APPLYING HUMAN FACTORS AND ERGONOMICS TO A HEALTHCARE CLINIC RECORD-KEEPING PROCESS USING A COMMUNITY-BASED PARTICIPATORY RESEARCH APPROACH IN MAKHANDA

BY

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Abstract

Background: Healthcare record-keeping is an important process. However, several challenges associated with taking, storing and maintaining accurate records have been identified as a barrier to the quality and safety of care globally and locally in primary healthcare clinics in Makhanda, Eastern Cape, South Africa. In this context, local healthcare providers argue that this stems from the hybrid nature of the system (paper and electronic) and the impact of several systemic challenges. Poor records can result in negative outcomes for patients, healthcare workers and the greater public healthcare system. For example, if patient files are not adequately completed, poor patient care and medico-legal litigation costs may emerge. Furthermore, given that HFE promotes the participation of stakeholders in identifying and resolving workplace challenges, this study adopted a participatory research approach, more specifically a Community-Based Participatory Research (CBPR) approach. This research project, therefore, aimed to explore the barriers and facilitators to record-keeping in a primary healthcare clinic in Makhanda, the adequacy of patient file completeness and reasons as to why files may or may not have been adequately completed, following a CBPR approach. **Methods:** Following a period of pre-data collection embedding in the clinic to become familiar with the system and the staff and to form a relationship with a community collaborator from the clinic, this study was completed in two broad phases. During Phase 1*,* observations, informal discussions and semi-structured interviews were conducted with 11 clinic staff members to understand the clinic and record-keeping systems through the work system components and barriers of both systems. Phase 1 data was analysed through thematic analysis and presented by work system components, selected SEIPS 101 tools and a Hierarchical Task Analysis to detail the tasks involved in the record-keeping process. During Phase 2, a comparative assessment of a sample of patient files (n=55) was conducted against a local standard checklist, detailing what was to be completed in patient files. This was done to assess the completeness of different file sections which were analysed through a frequency count. This was followed by three interviews with clinicians, which explored their perceptions on why sections of the records may have been better completed than others. The interviews were then thematically analysed. **Results:** Administrative staff shortages, a lack of file storage space, limited access to technology such as computers, lost files, and the amount of information to complete in files were identified as the major challenges associated with the record-keeping system and influencing the completion of patient files. Through the analysis of patient files, it was found that some patient file sections were completed more adequately than others. For example, administrative details were the most well-completed section, and the Anti-Retroviral Therapy (ART) initiation section was the most poorly completed. The findings also revealed reasons as to why these sections may or may not have been adequately completed. These included the need for the duplication of information, particularly for antenatal care clinicians. Time pressure for clinicians to see and complete patient records and work ethic and accountability were additional emergent themes. Lastly, clinicians argued that having a lack of access to, a shortage of or broken medical and record-keeping equipment that inhibited clinicians from obtaining and recording patient information, were additional reasons for poorly taken records. **Conclusions:** As the findings revealed, the primary healthcare clinic and its hybrid record-keeping system and process were influenced by a variety of clinic and record-keeping challenges that interacted and ultimately influenced the record-keeping process and completeness of patient files. The system constraints are important considerations as understanding how the clinic functions under them is a starting point for future system improvement. Furthermore, barriers impacting the record-keeping system influence several key steps in the record-keeping process, including the completion of details within patient files. Here it was found that some sections and information details were more adequately completed than others, which impacted the continuity, quality and safety of patient care. Additionally, the discrepancies found between the standard checklist and patient files were highlighted as a point of concern for the Department of Health (DoH) as clinics were being assessed based on a checklist that did not match the patient files, incorrectly representing the completeness of files to the DoH. Throughout the research project, the application and implementation of HFE and CBPR have been shown to be important in the local healthcare record-keeping system in that real-world challenges were identified through the perspective of community members facing the challenges. Therefore, HFE researchers should adopt a CBPR approach and apply these complementary domains in other complex systems and varying contexts to comprehensively understand the barriers, facilitators and opportunities for human-system interaction improvements.

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Chapter One: Introduction

Healthcare records are essential documents containing important demographic and medical patient information (Berger & Scott, 2020; Ohuabunwa et al., 2016), with record-keeping being the process of completing these documents and recording patient information. Good-quality record-keeping is essential for a multitude of areas and for several reasons. First and foremost, for the quality of patient care using management, communication and coordination of patient information while also facilitating research, medico-legal litigation and the performance of tasks and medical care (Berger & Scott, 2020; Britz, 2018; Houben et al., 2015). Therefore, the taking and maintenance of records require a clearly defined step-by-step process of the tasks which forms part of the broader record-keeping system (which for the purposes of this thesis refer to the interactions between components such as the people, equipment, environment and organisation within the system).

However, healthcare record-keeping systems are complex due to challenges related to the actual records taken and how they are stored and retrieved (Pirkle et al., 2012). The dynamic interactions between the work system components (Carayon et al., 2006), and emergent outcomes thereof and the hybrid nature of the record-keeping system also contribute to the system's complexity. Several common barriers to effective record-keeping within South Africa have been reported and include the divide between the public and private healthcare system, human, financial and infrastructural resource constraints and high demand (and pressure) on the public healthcare system (Coovadia et al., 2009; Kautzky & Tollman, 2008; Maphumulo & Bhengu, 2019; Mayosi & Benatar, 2014). The designs of the systems and the many interactions that occur when they are taken, stored or used have resulted in inaccurate or inadequately completed records, which could impact outcomes of the healthcare system. For example, the performance of care tasks leading to the safety and quality of patient care are impacted (Berger & Scott, 2020; Pirkle et al., 2012) which in turn contribute to medico-legal litigation costs, amounting to a total of R81,80 billion in South Africa in 2022 (Standing Committee on Public Accounts, 2023). The complexity of record-keeping systems and the negative impacts on the healthcare system outcomes justify an investigation into understanding record-keeping systems through appropriate disciplinary approaches.

Human Factors and Ergonomics (HFE), as a systems discipline, is appropriate to apply to and understand healthcare record-keeping systems and the barriers and facilitators that influence record-keeping systems, due to previously being used to understand healthcare systems (Hignett et al., 2018; World Health Organisation, 2021). An essential part of the application of HFE principles and methods is the involvement of workers and other relevant stakeholders in understanding and re-designing a system(Berger & Scott, 2020; Leape & Berwick, 2005). Participatory ergonomics actively involves workers in understanding, designing, implementing and evaluating their own work systems (Wilson et al., 2005). Building on the participatory nature of HFE, participatory research approaches, such as Community-Based Participatory Research (CBPR), can be used to conduct research with people/ communities and for the people/ communities rather than on people/ communities by others from the onset to completion of a study (Telleria, 2021) when using HFE approaches. CBPR is a common approach that provides a framework for conducting participatory research that takes action by involving the community to ensure research is conducted for, by and to the benefit of the people from the start of the research process (DeJonckheere et al., 2019; Telleria, 2021). Due to the people-centred nature of both the HFE and CBPR approaches, they are appropriate to apply in combination in complex systems such as primary healthcare systems.

1.1 Background to this study

Prior to the COVID-19 pandemic, a relationship existed between the Department of Human Kinetics and Ergonomics and the local Makhanda Department of Health (DoH), where research was conducted focusing on barriers to the provision of high-quality healthcare (Card, 2020). Following the CBPR approach and framework, at the start of this research project, the relationship with the DoH was re-established, which allowed collaboration with community partners from the onset of this research project. This collaboration enabled early discussions with the DoH and clinic stakeholders where healthcare record-keeping, or more specifically the completeness of patient records, was identified as an ongoing challenge and area worth investigating in local primary healthcare clinics. The consultation with local and relevant stakeholders and the investigation of the identified challenge makes this research project responsive in nature. This study, therefore, aimed to address the locally identified issue of why records were or were not adequately completed within a clinic in Makhanda, South Africa. Furthermore, it also aimed to understand how broader factors influence the record-keeping process and system by applying Human Factors and Ergonomics as a systems discipline exploring interactions, barriers and facilitators within the hybrid record-keeping system using a CBPR approach. This is particularly important as there has been little to no research on the application of HFE to understand barriers and facilitators to record-keeping using a CBPR approach, specifically in low and middle-income countries (LMICs) and South Africa.

1.2 Objectives

To address the overall aims of this project, the following objectives were set:

1) To understand the clinic system and its work systems components along with clinic barriers and facilitators.
2) To gain insights into the record-keeping system and the barriers and facilitators of the record-keeping process.
3) To determine if patient records are adequately completed or not.
4) To understand the reasons behind why patient records may or may not be adequately completed.

1.3 The structure of this thesis

To address the above aim and objectives, this thesis will start by reviewing the literature on patient safety and quality of care before moving onto the South African healthcare system and healthcare record-keeping, along with their associated challenges. The remainder of the review explores the Human Factors and Ergonomics discipline and participatory approaches to research along with how they have both been previously applied in healthcare settings. Following the review is a chapter giving context to this research project and how the research objectives were established along with detailing the context of the collaborating clinic as important considerations before getting into the methods in Chapter 4. The method chapter details the study design, data collection approaches, procedures and analysis methods before the results from data collection are laid out in Chapter 5. A discussion of results follows in

Chapter 6, where reasons for the completeness of patient files in relation to barriers and facilitators of the record-keeping system and broader clinic system are explored, along with research limitations and recommendations. A personal reflection on the application of CBPR concludes this section, before the conclusion of the thesis in Chapter 7.

Chapter Two: Literature Review

1.1 Patient safety and quality of care

The World Health Organization (2021, pg. v) defines patient safety as "A framework of organised activities that creates cultures, processes, procedures, behaviours, technologies and environments in health care that consistently and sustainably lower risks, reduce the occurrence of avoidable harm, make errors less likely and reduce the impact of harm when it does occur." Simply put, patient safety is when minimal or no preventable or unnecessary harm is inflicted on patients due to the healthcare system (Alti & Mereu, 2021).

Healthcare systems aim to provide safe, effective, patient-centred, timely, efficient and equitable healthcare, which can be achieved if stakeholders at all levels contribute to system design, from policymakers, regulators, and management to healthcare professionals and patients (Institute of Medicine, 2001; Jun et al., 2018; Kohn et al., 2000). If these aims are not adequately achieved, it could lead to unsafe and poor quality of care, which has been an important topic of discussion due to the problems it has presented within healthcare systems for many years, as reported by the Institute of Medicine in 1999 and 2001 (Bates & Singh, 2018; Clancy, 2009; Institute of Medicine, 2001; Leape & Berwick, 2005). In low and middle-income countries (LMICs), in other words, the Global South, the number of patients subjected to an adverse event can be as high as one in every four patients, with millions of adverse events and even deaths occurring annually due to poor quality care (Dhingra-Kumar et al., 2021; National Academies of Sciences, 2018). There has been a significant focus on patient safety in hospitals as the tertiary point of care, as this is where it is thought that most incidents occur, yet unsafe care extends back into primary care (Alti & Mereu, 2021; World Health Organisation, 2021).

The burden of patient safety can also be looked at from an economic perspective, with both direct costs (such as the waste of resources) and indirect costs (such as the loss of population productivity) associated with unsafe care. In light of this, reducing unsafe healthcare is vital for improving economic growth (World Health Organisation, 2021). To achieve this safer and higher quality of care, a constant interrogation of how healthcare systems are designed and how this influences the care processes is critical (Bates & Singh, 2018; Institute of Medicine, 2001; Lachman, 2021; World Health

Organisation, 2021) as poorly designed healthcare systems will never function optimally, no matter how hard workers try to make it (Institute of Medicine, 2001). This has led the World Health Organization to release the Global Patient Action Plan in 2021 to reduce avoidable harm caused by unsafe care as much as possible across the globe (World Health Organisation, 2021). The main goal of this plan is for patients to receive safe and respectful care everywhere and all the time through driving policies, strategies and actions rooted in science, patient and stakeholder collaboration and system design (World Health Organisation, 2021).

