the Witwatersrand, Human Research Ethics Committee (HREC), which is an independent committee established to help protect the rights of research participants at (011) 717 2301. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za.

Name of Participant: _____
Date: _____
Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

ANNEXURE 5 (B) Consent Form for Audio Recording of the Interviews

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FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF EHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE FACILITIES IN THE CITY OF JOHANNESBURG

I hereby consent to audio recording of the interview[1], or group discussion[1], or classroom interaction[1]

I understand that:

- The recording will be stored in a secure location (a locked cupboard or password protected computer) with restricted access to the researcher and the research supervisor.
- The recording will be transcribed and any information that could identify me will be removed,
- The recordings will be erased within either (a) two (2) years of the publication of the research findings, or (b) six (6) years, if no publications arise from this research
- Anyone wishing to access this information in the future will first have to obtain the approval of the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg
- Direct quotes from my interview, without any information that could identify me, may be cited in the research report or other write-ups of research.

Name of Participant: _____
Date: _____
Place: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

ANNEXURE 6: Interview Schedule for District and Sub-District Managers

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FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF EHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE CLINICS IN THE CITY OF JOHANNESBURG

INTERVIEW SCHEDULE FOR KEY INFORMANTS

This interview schedule serves as a guide for the areas that we will explore with the Key Informants in the in-depth interviews exploring their perceptions about the barriers to the utilisation of the eHealth system. Key informants include the clinic managers, district and sub-district managers that are responsible for all health care clinics in their sub-district.

Part 1: Background Information:

Date of interview: _____ Participant ID: _____

Gender: Male _____ Female _____ (please tick appropriate)

Job title of respondent: _____

Sub-district _____

Education level of respondent: _____

Length of time in this position: _____

Department: _____

PART 2: Individual level factors

2.1 What is your role in the implementation of eHealth within the district?
Probe on:

- What is your involvement with eHealth in the sub-district?

2.2 Can you tell me more about your sub-district?
Probe on:

- Number of the clinics, number of patients seen in a month, human resources, and managerial structure?

2.3 Knowledge about eHealth System:
What is the intended purpose of the eHealth system?

Probe on:

- Can you tell me what the eHealth system is about?
- What role did you play in the design of the eHealth system?
- In your view, is this system achieving its intended purpose?
- When was the eHealth system rolled out in clinics in the City of Joburg?
- Which cadres are responsible for using eHealth at clinic level?
- What is your role in the implementation of eHealth in your sub-district?
- How do you think eHealth impacts on the work of those using the eHealth system?
- How does it impact on patient care (has it made it easy or difficult?)

PART 3: Environmental and Organisational Context:

3.1 Did PHC clinicians receive any training on how to operate the eHealth system?
Probe on:

- Who provided the training (was it internally or externally facilitated)?
- How long was the training?
- What was the content of the training?
- Has the training been useful in helping your staff use the eHealth system? (probe – in what way has it been helpful?)

3.2 To what extent would you say that PHC clinicians have the technical skills to operate the eHealth system?
Probe on:

- What IT skills do you think are essential to enable PHC clinicians to use the eHealth system?

3.3 To what extent would you say the management at clinic level are equipped to provide support to clinicians in implementing eHealth?

Probe on:

- What is the nature of the support provided?

3.4 What policies and standard operating procedures exist to guide PHC clinicians in implementing eHealth?
Probe on:

- What policies help you to know what the eHealth system is about and how it benefits the user, the patient as well as the health system?
- Which policies and regulations help PHC clinicians to know which functions of the eHealth system to use and under which situations?

Part 4: Technological factors

4.1 What tools do you have accessible to you to help you in managing the implementation of eHealth?
Probe on:

- Do you have access to a computer/laptop/other device such as a tablet to capture patient data?
- What access do you have to the internet/WIFI to enable the functioning of eHealth?

4.2 How easy is it for you to share information and files with others using the eHealth system?
Probe on:

- What network challenges do you experience which affect sharing of information?
- What challenges do you generally experience in sharing files with others in the same clinic and outside your clinic?