The World Health Organisation (2021) takes the standpoint that using the term patient safety rather than medical error allows for recognising several essential points, including that human error needs to be diminished and avoided rather than wholly eliminated (World Health Organisation, 2021). Unfortunately, patient safety has been slow to improve due to several systemic challenges (Bates & Singh, 2018; Beleffi et al., 2021; Clancy, 2009; Institute of Medicine, 2001; Leape & Berwick, 2005). These include the fragmentation between processes, a lack of involvement from stakeholders, organisational and individual unwillingness to learn from errors, how errors are viewed in a system, a lack of leadership, inadequate testing measures, inadequate investment, cultural barriers and more recently, the constraints and effects of the COVID-19 pandemic (Beleffi et al., 2021; Leape & Berwick, 2005; Mann, 2005; Mbunge, 2020). These systemic challenges transcend contexts and become more specific and unique in varying settings. In LMICs, for instance, significant systemic barriers to patient safety and quality of care may also include poverty and inequalities across cities and provinces within the countries (Achoki et al., 2022; Scott & Charteris, 2004). As an LMIC, South Africa faces additional challenges within different contexts in maintaining adequate patient safety and quality of care, which will be discussed in further depth in a later section.

Several vital principles should be considered to achieve this global safety goal including considering the context and nature of the healthcare setting, combining science and patient experience to improve safety, and finally, creating a safety culture across all levels of healthcare, including staff, patients, decision-makers and other stakeholders (World Health Organisation, 2021). Above these goals, for the improvement of quality of care, well-being and patient safety, there has been an acknowledgement of the need for a systemic approach for many years (Kohn et al., 2000), which is crucial as it recognises the context and complexity in which healthcare services occur (Beleffi et al., 2021). As part of the context of healthcare systems, it is now important to understand the context of the South African public healthcare sector in which these patient safety challenges occur.

1.2 The South African Healthcare System

1.2.1 The structure of the South African healthcare system

Understanding the context of the South African healthcare system is essential to understand patient safety and other system challenges. The South African healthcare system is split into private and public care. The public sector is then divided into three sections; entry-level primary care, which does not require referral and could include healthcare clinics, general practice or community care; a patient can then be referred to secondary care, which are often hospitals with several more specialised departments (Dookie & Singh, 2012; Young, 2016). Finally, tertiary-level care becomes even more specialised with specific equipment and highly technical knowledge (Dookie & Singh, 2012; Young, 2016).

1.2.2 Understanding challenges faced by the South African Healthcare System

A significant challenge across the South African healthcare system is the inequalities stemming from the divide between public and private care and the reasons for this divide. The private sector is primarily funded by out-of-pocket payments or medical schemes, with only a small percentage of the population being funded by these schemes (Coovadia et al., 2009; Mayosi & Benatar, 2014; Peltzer, 2009). On the other hand, most of the South African population solely depends on public healthcare, while some use a combination thereof (Coovadia et al., 2009; Mayosi & Benatar, 2014; Peltzer, 2009). The public sector is often the only point of care for much of the population, which places high demand on an already strained system, resulting in services that are still difficult to access, especially for the poorest and most ill (Achoki et al., 2022; Kautzky & Tollman, 2008; Ngene et al., 2023; Young, 2016). Unequal healthcare delivery across district levels and the public and private sectors is created from this divide (Achoki et al., 2022; Dookie & Singh, 2012). Furthermore, despite the public healthcare sector servicing the majority of the population (approximately 84%), it is staffed by only 30% of the national healthcare staff, which demonstrates how short-staffed the public healthcare sector is and provides some reasoning for the poor quality of care (Mayosi & Benatar, 2014; Ngene et al., 2023; Young, 2016). Over and above the challenges created by the divide between public and private care in South Africa, many other emergent challenges are faced nationally.

These challenges are rooted in the segregation and underfunding of parts of the healthcare system that occurred during Apartheid (Coovadia et al., 2009). Post-apartheid, 1994, the motivation to transform the healthcare system was high, yet implementing national and local change policies and redistribution of resources has not been adequately achieved (Achoki et al., 2022; Coovadia et al., 2009; Kautzky & Tollman, 2008). Despite the South African Constitution having formulated policies for the right to health for all, significant health inequalities remain, particularly concerning race, province, gender and care provided in public facilities as compared to private ones (Achoki et al., 2022; Coovadia et al., 2009; Kautzky & Tollman, 2008).

While multifaceted, some common challenges that continue to hinder improvements in South African healthcare include a lack of human resources, poor planning, poor stewardship, poor management, poor leadership, unequal resource distribution, increased demand and various contextual challenges in the public healthcare system (Coovadia et al., 2009; Kautzky & Tollman, 2008; Maphumulo & Bhengu, 2019). Contextual challenges may include the HIV/AIDS epidemic, a healthcare worker shortage, historical imbalances concerning healthcare access, a burden of communicable and non-communicable diseases, restricted and misappropriated spending and inadequate access to basic life rights leading to poverty and ill health (Coovadia et al., 2009; Dookie & Singh, 2012; Kautzky & Tollman, 2008; Maphumulo & Bhengu, 2019; Mayosi & Benatar, 2014). Furthermore, state hospitals and infrastructure have been mismanaged, underfunded and neglected, leaving the healthcare system dysfunctional (Mayosi & Benatar, 2014), particularly in the wake of the COVID-19 pandemic (Mbunge, 2020).

Understanding these unique systematic and contextual challenges of the healthcare system is essential as they have several downstream effects within smaller-scale healthcare systems across South Africa, affecting patients and organisations in various ways (Maphumulo & Bhengu, 2019; Peltzer, 2009). The negative impact of these challenges on patients can be substantial; for example, patients have ranked waiting time, autonomy, and basic amenities as poor in the South African healthcare system (Peltzer, 2009). Furthermore, various unique challenges to healthcare systems have emerged provincially, for example, provinces such as the Western Cape and Kwa-Zulu Natal have a stronger Healthcare Access and Quality Index as compared to rural provinces such as Free-State, Northern Cape and Eastern Cape (Achoki et al., 2022). Previous research by Card (2020) explored the systemic barriers to care provision in 15 local clinics in the Sarah Baartman district of the Eastern Cape Province. Notable and prominent system barriers identified included staff shortages, poor management and leadership, lack of equipment and basic necessities, inadequate infrastructure, patient complexity and high workloads (Card, 2020).

In sum, many complex challenges continue to impact the South African healthcare system and its ability to provide high-quality care. An area within the healthcare system affected by these challenges includes the information produced and stored by the system, in other words, healthcare information systems (English et al., 2011). This information and the successful recording of the information impacts the performance of medical tasks and, therefore, patient care, which will be discussed in further detail in the following section. English et al. (2011) and Maphumulo & Bhengu (2019) highlight various information-related challenges that affect the functioning of public healthcare systems. These challenges may include not having an overarching strategy to standardise health information systems and legislation guiding the implementation of the system, a lack of standardisation and buy-in from healthcare managers, adverse events, increased litigation because of avoidable errors and poor health data collection and feedback, therefore, poor record-keeping. Due to the importance of healthcare information, specifically, healthcare record-keeping and related challenges, this review will now focus on healthcare record-keeping.

1.3 Healthcare record-keeping

Healthcare records contain patient information such as demographics, progress notes, vital signs and medical histories (Berger & Scott, 2020; Ohuabunwa et al., 2016). These records are considered medico-legal (involving medical and legal aspects) documents supporting patient management, continuity of care, and quality of care (Britz, 2018). The medico-legal aspect of healthcare records is important as they defend healthcare practitioners and institutions against legal action; in other words, they serve as evidence in medico-legal litigation (Britz, 2018). Healthcare records are also crucial as they hold and communicate critical patient information among healthcare professionals, making good record-keeping essential to patients' current and future care (Wong & Bradley, 2009). Good healthcare records support good quality care as they allow for effective communication among healthcare staff (Pullen & Loudon, 2006). Accurate record-keeping is essential to the patient care processes, service management, research and the coordination and communication of patient treatments (Berger & Scott, 2020; Houben et al., 2015).

Other benefits of good quality record-keeping include increasing access to information, allowing for better decision-making, allowing for patient and family involvement in care, protection for those providing care, allowing for evaluation of care, playing a role in patient management, serving educational purposes, minimising untreated patients while allowing for the implementation of research findings in patient care (Bizimana & Bimerew, 2021; Mutshatshi et al., 2018; Pirkle et al., 2012).

1.3.1 Inaccurate healthcare record-keeping

Despite the importance of medical records in creating high-quality and efficient care, the accuracy of records completion, paper or electronic, is not always adequate (Berger & Scott, 2020; Wong & Bradley, 2009). Inaccurate information in records or inadequate record-keeping is problematic as it negatively impacts and threatens the safety and quality of current and future patient care by impacting worker's ability to do work (Berger & Scott, 2020; Pirkle et al., 2012). For example, medical records that are inadequately managed can be lost, impacting and potentially affecting patients' lives, with lost records reported to be as high as one in every seven records (Marutha & Ngoepe, 2017). Missing records are also a problem as they lead to time-consuming duties and create high demands for staff to look for missing files and information and open new files, which takes away from adequately caring for patients (Marutha & Ngoepe, 2017).

1.3.2 Challenges to accurate healthcare record-keeping

Due to the problems that inaccurate records may cause for the broader healthcare system, as mentioned above, it is vital to understand the challenges that the healthcare system and staff encounter in accurately completing healthcare records. Internationally, investigations into healthcare record-keeping and associated challenges are centred around electronic record-keeping (Asan & Carayon, 2017; Laur, 2015; Lopez et al., 2021; Ngugi et al., 2021). However, as will be discussed, this is not the record-keeping format South Africa uses; therefore, the two overarching categories of manual record-keeping challenges are charting barriers (issues with the actual recording) and archiving issues (issues related to the retrieval of charts) (Pirkle et al., 2012).

Specifically related to South African healthcare record-keeping, issues may include incorrect documentation regarding informational inconsistencies and incorrect file numbering, unlocatable folder numbers, incomplete folders and inadequate file storage space and methods (Wegner, 2013). These record-keeping challenges hinder both the quality of patient care and research (Wegner, 2013). Luthuli & Kalusopa, (2018) explain that adequate records and information management are essential to be able to work and therefore, provide good service delivery and quality of care. However, South African citizens are only sometimes satisfied with the services offered by the government, including healthcare services. Therefore, patients are unhappy with how their records are handled and the suboptimal quality of healthcare service delivery (Luthuli & Kalusopa, 2018).

Record-keeping in South Africa faces an extensive list of challenges including time-related, staff-related and environmental challenges, as summarised in **Table 1** below and are essential to understand as they may contribute to inaccuracies, reduced quality of record-keeping and prevent optimal healthcare. The explored challenges are closely related to reasons why records may not be adequately or consistently completed, which will now be explored.

1.3.3 Reasons for inadequate healthcare record completion

Literature across LMICs such as Indonesia, Bangladesh, Niger, Guinea, Mali, Uganda, Ethiopia, Brazil and South Africa have briefly explored reasons or factors that may contribute to inadequate completion of healthcare patient records. Areas of healthcare reflected in the literature include hospital settings (general, maternal, surgery and nursing-specific) and in primary healthcare. Broad categories of factors related to the completeness of records were found by Triananda et al. (2021), including individual characteristics, organisational characteristics, job characteristics and standard operating procedures which all influence the completeness of patient records in Indonesia.

Table 1: Record-keeping challenges in South Africa.

Reference	Challenge	Data collection method
(Mutshatshi et al., 2018)	Inadequate records management	Semi-structured interviews
	The amount of time manual records take to complete	
	Inadequate access to recording materials such as forms and stationary	
(Luthuli & Kalusopa, 2018; Mutshatshi et al., 2018)	A lack of time to complete and retrieve records	Semi-structured questionnaire, semi-structured interviews and observations
(Bizimana & Bimerew, 2021)	Demotivation	Questionnaire
	A high number of patient admissions	
	Excessive burden of work	
(Bizimana & Bimerew, 2021; Marutha & Ngoepe, 2017; Mutshatshi et al., 2018)	Shortage of staff and no designated filing staff	Questionnaire, Semi-structured interviews
(Luthuli & Kalusopa, 2018)	The movement and locating of medical records	Semi-structured questionnaire, semi-structured interviews and observations
	Being inconsistent	
(Marutha & Ngoepe, 2017)	Lost patient files	Questionnaire
	Limited file storage space	
	Lack of budget for record-keeping tools	
	Damaged files	
	Skills and training	
	Poor leadership	
	Staff buy-in	
	Using manual records	
	Staff being unfamiliar with the record management system	
	Poor infrastructure	
	Inadequate budget	
	Poor planning	
	Poor communication	
	Theft of files from patients	
	Staff awareness of the record-keeping system and its importance	
	Poor organisation	
	Inadequate filing systems	
	Misfiling and untidy filing	

More specific reasons or factors impacting the completeness of healthcare records were also found in the literature, including healthcare facilities being overburdened and understaffed, leading to increased workload (Almeida et al., 2021; Kebede et al.,2017; Landry et al., 2014; Shihundla et al., 2016); tiredness, reduced attendance to patients and demotivation as a result of the increased workload (Shihundla et al., 2016). Further reasons included lengthy documentation and duplication of information (Landry et al., 2014; Shihundla et al., 2016); a shortage of time and a lack of space to store documentation (Kebede et al., 2017; Shihundla et al., 2016); a lack of record formatting (Kebede et al., 2017); insufficient professional knowledge, a lack of training and ineffective communication between care team members (Almeida et al., 2021).

A factor that has not been explored but may contribute to the challenges within the record-keeping process and, therefore, challenges faced in the design of the record-keeping process is whether paper-based records, electronic records or a hybrid approach is used. These differing approaches will now be explored.

1.3.4 Different record-keeping approaches (paper-based, electronic and hybrid)

Difficulties arising from the use of paper-based records include incomplete charts, unclear handwriting, missing notes and, more generally, missing files, problems preserving records, time-consuming activities, ensuring safe and secure storage, preventing theft, and quality of materials, all of which impact on staff workload and the quality of patient care (Marutha, 2021; Ohuabunwa et al., 2016). The move to records being entirely electronic has been encouraged due to its many potential benefits, such as improving access, workflow, patient experience and work morale, reducing costs, prompt services and support and making operations more efficient in healthcare (Cline & Luiz, 2013; Ngugi et al., 2021). Furthermore, using electronic medical records has important benefits related to quality of care, patient safety, and ease of use (Houben et al., 2015). Electronic medical records are, therefore, popular and widely used in high-income countries due to their extensive benefits for improved clinical, organisational and societal outcomes (Ohuabunwa et al., 2016). However, if implemented locally in South Africa, it will take time and commitment from all parties to work successfully and smoothly despite the lag time of the benefits, if successfully implemented, that would outweigh the challenges in the long run (Marutha, 2021; Ohuabunwa et al., 2016). An electronic record-keeping approach is also not always used due to barriers, including technical challenges in terms of privacy, connectivity, password and standardisation issues and financial barriers. Furthermore, social issues such as the adoption of the system, new forms of communication, and mistrust of technology are barriers, along with the transition process from manual to technological records (Laur, 2015). Therefore, despite electronic medical records aiding in improving medical record-keeping, not all contexts have the adequate infrastructure and resources to use electronic record-keeping fully; thus, a completely paperless system may not be realistic, and a hybrid of paper-based and electronic systems may be used in these contexts (Houben et al., 2015; Wong & Bradley, 2009).

Internationally, it has been shown that paper-based and a hybrid of paper and electronic record-keeping are still being used despite the benefits of a purely electronic record-keeping system (Alnashmi et al., 2022; Houben et al., 2015; Ohuabunwa et al., 2016). When a hybrid approach is used, some information is contained in both paper and electronic records, while other information may only be included in one record type (Houben et al., 2015). This has led to many LMICs adapting their record-keeping to incorporate some electronic record-keeping elements within the constraints of limited resources due to the many benefits electronic record-keeping may provide (Ohuabunwa et al., 2016). For example, in South Africa, particularly in more rural areas, paper-based or manual processes are predominantly used in delivering care and fulfilling administrative tasks (Cline & Luiz, 2013), which includes record-keeping. Furthermore, within South Africa, each province uses different systems; however, to communicate with other healthcare facilities, paper records are often scanned and/ or put into a centralised electronic database (Ohuabunwa et al., 2016).

This hybrid approach of using paper and electronic medical records may create problems related to finding, using, updating, communicating and managing medical records where several attempts have been made to combine the record-keeping systems (Houben et al., 2015). Optimising the current system would therefore, be helpful to optimise workload and workflow. In South Africa, despite the challenges preventing hybrid record-keeping from working successfully, it is still used for several reasons, which include medico-legal requirements to have hard copies of documentation, difficulties when staff decision-making is open to scrutiny, managing crises while trying to figure out a new system and challenges associated with new technology (Ohuabunwa et al., 2016).

An example of the hybrid approach and difficulties thereof are shown in the hospitals in the Limpopo province that mostly use manual record-keeping apart from issuing and locating reference numbers, which are electronic (Marutha, 2021). Here, records were not well structured or put together, and there was improper file content management due to file backlog, staff shortage and high vacancy rates (Marutha, 2021). Other issues experienced included records not being easily accessible, inadequate safety measures to preserve files physically, records not being electronically backed up, poor file arrangement, inadequate buildings for record storage, complex record retrieval and bad record tracking (Marutha, 2021). Taken together, several systemic challenges impact record-keeping in terms of what is used, how it is used, and how accurate the records are. These challenges and inaccuracies of the record-keeping system and, more specifically, related to the hybrid record-keeping approach, may have unwanted outcomes leading to medico-legal litigation.

1.3.5 Medico-legal impacts of inaccurate record-keeping

Internationally, medical records need to be protected, and record-keeping duties need to be carried out with care; therefore, there are laws and regulations in place within different countries that need to be followed (Thomas, 2009). For example, physical medical records in South Africa must be kept for at least six years (Wegner, 2013) and patients have the right not to have their records shared to maintain confidentiality. However, there are several scenarios where patient information can be rightfully shared, including when demanded by legal authorities (Britz, 2018; Thomas, 2009), such as when there is a negligence claim against the healthcare facility.

This continues to show that in addition to the importance of medical records for communication and continuity of care, they are also essential in influencing the outcomes of medico-legal cases (Britz, 2018; Nundy et al., 2022; Wegner, 2013). Legal claims are common in the public healthcare sector in South Africa, which faces medico-legal litigation stemming from medical malpractice/ negligence and patient safety concerns (Dhai, 2015). Poor record-keeping also contributes to increased litigation and high pay-outs by the Department of Health (Dhai, 2015; Maphumulo & Bhengu, 2019). For example, healthcare institutions are vulnerable to legal claims as inadequate or incomplete records represent work not being done (Mutshatshi et al., 2018) and work not being done shows negligence in patient care. Dhai, (2015) acknowledges that these medico-legal claims cannot and should not be traced back and blamed on one single person or factor, and urgent intervention within healthcare systems is needed. These challenges can be addressed through a multi-disciplinary approach tackling various aspects of the problem, making the design of the record-keeping process vital.

1.3.6 The improvement of healthcare record-keeping

Given the importance of good quality record-keeping, the improvement of record-keeping processes and systems has been well studied due to these potential improvements contributing to better outcomes for patients, healthcare workers and healthcare organisations (eg. Bunting & de Klerk, 2022; Glen et al., 2015; Goveia et al., 2013; Homb et al., 2014; O. Mahomed & Asmall, 2015; Okaisu et al., 2014; Pezaro & Lilley, 2015; Tola et al., 2017). Changes and interventions are to be implemented within various healthcare systems to improve such processes. A summary of some successful record-keeping interventions across many different areas of healthcare can be found in **Table 2** below.

As can be found in **Table 2**, some contexts where interventions have been investigated include working with nurses in South African primary healthcare, educational and hospital settings. However, many of these interventions do not consider the broader system in which these healthcare interventions are implemented. While all of the studies in **Table 2** were successful, the extent and sustainability of success is not known. Furthermore, as acknowledged by Bunting & de Klerk (2022), context-specific interventions must be considered. This would allow the impacts and systemic challenges of the broader healthcare system to be captured in parallel with the record-keeping process.

Record-keeping in healthcare needs to be understood using a systems approach, meaning individual system components cannot be studied in isolation as they emerge from complex interactions between the components (Berger & Scott, 2020; Pullen & Loudon, 2006). This is shown in that record-keeping quality emerges from both the clinician factors, such as their confidence, mood, decision-making/ bias, and experience, as well as others and from record process factors, such as specific record

Table 2: Successful healthcare record-keeping interventions

Reference	Setting	Intervention	Measure of change	Use of HFE (yes/no)
(Glen et al., 2015)	Hospital setting	Single episode folders, patient identity and educational posters	Number of loose pages in folders, patient identifiers and designation and name of writer recorded	No
(Pezaro & Lilley, 2015)	Midwifery practice	Voice recordings of information	Overall obstetric outcomes	No
(Homb et al., 2014)	Chiropractic educational clinic system	Audit-feedback systems without consultation	Improved compliance in areas of: Review (Non-Medicare) History, Review (Non-Medicare) Treatment Plan, and Review (Non-Medicare) Exam	No
(Goveia et al., 2013)	Use of electronic health records	Trainee suited educational interventions (eg. Classroom training, computer-based training and feedback)	Satisfaction level of participants, opinions of stakeholders, practical examination of tasks, evaluation of experiences, analysis of files	No
(O. H. Mahomed et al., 2015)	Primary healthcare facilities in South Africa	Primary care guideline training and a 2xA4 structured clinic record for chronic patients	Patient record analysis	No
(Tola et al., 2017)	Rural hospital setting	Awareness training on the importance and formatting of records for healthcare workers	Patient record analysis	No
(Bunting & de Klerk, 2022)	Non-specific	After a review it was found documentation audits with personal feedback in combination with other context-specific interventions (eg. Education, new forms, new templates, electronic record modification) is helpful	Most common in review was patient record analysis with personal feedback	No
(Okaisu et al., 2014)	Nurses in Uganda	Staff training alone is insufficient therefore, a broader combination of interventions are necessary such as building a competent staff, redesign of an orientation programme with continuous education, redesign of documentation, changes in nurse skill mix and continuous support from leadership	Patient record analysis	No

information, information screen properties, information system demands, and information entry requirements (Berger & Scott, 2020). Improved system management through the accessibility and completeness of records, better patient information, increased training and performance of healthcare staff and improved physician satisfaction can be achieved through management in a context with limited resources through intervention (Wong & Bradley, 2009). Pullen & Loudon, (2006) argue for not only finding out how the systems work but emphasise the need for continuous improvement to be achieved in practice to improve record quality and, therefore, improve work and the quality of care provided. The complex and systemic nature of the healthcare record-keeping process warrants the investigation into and implementation of interventions that could aid in optimising inefficient record-keeping processes. This thesis, therefore, argues that a way to understand the broader context and systems in which a problem occurs and then start the process of change within the system, such as a healthcare record-keeping system, is by taking a systems approach by applying Human Factors and Ergonomics (HFE) concepts and methods.