4.2 To what extent would you say PHC clinicians use the eHealth system to capture patient data?
Probe on:

- What would you say are the factors enabling PHC clinicians to use the eHealth system?
- What would you say are the barriers hindering PHC clinicians to use the eHealth system?
- What do you think should be done to assist PHC clinicians to use the eHealth system more?

5. Are there any other comments you would like to make on how the utilisation of eHealth can be improved amongst PHC clinicians?

ANNEXURE 7: Interview Schedule for Doctors and Nurses

FACILITATORS AND BARRIERS TO THE IMPLEMENTATION OF eHEALTH SYSTEMS BY HEALTH CARE WORKERS AT HEALTH CARE CLINICS IN THE CITY OF JOHANNESBURG

INTERVIEW SCHEDULE FOR PRIMARY HEALTH CARE (PHC) CLINICIANS (DOCTORS AND NURSES)

This interview schedule serves as a guide for the areas that we will explore with the PHC Clinicians in the in-depth interviews exploring their perceptions about the facilitators and barriers to their utilisation of the eHealth system.

Part 1:Background Information:

Date of interview: _____Participant ID: _____

Gender: Male _____ Female _____ (please tick appropriate)

Name of clinic: _____Sub-district: _____

Job title of respondent: _____

Education level of respondent: _____

Length of time in this clinic: _____

Department: _____

PART 2: Individual level factors

2.3 What are your current roles and responsibilities?

– Probe on:
  - What day to day tasks do you perform in the clinic?

2.4 Can you tell me more about your clinic?
Probe on:
  - Size of the clinic, number of patients seen in a month, human resources, and managerial structure?

2.3 Knowledge about eHealth Systems:
What do you understand about the following terms?

- eHealth – Electronic Health
- EHR – Electronic Health Records
- EMR – Electronic Medical Records
- EPR – Electronic Patient Records
- Where did you learn about these terms/words?

Have you heard of the eHealth system being implemented in your clinic?

Probe on:

- Can you tell me what the eHealth system is about?
- Where did you get information about eHealth from?
- When was eHealth implemented in your clinic?
- Which cadres are responsible for using eHealth in your clinic?
- What is your role in implementing eHealth in the clinic?
- How do you think it impacts on your work?
- How does it impact on patient care (has it made it easy or difficult?)

PART 3: Environmental and Organisational Context:

3.2 Did you receive any training on how to operate the eHealth system?

Probe on:

- Who provided the training (was it internally or externally facilitated)?
- How long was the training?
- What was the content of the training i.e what were you trained to do with regards to the eHealth system?
- How has the training enabled you to implement the eHealth system?

3.2 To what extent would you say you have the technical skills to operate the eHealth system?

Probe on:

- What IT skills do you think are essential to enable you to use the eHealth system?

3.4 To what extent would you say the management in your facility provides support to enable you to use eHealth?

Probe on:

- What is the nature of the support provided?
- How frequently have you received support in the last year?

3.5 What policies and standard operating procedures exist to guide you in implementing eHealth?

Probe on:

- What policies help you to know what the eHealth system is about and how it benefits you as the user, the patient as well as the health system?
- Which policies and regulations help you know which functions of the eHealth system to use and under which situations?

Part 4: Technological factors

4.3 What tools do you have accessible to you to help you in implementing eHealth?

Probe on:

- Do you have access to a computer/laptop/other device such as a tablet to capture patient data?
- What access do you have to the internet/WIFI to enable the functioning of eHealth?

4.4 How easy is it for you to share information and files with others using the eHealth system?

Probe on:

- What network challenges do you experience which affect the
- sharing of information?
- What challenges do you generally experience in sharing files with others in the same clinic and outside your clinic?

4.2 To what extent would you say you use eHealth to capture patient data?
Probe on:

- What would you say are the factors enabling you to use the eHealth system?
- What would you say are the barriers hindering you to use the eHealth system?
- What do you think should be done to assist you further so that you use the eHealth system more?

5. Are there any other comments you would like to make on how the utilisation of eHealth can be improved amongst PHC clinicians?