1.4 Human Factors and Ergonomics (HFE)

The International Ergonomics Association defines Human Factors and Ergonomics (HFE) as “The scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimise human well-being and overall system performance.” (IEA, 2000). From this definition, HFE has three fundamental characteristics (IEA, 2000). Firstly, HFE takes a **systems approach**, capturing and considering all interacting components that form part of the system (Dul et al., 2012). A system is an interacting and interdependent combination of components designed to serve a common purpose, with the whole being more powerful than the sum of its parts (Wilson, 2014). HFE is also **design-driven**, aiming to optimise the work through system design. Design aspects that elicit desired human behaviour should be changed when using a systems approach to solve problems, therefore, not trying to fit the human to the job but rather the job to the human by changing the system (Dul et al., 2012). Therefore, change should be created in the environment to suit the person rather than vice versa to achieve positive performance and well-being (Dul et al., 2012). Furthermore, it focuses on **optimising both**

performance and well-being outcomes for humans within the systems in focus (Dul et al., 2012).

1.4.1 The notions of Human Factors and Ergonomics

As described above, HFE, as a systems discipline, aims to understand, adapt to and better the design of system components and the system as a whole (Wilson, 2014). Wilson (2014) describes this in further detail using six overlapping features or notions that characterise a good HFE systems approach to designing and optimising performance and well-being. The first notion focuses on a system as an interacting combination of factors and sub-systems in other words, a **system-of-systems** (Wilson, 2014). For example, each area of a system operates independently within the broader system, which could make the overall healthcare system a parent system with smaller systems being referred to as child systems (Braithwaite et al., 2021). This is an important conceptualisation leading to the second notion that all system interaction happens within a setting or **context.** This context of a complex system should be accounted for to help conceptualise and unpack systems better with a boundary needing to be drawn around the system in question (Wilson, 2014). The next notion is **interactions** whereby each system component intentionally or unintentionally interacts with one another to create an intentional or unintentional outcome (Wilson, 2014). These system components (such as workplace, human and technological components) are important; however, the interactions among the components are more important (Braithwaite et al., 2018; Hollnagel, 2014). From these interactions, unexpected outcomes may arise or emerge in various ways, leading to the notion of **emergence** (Wilson, 2014). These emergent outcomes can be positive or negative, showing how optimally the system functions through its interactions (Wilson, 2014) and can be used to improve the safety and quality of healthcare (Braithwaite et al., 2009). These interactions and emergent outcomes may also change the system's components and other interactions (Hignett, Carayon, et al., 2013). To fully understand the complexity of a system and its interactions, systems HFE adopts the concept of **holism**, where the system and the person/ people in the system should be seen and understood as a whole with the physical, social and cognitive characteristics being understood in relation to one another rather than as individual characteristics (Wilson, 2014). This holistic view allows for a deeper understanding of the interactions one has with other system components and, therefore, improved outcomes for all (Wilson, 2014). Finally, the way in which ergonomists should carry out their work to understand a complex system and its interactions from a holistic perspective is from within the system (Wilson, 2014). This is the final notion presented by Wilson (2014), which is **embedding** where ergonomists adopting a systems HFE view are embedded within and become part of the system to understand it (Wilson, 2014).

1.4.2 The importance of understanding healthcare systems through HFE

Vicente (1998) argues that global problems can be solved using a systems approach, and more recently, Thatcher et al. (2018) acknowledge the contributions HFE has made in addressing a variety of global issues and what can still be done. One area in which this is applicable is within healthcare systems. HFE has and continues to be used in healthcare systems and healthcare design to improve performance and safety and reduce healthcare costs, therefore improving the system for both patients and clinicians (Berman et al., 2021; Carman et al., 2021; Hignett, Carayon, et al., 2013; Wust et al., 2022).

Most work being conducted in the patient safety field focuses on investigating the challenges surrounding reducing patient harm (Card, 2023). However, it is argued that understanding patient complexity and the complexity of the healthcare system is also crucial to appreciating the investigated challenges and improving patient safety (Carayon et al., 2006; Card, 2023; Hignett, Carayon, et al., 2013; World Health Organisation, 2021). Gathering information and assessing risks regarding the challenges faced in the provision of patient safety and care is helpful as it identifies gaps and informs change but does not aid in improving patient care itself, which leaves patient safety studies stagnant and in need of forward movement (Card, 2023). Card (2023) argues that more could be done by controlling the identified risks and challenges. Therefore, patient safety research should be continued by attempting to start changing outcomes by identifying and tackling system challenges (Card, 2023; Lachman, 2021; World Health Organisation, 2021). To successfully begin tackling patient safety challenges the involvement of many domains, including further involvement of HFE, is encouraged to bring together their expertise in creating effective change (Card, 2023; Institute of Medicine, 2001). Therefore, the only way change will occur is to move beyond identifying challenges and working within the messiness and complexity of work systems and creating change within them (Card, 2023).

Taking a systems view and human-centred design approach when applying HFE in healthcare systems has the potential to lead to a cheaper, safer and fairer system benefiting healthcare practitioners, organisations and patients (Catchpole & McCulloch, 2010; Norris, 2012). This systems HFE approach is similar to that of a primary healthcare approach, which is an approach to understanding healthcare while considering broader levels of influencing factors such as economic or societal impacts on the healthcare system (Dookie & Singh, 2012). In the past, many of the contributions HFE has made to healthcare systems have been in developed countries. However, the application of HFE in healthcare systems is also needed in LMICs (Aceves-González et al., 2021; Holden et al., 2020). The high rates of inequalities within the LMICs are a major reason for encouraging HFE to be implemented in healthcare systems which could improve both safety and performance (Aceves-González et al., 2021). The implementation of HFE in healthcare systems occurs through applying an HFE perspective using HFE methods and tools, which will now be unpacked.

1.4.3 HFE methods

Many HFE methods and tools can be used to understand, unpack and investigate complex systems and adverse events that emerge from systems, allowing for system redesign, solutions or interventions to improve the system. For example, one systems-based model to analyse complex systems is to compare work as imagined (how work should happen under normal working conditions) and work as done (how work is actually done under the influence of the complex system) as there may be discrepancies which highlight the importance of work observations and areas for improvement (Sampson et al., 2021).

In the case of the healthcare system and improving quality of care and patient safety through work improvements there are a variety of tools that can and have been applied, as highlighted below.

- Functional Resonance Analysis Method (FRAM) (Sampson et al., 2021- application example)
- Cognitive Workload analysis (Landa-Avila et al., 2022- application example)
- Systems Engineering Initiative for Patient Safety (SEIPS) (Carayon et al., 2006)

- Human Factors Analysis and Classification System (Woodier et al., 2022- application example)
- AcciMap (Igene & Johnson, 2022; Igene et al., 2022; Salmon et al., 2022, 2023; Woodier et al., 2022- application examples).
- ActorMap (Salmon et al., 2022- application example)
- PreventiMap (Salmon et al., 2022- application example)
- DIAL-F (Hignett, Griffiths, et al., 2013)
- Event Analysis of Systematic Teamwork (EAST) (Stevens et al., 2023- application example)
- Systems Theoretic Accident Modelling and Processes (STAMP) (Canham et al., 2018- application example)

While these tools/ methods will not be reviewed in this study, it is important to note that they allow for a holistic approach to understanding a situation and system from multiple angles to understand a system's functions and goals (Pickup et al., 2018). HFE tools and methods identify contributing factors to problems within the system, allowing for recommendations to be designed for improved healthcare (Carayon, Xie, et al., 2014). Interventions can then be applied across various clinical applications within the healthcare system to improve outcomes for patients, healthcare workers and organisations.

Of these HFE methods used to investigate complex systems, the various versions of the SEIPS model are commonly used (Holden et al., 2013; Wheway & Jun, 2021; Wooldridge et al., 2017; Wust et al., 2022). However, unlike other widely used tools, it is specifically designed to understand the complex and dynamic nature of healthcare systems (Wheway & Jun 2021) and, therefore, will be the focus of this study.

1.4.3.1 The Systems Engineering Initiative for Patient Safety (SEIPS) model

The Donabedian structure-process-outcome model is widely accepted and used in healthcare regarding quality standards where the quality of healthcare should be measured on the following components (the system structure, the systems processes and the outcomes of the system) that contribute to the determination of the quality of care and have an impact on the next stage (El Haj et al., 2013). Additionally, the work systems model considers five interacting elements: the individual (or person), the tasks, the tools and technology, the environment and the organisation, which contribute to producing goals (Carayon & Smith, 2000). These two models are important as the original SEIPS model emerged from the work systems model and incorporates ideas from Donabedian and care quality assessment (Carayon & Smith, 2000; El Haj et al., 2013). Therefore, SEIPS maps the interactions people have with their environment and these interactions, in turn, affect health and safety, performance, quality of working life and production outcomes (Carayon et al., 2006). The SEIPS model has multiple versions as it has evolved several times and has become a commonly used method for systems analysis as it condenses system interactions to identify areas where improvement can occur, providing a framework or lens through which one can view the work system, interactions and possible outcomes and integrate HFE into improving healthcare quality (Carayon et al., 2006; Carayon, Wetterneck, et al., 2014).

Carayon et al. (2014) present five key uses of the various SEIPS models: 1) it describes work system elements and acknowledges their interactions, 2) it incorporates quality of care, 3) shows how the work system influences care processes to produce outcomes, 4) helps to understand patient, employee and organisational outcomes, and 5) acknowledges feedback loops between processes and outcomes back into the work system (Carayon, Wetterneck, et al., 2014).

Capturing the SEIPS model components is the SEIPS 2.0 model (Holden et al., 2013), as shown in **Figure 1** below where interactions occur within the work system, affecting physical, cognitive and social processes and, ultimately, outcomes for the patient, professional and organisation under investigation. Using a systems approach, such as the SEIPS 2.0 model, is helpful in various ways, starting with identifying system barriers and facilitators. Taking this broader look at a system across organisational levels also allows for investigating and resolving deeper issues, which could reduce overall risk (Woodward et al., 2022). It can then be used to identify areas needing improvement and provide information that can assist in the design of quality and safety interventions by identifying barriers and facilitators and investigating how they intersect (Carman et al., 2021). Therefore, applying the SEIPS models can help understand the complexity of a system and be a starting point for system improvement. This is further demonstrated in a later section, which explains a simplified version of SEIPS and provides SEIPS-based tools that can be used to break down and further understand a system.

Due to the importance and benefits of applying a systems HFE perspective and tools such as the various versions of the SEIPS model, the extent of SEIPS application in healthcare research will now be highlighted.

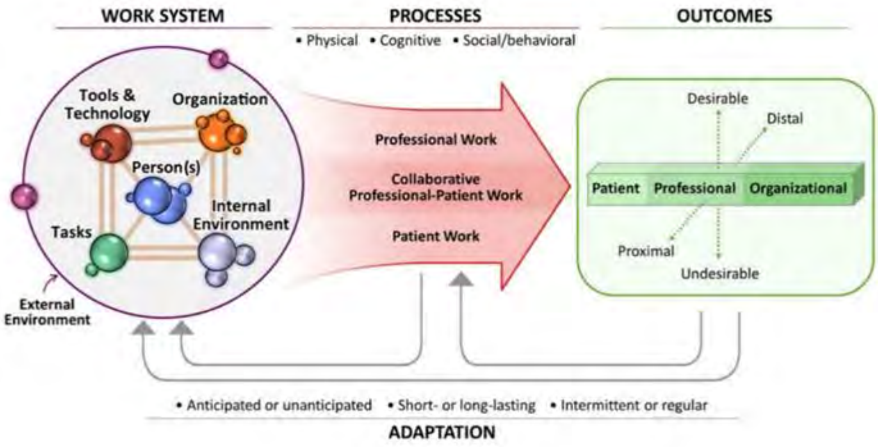


Figure 1: SEIPS 2.0 model (taken from Holden et al., (2013))

1.4.3.2 Studies using the SEIPS model

The various versions of the SEIPS models, including SEIPS 2.0, has been extensively and successfully applied in the healthcare industry for both research and practice (Carayon, Wetterneck, et al., 2014; Faiola & Holden, 2017; Tevaarwerk et al., 2018; Wilson et al., 2017; Wust et al., 2022). However, further research can still be done on work-system interactions and their impact on workers' ability to do work and, therefore, the quality of care and patient safety, which would allow for system redesign. The use of this model in practice allows healthcare professionals to expand their thinking and knowledge to a broader level in improving healthcare systems (Carayon, Wetterneck, et al., 2014).

Many studies, as shown in **Appendix A,** investigating the healthcare industry and patient safety have used and applied the SEIPS model in their systems to attempt to understand system components (Holden et al., 2013). For example, Waterson & Wooldridge, (2018) details care transition applications in healthcare for a systems approach, including the SEIPS 2.0 model. These studies originate from countries from across the world however, predominately from the United Kingdom and United States and focus on various aspects of the SEIPS model with some only focusing on work systems components and others including process and outcome factors (Faiola & Holden, 2017; Wheway & Jun, 2021; Wilson et al., 2017; Wust et al., 2022). A range of qualitative data collection methods were used including observation, interviews, case studies and focus groups and only some studies conclude with recommendations. This summary shows the extensive range of healthcare systems that a systems perspective and the SEIPS models have been applied to highlight the predominant application in the Global North and demonstrate the need for further application in Global South countries such as South Africa. With the focus of this study being on healthcare record-keeping, the application of HFE to record-keeping is now reviewed.

1.4.3.3 HFE and SEIPS applied to healthcare record-keeping

HFE has been used to understand and unpack work systems using a systems lens in many industries, including healthcare, as demonstrated above with the SEIPS model. Within healthcare, record-keeping has been understood through an HFE lens, which has included considerations such as the design of record-keeping considering the entire work system, the use of diverse HFE methods to understand work-as-done and the involvement of collaborators in the continuous design of record-keeping systems (Carayon & Salwei, 2021). However, with many healthcare systems using electronic information technologies (Elrod & Androwich, 2009) most research looking at the application of HFE to healthcare record-keeping investigates the functioning, usability and design of such electronic record systems (Carayon & Salwei, 2021; Elrod & Androwich, 2009; Ngugi et al., 2021; Rogers et al., 2013). All of these investigations found that HFE is a useful approach in understanding and improving electronic healthcare record-keeping systems. Therefore, investigations using an HFE approach should also be done into paper-based or hybrid record-keeping systems.

Similarly to the application of HFE to healthcare, an HFE method that has been applied to healthcare record-keeping is the use of the SEIPS model. However, as can be seen in **Table 3**, this application is limited to understanding parts of the record-keeping process in only three studies in high-income countries including England, the Netherlands and the United States of America. All of the studies in **Table 3** focused on work system components, had differing application areas and possible interventions were mentioned in two of the three studies. However, further studies could be done to understand the record-keeping process as a whole and its barriers

Table 3: Studies where the SEIPS model is applied to healthcare record-keeping

Reference	Area of application	Data collection methods	SEIPS focus area	Country	Interventions/ solutions emerged from the study (yes/no)	Conclusions
(Berger & Scott, 2020)	The creation and use of health and care records		Work systems components and processes	England	Yes	● The SEIPS model needs further validation but is a useful framework for system design and intervention implementation. ● When adopting a systems approach to understand records, components cannot be viewed in isolation but rather as interconnected. ● Identifying risk, error and understanding how problems arise in record-keeping may reduce their occurrence and in turn improve patient safety and the quality of records.
(Blijleven et al., 2017)	Investigation of electronic health record system workarounds	Direct observations and follow-up semi-structured interviews	Work system components, procedures and outcomes	Netherlands	No	The SEIPS model is useful in understanding electronic healthcare record workarounds from different component perspectives and well as their benefits and how to manage them and use them for design improvement.
(Khunlertkit & Paine, 2015)	Duplication of medical records	Semi-structured individual observations and semi-structured interviews	Work systems components	USA	Yes	● Many components that contribute to the duplication of medical record numbers may be difficult to resolve; therefore, redesign of the system may be necessary. ● Training is not adequate is resolving the duplication of medical record numbers.

and facilitators from a holistic perspective and apply the SEIPS model to understand and highlight record-keeping and its challenges in LMICs. The gap in the application of HFE in LMICs healthcare record-keeping systems shows that there is an important space for HFE, and its methods, such as SEIPS, to investigate healthcare record-keeping in LMICs, such as South Africa, as electronic systems are not universally used for record-keeping but often a paper-based or hybrid approach.

Building on the SEIPS model, there is SEIPS 101 which will be explained below and can be used to further break down and understand a system such as healthcare record-keeping.

1.4.3.4 SEIPS 101

The various versions of the SEIPS models have been used extensively in both theory and practice. However, greater use and a simpler version of the model was necessary. Therefore, it was argued that more use would come from an ‘easy-to-use’ version of SEIPS and simple, practical and applicable tools (Holden et al., 2013). This prompted the development of SEIPS 101, where Holden & Carayon, (2020) present seven easy-to-use tools based on the SEIPS models, that can be applied in the healthcare system. These tools help to easily understand and present the components of the SEIPS models and, therefore, the healthcare system to inform change and improve system outcomes for all. Before understanding the tools, a simplified model of SEIPS is presented below in **Figure 2**. The original SEIPS model components of the work environment, process and outcomes all remain in simplified versions for a simple understanding of the essential components of SEIPS in the given scenario (Holden et al., 2013).

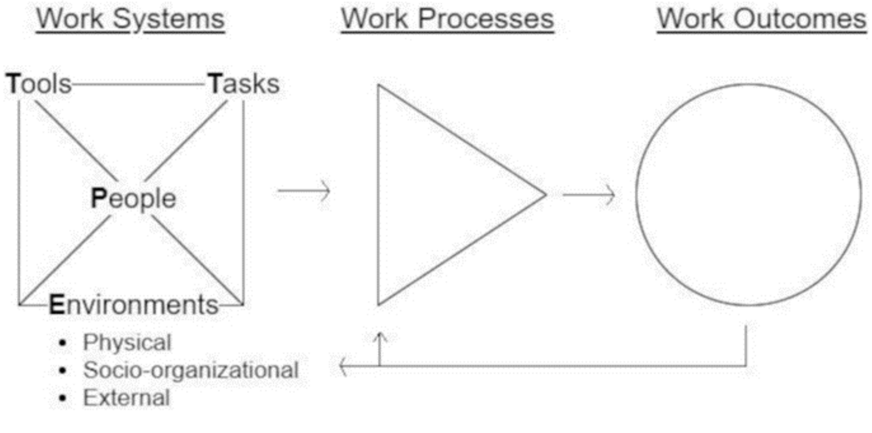


Figure 2: The simplified SEIPS model by Holden & Carayon, (2020)

SEIPS 101 consists of various tools that can be used as a framework or to map out a system, as specified in **Table 4** below. These tools have started to be applied to various healthcare contexts. For example, Sheehan et al. (2022) applied the PETT scan tool to identify barriers and opportunities to implement HFE in undergraduate curricula. Other applications include using the SEIPS 101 tools to highlight errors in cytology testing in cancer patients (Dowers & Jurewicz, 2023) and understanding the management of childhood pneumonia in primary healthcare in Malawi (Mbakaya et al., 2024).

Table 4: The seven simple SEIPS tools and their primary uses for application that can be used in healthcare systems (adapted from Holden and Carayon, 2020)

Tool (type/ format of tool)	SEIPS Components Addressed	Primary Uses
PETT scan (checklist and documentation)	All work systems components (people, tools, tasks, environment and their interactions)	Describing the overall complex system and its barriers/ facilitators
People map (map/ diagram)	People and their tasks	Describe people involved in a system and how they interact
Tools and tasks matrices (table)	Tasks and tools	Describe tools and tasks in relation to who, why, how often and when tasks are performed for potential redesign.
Outcomes matrix	The outcomes	Identify important outcomes and their measures
Journey map (map/ diagram)	The process, along with work systems components and the outcomes	Understand the process overtime in relation to how conditions and outcomes change
Interactions diagram (map/ diagram)	Interactions of work systems components	Identify and represent important system component interactions for design or comparison with other sets of interactions
Systems story (story frame)	Work system, processes and outcomes	To represent the relations between work systems, processes and outcomes as a story to capture an audience

To apply HFE and HFE methods, such as the SEIPS 101 tools, to practice and contexts such as healthcare research and record-keeping, an important approach is involving relevant stakeholders in the research process such as patients, their families, and community members (Sheridan et al., 2021). The co-production of knowledge in healthcare systems means that patient safety initiatives benefit all stakeholders at every level of the system; therefore, patients are not seen as separate from their healthcare but are actively involved in creating a positive experience (Sheridan et al., 2021). This reinforces the importance of embedding within a system and understanding the context of a system from the perspective of the people that form part of the system to create change for optimal performance and well-being. HFE emphasises the important role that participatory approaches play in both research and in-situ applications. This suggests that in addition to HFE methods, participatory ergonomics as an approach is important and therefore, will now be explored.

1.4.4 Participatory ergonomics

Participatory ergonomics has various definitions with two being detailed below (Burgess-Limerick, 2018; Wilson et al., 2005). Simply, it entails applying participatory techniques to the "analysis, design, implementation and evaluation required to improve individuals tasks, equipment, interfaces, workplaces, jobs and work organisation" (Wilson et al., 2005, pg. 934). A specific definition of participatory ergonomics, as given by Burgess-Limerick, (2018, pg. 289), is "actively involving workers in developing and implementing workplace changes which will improve productivity and reduce risks to health and safety". Participatory ergonomics programs bring together a team of experts and workers to improve identified challenges in the workplace, with most programs traditionally focusing on musculoskeletal injuries or disorders (Burgess-Limerick, 2018; Costa-Black & Arteberry, 2020).

Participatory ergonomics has been applied extensively across various industries and organisations (Burgess-Limerick, 2018; Costa-Black & Arteberry, 2020; van Eerd et al., 2010), mainly focusing on the reduction of work-related musculoskeletal disorders (MSDs) or identification of physical ergonomic risks (Costa-Black & Arteberry, 2020) as reviewed by van Eerd et al., (2010). For example, Cervai & Polo, (2018) found the involvement of workers in discussions of their workstations to be effective, particularly regarding workstation utility, worker job satisfaction and organisational safety. One such industry that has commonly applied participatory ergonomics has been healthcare (Bohr et al., 1997; Hansen et al., 2024; Hignett et al., 2005) however, the majority of these applications have also had a focus on the reduction of MSDs and physical ergonomic risks.

In addition to the physical aspects of the workplace, organisational aspects, including organisational culture, also influence the above-mentioned workplace factors (Cervai & Polo, 2018). This is reviewed by Elkefi et al. (2024) who demonstrate that participatory ergonomics contributes positively to improvements in MSDs, understanding and controlling physical loads, risk and injury reduction and extends beyond physical elements into positive effects on performance efficiency in complex systems and medication errors. Therefore, participatory ergonomics has and should continue to extend beyond only looking at physical risk factors and safety by considering workers and their work more holistically. This is shown in that participatory ergonomics has grown and developed extensively over time for multiple reasons and influenced by various other fields, which led to a more participative culture and worker involvement (Elkefi et al., 2024; Wilson et al., 2005).

1.4.4.1 A systems approach to participatory ergonomics

HFE emphasises holism and people-centeredness, meaning that physical work factors cannot be understood without acknowledging psychosocial and organisational factors for greater success (Burgess-Limerick, 2018; Wilson et al., 2005). Therefore, participatory ergonomics programs have also considered creating human-centred work, considering organisational climate and being used for health promotion, considering the broader work system design (Burgess-Limerick, 2018). The implementation of participatory ergonomic programs is described as hierarchical by Henning et al. (2018), in this way, workers have various levels of participation when involved in various aspects of workplace improvements.

To create a more positive workplace environment and therefore, improve outcomes, one should consider social sustainability where Costa-Black & Arteberry, (2020) highlight emerging social sustainability themes such as empowerment, participation and education, health and safety, social capital and well-being, happiness and quality of life. These sustainability goals promote the value of a participatory ergonomics approach and highlight the importance of considering workers' overall well-being in improving the workplace. These are complex considerations, and therefore, systems approaches are well suited to applying participatory ergonomics, forming system changes and improving overall worker well-being (Costa-Black & Arteberry, 2020). Costa-Black & Arteberry, (2020 pg. 919) capture this integration of a more holistic view by defining participatory ergonomics as “a systematic approach to involve people in a team or multiple teams setting to build knowledge for the purpose of improving the design of work and/or resolve work system deficiencies”.

Many positive benefits emerge from the application of participatory ergonomics which may include, but are not limited to, improved worker motivation, production, performance, working conditions, design solutions, information flow, understanding of stakeholder views, worker empowerment and control, increased chance of successful implementation, worker growth and learning, the responsibility of health and safety and an overall reduction of risk (Burgess-Limerick, 2018; Costa-Black & Arteberry, 2020; Eklund, 2000; Haines et al., 2002). Participatory ergonomics, therefore, has been and continues to be an important approach, which involves workers or those performing tasks getting actively involved in problem-solving to assist in the development and implementation of changes in the workplace, which can improve productivity, reduce risk factors and then achieve desirable workplace goals (Burgess-Limerick, 2018; Haines et al., 2002; van Eerd et al., 2010).

1.4.4.2 Characterising Participatory Ergonomics

Due to these important benefits and the continued use of participatory ergonomics, the use of a participatory ergonomics framework (PEF) is encouraged (Costa-Black & Artberry, 2020; Haines et al., 2002). The framework, as shown in **Table 5**, defines and characterises nine dimensions of participatory ergonomics. These dimensions are important in understanding the key aspects involved in the application of participatory ergonomics by categorising various aspects of use (Haines et al., 2002).

Table 5: Participatory Ergonomics Framework (adapted from Haines et al., 2002)

Dimension	Categories
Permanence	Temporary - Ongoing
Involvement	Direct participation - Partial direct participation - Representative participation
Level of influence	Department/work group - Entire organization
Decision making	Individual consultation - Group consultation - Group delegation
Mix of participants	Operators - Supervisors - Middle management - Specialist/technical staff - Senior management
Requirements	Compulsory - Voluntary
Focus	Designing or specifying `equipment’ or tasks - Specifying work organization issues - Formulating policies and strategies
Remit	Process development - Problem identification - Solution generation - Solution evaluation - Solution implementation - Process maintenance
Role of ergonomics specialist	Initiates and guides process - Acts as a team member - Trains participants - Available for consultation

The participatory nature of HFE, hierarchical levels of worker involvement in the application of participatory ergonomics, and potential benefits of worker involvement reinforce the idea that it is appropriate and arguably necessary to apply participation in investigations of work systems using an HFE perspective and methods.

Participatory ergonomics is commonly applied in workplaces; however, a deeper conceptualisation of participation is needed to apply these concepts within research settings. This will now be done in the following section, which explores participatory research approaches. Therefore, a parallel can be drawn between participatory ergonomics and the application of a participatory research framework alongside HFE methods in a healthcare record-keeping setting.

1.5 Participatory research

1.5.1 Participatory research design

Participatory research, as described by Vaughn & Jacquez, (2020), refers to a ‘research-to-action’ approach which involves and engages relevant stakeholders in research which is similar to and can be argued to be the same as community-engaged research, where communities and researchers work collaboratively to address issues faced (Key et al., 2019). These two terms describe a participatory research paradigm, amongst many used to capture this type of research linked to applied social science and social activism, where the differences in terminology are difficult to distinguish (Wallerstein & Duran, 2008). Therefore, there are various ways to refer to engaged or participatory research that involve and empower stakeholders and communities to address issues through research activities alongside researchers. Each of these methods and how the actual research is carried out falls on a spectrum between having participants involved in and supporting research to having ‘participants’ as collaborators or equal partners (Brown, 2022). Vaughn & Jacquez, (2020) describe this engagement continuum as ranging from academic-driven research to a collaboration between academic and community partners driving equitable and shared decision-making, particularly in addressing inequalities (Key et al., 2019).

1.5.1.1 The importance of participatory research

There has been an increase in calls for researchers to form a stronger, bidirectional relationship with the public in research to create meaningful knowledge and have it translated into action for change (Felt & Fochler, 2008; Telleria, 2021; Vaughn & Jacquez, 2020). In this case, participatory research draws upon both science and practice perspectives, where both parties benefit from the interaction, and the two can begin to understand and complement each other. It also allows for insights to be gained into a community’s meaning-making and dynamic social interactions (Bergold & Thomas, 2012). It is important to note here that a community can be defined as a group of members who share common attributes and space and work towards a common goal (Schmittdiel et al., 2010). Therefore, when understanding a work system, workers can be defined as the community, and participatory research can be carried out by taking a bottom-up or participatory approach to workplace improvement (Mayosi & Benatar, 2014), which allows for an understanding of problems collaboratively and from lived experiences of those within a system to aid in change (Bourke, 2009; Mayosi & Benatar, 2014).

1.5.1.2 Participatory research in healthcare

Unequal access to healthcare services is a prevalent yet complex issue, as shown in the South African context, which makes it a public health concern and leads to researchers seeing the need to understand and intervene through research (Olshansky et al., 2005; Tapp et al., 2013; Wallerstein & Duran, 2006). At the same time, within communities there are plentiful resources, strengths and skills present that can be used to address real-world problems. Therefore, participatory research approaches have and should be used in healthcare research and practice to actualise healthcare as a right for all rather than a privilege (Israel et al., 2001; Olshansky et al., 2005; Vaughn & Jacquez, 2020). To achieve and support a safe and healthy environment for healthcare patients and workers and therefore improve health outcomes, organisations need to listen to what people within and those affected by the system, find important (Costa-Black & Arteberry, 2020; Mayosi & Benatar, 2014).

Through experience using participatory research in healthcare, Bourke, (2009) reports three key considerations. Firstly, participation is an integral part of the research process; however, due to each context in which it can be applied being unique, researchers should be flexible to different forms of participation. Next is the method, which is often qualitative however, this and other methodologies cannot be predetermined as researchers should educate participants but also respond to their needs and choices Lastly, the issue of power and power dynamics, which should be removed from the researcher as the expert, allows for an understanding of the researcher's limits and highlights power sharing, which may require negotiation before the research process begins.

As mentioned, there are various ways in which participatory research can be termed and carried out. One method is through a Community-Based Participatory Research

(CBPR) approach. CBPR was chosen and will now be focused on as it is a useful framework that can be considered the gold standard of participatory research as described on the continuum of community engagement in research (Key et al., 2019) as well as that it considers community involvement at every stage of the research process. This framework can involve the community and other stakeholders in research and put elements of participatory research into action, as discussed below.

1.5.2 Community-Based Participatory Research (CBPR)

Community-Based Participatory Research (CBPR), as a form of or framework for participatory research, is defined not as a method but rather as an orientation towards research that can use qualitative or quantitative methods (Minkler, 2005). CBPR, according to Schmittdiel et al. (2010), has four core principles that should be followed when collaborating with a community in research: 1) researchers should engage the community in all phases of research; 2) researchers should build on existing community resources and goals; 3) researchers should invest in long-term and sustainable partnerships; and 4) research should follow a cyclical and iterative process. Here, community members are involved throughout the research process to ensure research is conducted for, by, and to benefit the community and local setting (DeJonckheere et al., 2019; Telleria, 2021).

Action for change can be initiated in a given context by understanding the human experience; therefore, instead of conducting research ‘on’ participants, research is conducted by engaging with community members as collaborators, which enables researchers to closely understand the actual lived experiences of participants (Olshansky et al., 2005). Furthermore, the community is empowered to co-construct research that can allow learning for both researchers and community members (DeJonckheere et al., 2019; Telleria, 2021). An important focus of CBPR is empowering individuals, organisations and communities (Minkler, 2005) by using data for knowledge creation and improving health equality and equity through collective action which helps to develop both community and organisation (Parajón et al., 2021).

CBPR is also defined by several principles as laid out by (Israel et al., 2001). Briefly, this includes an emphasis on the participation, community resources, influence, power sharing and control given to community members and the collaborative process between stakeholders and embedded researchers for mutual benefit and learning in creating action for change (Baum et al., 2006; Israel et al., 2001). Israel et al., (2013) also lay out core components or steps as a guideline to follow when conducting CBPR as shown in **Figure 3** below.

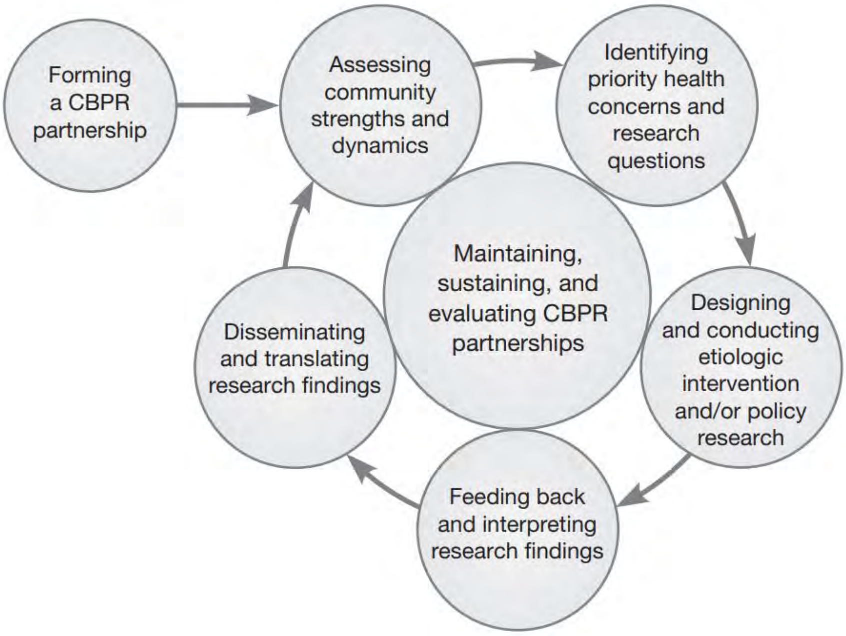


Figure 3: Steps in conducting CBPR (Taken from (Israel et al., 2013)).

These do not necessarily occur in a specific order however, for ease of reading, they are given in steps 1-7 in the following sentences. Firstly, a CBPR partnership should be formed which entails identifying potential communities and partners and creating a basis for research. Secondly, community strengths and dynamics should be assessed which involves becoming familiar with the strengths and resources of the community. Next, the priority health concerns, and research questions should be identified, which means that issues of concern to the community are raised and discussed. Furthermore, interventions and/or policy research should be designed and conducted which involves establishing research methods and strategies to carry out the research process. Following this, research findings should be interpreted and fed back to collaborators, partners and participants. Then, research findings should be disseminated and translated by investigating how best to understand and share findings for the appropriate change. Finally, CBPR partnerships should be maintained, sustained, and evaluated as a continuous process that should be carried out within each step of the broader research process. At the same time, Parajón et al., (2021) recommend following the iterative cycle of listening, dialogue, action and re-listening and reflection on actions which guide the collective reflection, program planning, evaluation and policy change needed in the CBPR approach.

1.5.2.1 The value of a CBPR approach in healthcare

CBPR is suited to healthcare research due to the complexity of healthcare problems, and Minkler (2005) shows that CBPR is appropriate to apply to problems that traditional research approaches may not adequately address. CBPR can be successful and influential through its systematic approach to facilitating equitable collaboration and community strengths, therefore, this approach allows researchers to integrate multi-sectoral collaboration and community empowerment in primary healthcare (Parajón et al., 2021). Given that primary healthcare is complex, dynamic and influenced by unique contexts in which institutions occur, Parajón et al. (2021) argue that to create change and equity within the systems, some fundamental principles should be taken into account, including using systems thinking, having a shared vision, building community and organisational alignment, individual and team learning and critical reflection. Furthermore, for collaboration and community empowerment through CBPR to work in primary healthcare, organisations must create, adapt, or improve policies, practices, or services for system outcome improvements and optimisation. CBPR, therefore, links well with a systems thinking approach to create a more equitable primary healthcare system (Parajón et al., 2021).

CBPR involves all partners and their different strengths to aid in societal transformation, for example, improving community health and reducing health disparities by improving access to healthcare and increasing healthcare research and distribution within communities (Wallerstein & Duran, 2006). This partnership would entail co-learning, building capacities, mutual knowledge generation, and long-term partner commitments (Wallerstein & Duran, 2006). These aspects of CBPR are important considerations as interventions are strengthened when involving community partners, participation adds value to improving health outcomes, and there is an important space for this type of research in reducing healthcare disparities (Wallerstein & Duran, 2006).

1.5.2.2 Benefits and challenges of CBPR

CBPR has been shown to serve many benefits including the support of research that reflects community concerns, building on community strengths, achieving informed consent and addressing risks and benefits of research, improving cultural sensitivity and validity and reliability. Furthermore, deeper insights into community knowledge, increased trust and ownership therefore, recruitment and retention, assist in the accuracy of the interpretation of findings and increase the relevance and success of interventions (Israel et al., 2001; Minkler, 2005; Tapp et al., 2013). CBPR also adds value to research quality by addressing community concerns and working with community partners to effectively change healthcare problems (Minkler, 2005; Schmittdiel et al., 2010; Tapp et al., 2013). A further advantage is that CBPR can be investigator-driven when translating research findings into healthcare practice to promote action and change real contexts (Schmittdiel et al., 2010). Additionally, the use of CBPR in translational research increases the relevance of research, sustainability of interventions and that action can be taken into practice based on findings (Schmittdiel et al., 2010).

On the other hand, challenges associated with CBPR may include ensuring an understanding of the community perspective on the research issue, insider-outsider tensions and power dynamics, the frustration of practically using participation in research, level of involvement, getting community consent, deciding how data will be used with the community partners and ethical challenges in taking action stemming from the research (Minkler, 2005; Telleria, 2021; Wallerstein & Duran, 2008). Further challenges faced when adopting a CBPR approach may include how to sustain a project as long-term funding could be difficult to maintain, differentiating between community and researcher goals, the interpretation of findings, results being unique to the context in which they are studied and a disconnect between researchers, healthcare providers and community members which may lead to a host of negative challenges or outcomes for research (Tapp et al., 2013). Ensuring true collaboration between all parties, stereotypes of both researcher and community partners, ensuring collaborators share open and honestly, compliance with regulations when working with and protecting people, time constraints, overcoming damage created by previous researchers and false promises and resource challenges may also prove to be challenges in applying CBPR (Tapp et al., 2013).

Using CBPR to create equality in primary healthcare can present some challenges, including the commitment of leadership, power dynamics, creating evaluation guidelines, sustainable resource allocation and health professional education (Parajón et al., 2021). Furthermore, challenges in translating research findings into practice may include different community members having different timelines, contexts and reward systems; however, these differences could be bridged (Schmittdiel et al., 2010). For example, each challenge in this extensive range can be dealt with and even overcome when using the correct means to understand and work with collaborators (Tapp et al., 2013).

1.5.2.3 Healthcare workers as a community

Taking a CBPR approach through collaboration has resulted in overall health improvements and decreased inequalities in access to healthcare in multiple communities and healthcare settings, as reviewed by Tapp et al. (2013). Here it is important to define ‘community’ as those whom the issue directly affects (Schmittdiel et al., 2010). The orientation of understanding healthcare workers as the community being affected by an issue is important as participatory research should be applied in healthcare to understand the safety of patients and consider and improve healthcare workers' safety and wellbeing (Elkefi et al., 2024). Communities have managerial and administrative staff and front-line staff working in healthcare facilities that could be consulted and impacted by research findings (Schmittdiel et al., 2010). Therefore, Schmittdiel et al., (2010) argue that ‘community’ in the healthcare context is defined as system leadership, healthcare staff and patients. A community population’s overall health depends on the quality of primary healthcare services; therefore, CBPR has been adapted or extended to look into community-based practice and improve primary healthcare quality (Schmittdiel et al., 2010; Tapp et al., 2013).

When embarking on a participatory research process, it is essential to understand how one's own worldview impacts how we interpret our surroundings and the communities we work with, as can be said for community members' worldviews (Wallerstein & Duran, 2008). Furthermore, despite working alongside the community, one can never fully understand it. Yet, benefits still arise from mutual learning and how community knowledge can shape and grow one's understanding of the world (Wallerstein & Duran, 2008). Applying participatory research and a framework such as CBPR aids the researcher's ability to understand the context in which they work and identify what works and what doesn’t within a system. This allows one to begin working within the messiness of a system and reap the multitude of benefits when working alongside research ‘participants’ and a community. In this thesis, the focus will be on applying a CBPR approach to a healthcare record-keeping system.

1.5.3 Participatory approaches in designing healthcare record-keeping systems

Within healthcare research, participation or participatory research approaches are important in medical research (Haijes & Van Thiel, 2016) and have been shown be useful and successful in the improvement of patient well-being (Doucette et al., 2023; Shepherd et al., 2020), continuity of care (Marais et al., 2019) and problem-solving for change (Almond et al., 2015) in addition to the many benefits collaboration adds to research in the workplace, as previously discussed. More specifically, in healthcare record-keeping, some research has been done using participatory approaches, for example, looking at record-keeping of child social care (Shepherd et al., 2020) where a human-centred participatory framework was created, allowing for a focus on needs and rights of care-experienced people to manage records. Furthermore, participation has been used to investigate different aspects of electronic record-keeping and its systems in healthcare with the involvement of users (Almond et al., 2015; Bossen, 2006). For example, Almond et al. (2015) found that using a CBPR approach to co-create knowledge focusing on problem-solving, practical issues and change related to electronic record-keeping was useful to the community and researchers due to its multiple benefits such as community empowerment and the co-creation of knowledge. Bossen (2006) applied participatory design to a standard for electronic patient records and argues that participation is valuable, but concepts and challenges such as power, methodology and knowledge in participation should also be considered during the process.

In sum, CBPR as a framework has been shown to be crucial in healthcare research, with most of its application focusing on the involvement of patients and general community members, as summarised by Tapp et al.(2013). This thesis focuses on the involvement of healthcare workers as community collaborators rather than the patients of healthcare institutions. Furthermore, applying CBPR in healthcare record-keeping focuses on studying electronic record-keeping in the Global North. Therefore, it often does not reflect hybrid healthcare record-keeping systems used in South Africa, which are impacted by the unique context. Thus, there is scope to apply participatory research design in understanding South African healthcare record-keeping systems using HFE approaches.

1.6 Summary and rationale for this study

The South African public healthcare system is complex due to its many interacting factors, including various systemic challenges that still impact the safety and quality of healthcare services provided to patients throughout the country. An area impacted by these challenges that affects patient care is the state of the record-keeping systems in the general healthcare system and, more specifically, primary healthcare clinics. Human Factors and Ergonomics, as a multi-faceted and systems discipline, can be used to investigate this identified issue of inadequate record-keeping through its systems lens, methods and key approaches such as participation in research. This study, therefore, aimed to address why records are or are not adequately completed within a clinic in Makhanda, South Africa, and how broader factors influence the process and system by applying HFE and exploring interactions within the hybrid record-keeping system. This is an important area to investigate as the use of CBPR in conjunction with an HFE perspective, and methods have not been previously applied to healthcare record-keeping in South Africa.

Chapter Three: Research and clinic context

Due to this study's unique nature and participatory approach taken, various steps were needed before research methods were finalised and data collection commenced. Therefore, this chapter gives an overview of the preparations prior to the research and the context of the collaborating clinic. More specifically, it focuses on discussions of my (the researcher’s) positionality, pre-methodological considerations, the embedding process and initial observations through this process. These initial observations provided important insights that were necessary to, firstly, build trust and rapport with clinic staff. Secondly, these initial interactions with staff affirmed the need to focus on the record-keeping system; thirdly, it helped to inform the data collection approach. Due to this chapter being reflective of the journey through the initial stages of the research process, it is written in the first person. In sum, this chapter provides the framework I used and describes the process taken to identify the research problem, who would be involved in the research and how the research would be conducted.

3.1. Methodological framework

As a guide to follow through the research process, I adopted a Community-Based Participatory Research framework as laid out by Israel et al. (2013). In **Figure *4***, the seven steps of CBPR are displayed in boxes, below these are circles with the operational steps that I followed. This chapter captures steps 1 through 3 and the early stages of step 4. However, I start with reflections on my positionality in relation to the research and acknowledge the impact this may have had on my interactions in the clinic and the collection of data.

3.2. My positionality

I am a white South African female from a privileged and educated background. These and other imposed and self-titles intersect in shaping my worldview and lens through which this research was conducted. Therefore, my positionality may have unconsciously impacted each step of the research process as I went into spaces and interacted with people different to myself. For example, the clinic staff may have been of different racial and educational backgrounds, may not have been privileged and may have spoken different languages to me. These differences may have impacted how I organised the research process, interacted with the project and healthcare stakeholders and collected and interpreted data. However, the impact of my position was partially impacted by having discussions with my supervisors and involving and consulting a community collaborator, as to be discussed. Now that my positionality has been stated, my journey through the early stages of the research process and initial observations can be discussed, starting with the steps I took following the CBPR framework.

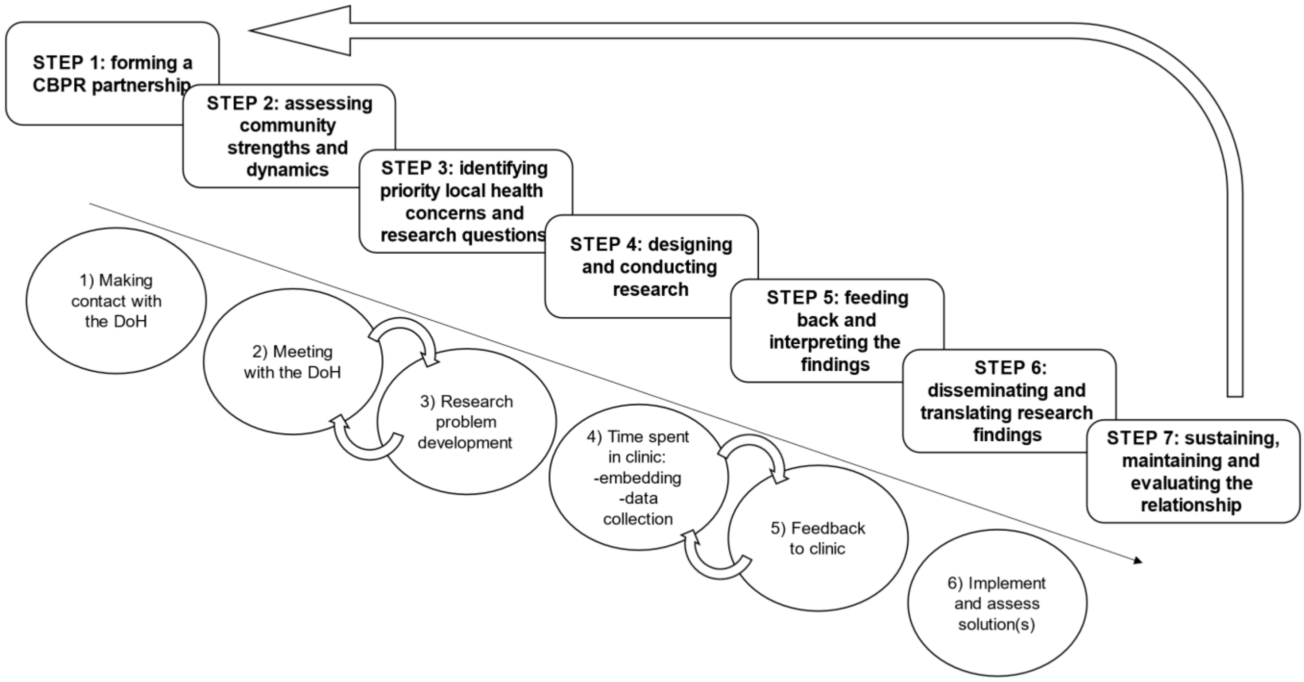


Figure 4: A proposed methodological framework (adapted from Israel et al. (2013)). Where the steps in boxes are from Israel et al. (2013) and the circles indicate this project’s operational steps.

3.3. Initial interactions with the DoH

Prior to the COVID-19 pandemic, a relationship existed between my supervisors and the community partner, the local Department of Health (DoH), when research was conducted assessing barriers to the provision of primary healthcare in the Sarah Baartman district. Unfortunately, due to the COVID-19 pandemic, the partnership was interrupted. Therefore, at the start of the research process, a relationship with the community partner was re-established by contacting a district pharmacist with whom my supervisors had previously worked. Once the connection at the DoH had been formed, we began having meetings and discussions with the DoH about local clinics, problems they could be facing and where this research project could focus. Between meetings, I continued reviewing literature and having discussions with my supervisors. These discussions around developing a research problem were fed back to the DoH for critique until all parties were satisfied with the record-keeping-focused research problem. This cycle is demonstrated through an iterative process, as seen in operational steps 2-3 of **Figure 4**. Additional interactions were had with the facility manager of a collaborating clinic, during which attention was drawn to why records or parts of records were not being adequately completed. During this final meeting, the facility manager and DoH connection requested research on the record-keeping system and processes given the concerns they expressed about the quality of records. We agreed and incorporated an assessment of patient files into the data collection process, pending ethical approval to look at patient files.

3.4. Clinic context

It was mutually agreed upon that it would be important for me to spend time in the clinic before data collection, which was achieved by embedding in the clinic. Before details of this process are explored, it is important to give some context about the clinic where data would be collected. Within South Africa, there are many public healthcare facilities, more specifically in the Sarah Baartman District in the Eastern Cape, which has 10 hospitals, four tuberculosis (TB) hospitals, one psychiatric hospital, 61 primary healthcare clinics and 10 mobile clinics (PROFILE: SARAH BAARTMAN DISTRICT MUNICIPALITY 2 PROFILE: SARAH BAARTMAN DISTRICT MUNICIPALITY 3 CONTENT, 2020). This study, however, focused on just one primary healthcare clinic and its record-keeping system. The clinic is in Makhanda (Makana municipality), which falls within the Sarah Baartman District of the Eastern Cape province of South Africa. The Eastern Cape province is shown in blue at the bottom of the South African map in **Figure 5** and then zoomed in on in **Figure 6** displaying the Sarah Baartman District in purple and circling the Makana municipality in red.

This clinic was suggested to conduct research in by the Local Department of Health, as it is a high-volume clinic. Furthermore, at the time of data collection the clinic had nine community healthcare workers, three lay counsellors, nine clinicians (one of which was the facility manager), two community services nurses, one enrolled nurse who was the outreach leader, two pharmacy assistants, one admin clerk, one data capturer (on maternity leave during data collection) and one property caretaker.

Figure 5: Map of South Africa (Source: Municipalities.co.za)

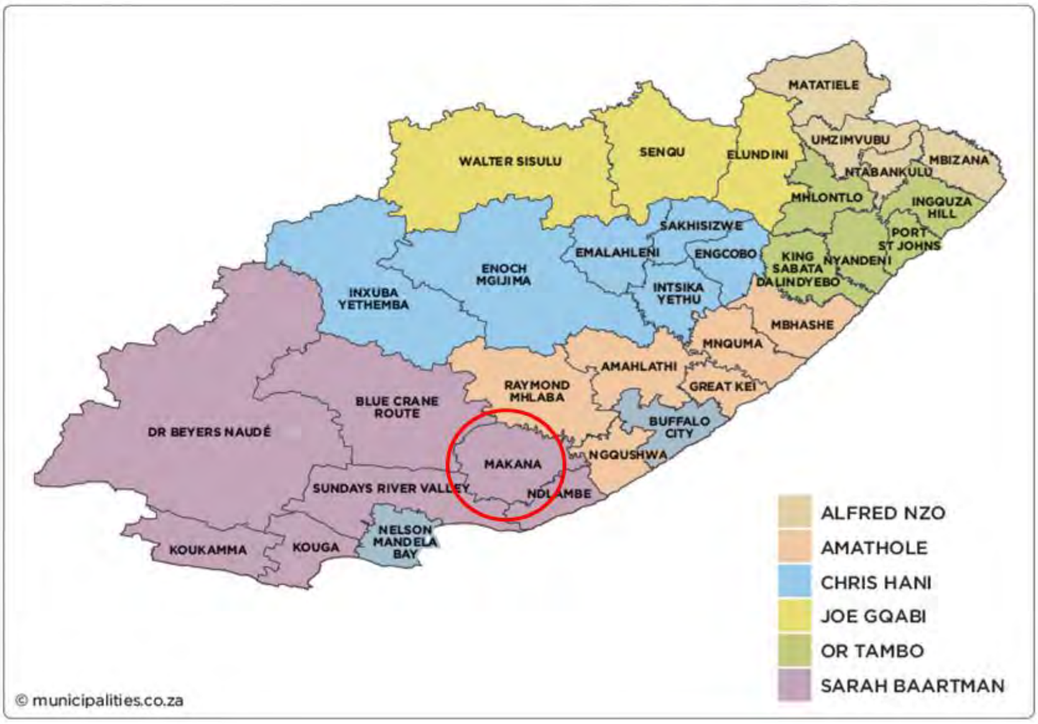


Figure 6: Map of the Eastern Cape province (Source: Municipalities.co.za)

3.5. The embedding process

When taking a systems approach, embedding within the system is crucial, as suggested by Wilson (2014). Therefore, before beginning data collection, I embedded myself within the clinic system to develop and confirm the research problem and build trust with the clinic staff. Importantly, I must note that before I entered the clinic or interacted with any clinic staff, excluding the facility manager, I received permission from the university's ethics chair, as indicated in the screenshot of an email in **Appendix B,** to partake in these interactions before receiving final ethical approval and starting official data collection (this is addressed in more detail in the next chapter).

I began embedding by attending a staff meeting where I explained who I was, what my project was about, and that I hoped to spend time in the clinic before opening for any questions or comments. The feedback I received from the staff was mixed with some positive remarks while one staff member, for example, asked if they *'had a choice'* and some chose not to comment. Overall, the staff were happy with me being there. Therefore, I began embedding within the clinic to have the clinic staff be comfortable with me in their space and for me to be comfortable in their space, build upon my understanding of the system, how it functioned and how these insights might help refine the research problem and approaches I would take to understand it.

I went into the clinic two or three times a week for around two months, a schedule of the time I spent embedding in the clinic can be found in **Appendix C**. During this time, I sat in the reception area observing the clinic and the record-keeping process, asking questions and having informal discussions with staff. Through this time, I started to form a broad understanding of the clinic and record-keeping process. Importantly, I formed trust and rapport with clinic staff, particularly with administrative staff, whom I spent the most time with. However, throughout the days, many nurses and other staff came in and out of reception to get files, discuss work, or have conversations with others during breaks. Therefore, I met and got to know other clinic staff and became a familiar face. As time passed in the clinic, staff members taught me how to retrieve files. This allowed me to help retrieve files and deliver them to the respective consultation rooms, especially when I went to the clinic early in the morning when things were busy with the first group of patients waiting to be taken in. On one particularly busy day, a staff member even asked me to take patient information and record it as they entered the clinic, showing the trust I began to build with clinic staff.

I made a few initial observations and insights during the time embedding in the clinic. Firstly, from the observations and discussions in the clinic, I gained a broad understanding of the record-keeping process, as displayed in the process map in **Figure 7** below. While embedding within the system, this understanding clarified the research problem and detailed focus of the study, which was why patient records were or were not adequately completed.

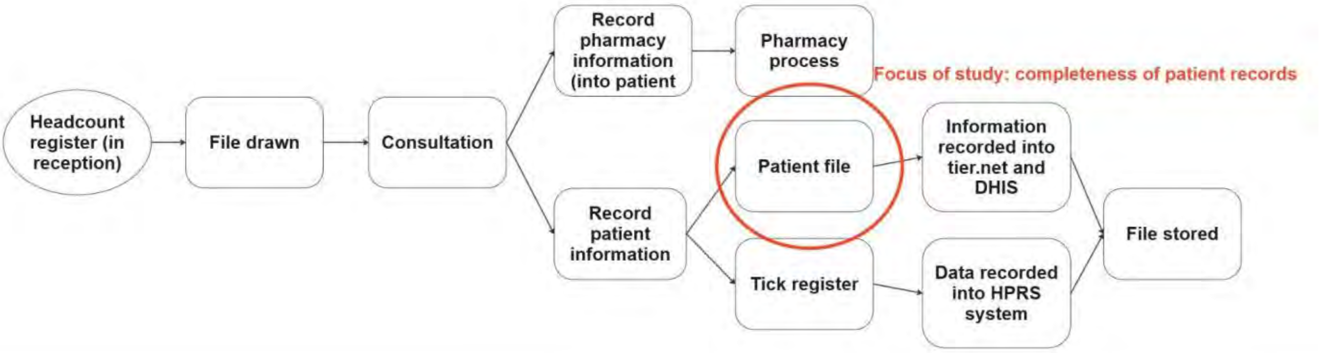


Figure 7: An overview of the record-keeping process highlighting the focus of the research project. Where DHIS stands for District Health information System and HPRS stands for Health Patient Registration System.

Another observation that I made, as confirmed in meetings with the facility manager and district pharmacist, was that the clinic reception area was too small for the purpose it served; with three computers, a printer, minimal desk space, file storage space and up to or more than four staff members being in reception at a time. Another important initial observation I made was that there was not a consistent division of work among administrative staff members. For example, when patients came into the clinic, their first stop was reception, where basic information such as name, file number, address and date of birth was recorded. At least six different staff members recorded this information during my time at the clinic, including the lay counsellor.

3.6. Identifying and working with the community collaborator

As part of the CBPR process, having someone from within the clinic to advise and guide me through the data collection process was deemed an important part of the research process. I met with the facility manager to discuss possibly having a community collaborator from the clinic, and she suggested the lay counsellor. This individual had a good relationship with the clinic staff, was described as a ‘go-getter’, got involved in the record-keeping process and was willing to help where she could and spoke up when necessary. The facility manager discussed this with the potential community collaborator, and she agreed and was enthusiastic about working with me on the project. The community collaborator was elected to guide me through the process and help ensure my data interpretation was in line with the views of the clinic staff. The importance of involving a community collaborator was two-fold. Firstly, it was useful to counteract the subjectivity of this research project. Secondly, having a community collaborator aligned with the CBPR approach by involving the community at every stage of the research process.

An initial meeting was held with the community collaborator where her role was discussed, the research methods were agreed on and finalised and a weekly meeting was set. The minutes of this first meeting with the community collaborator can be found in **Appendix D**. At this meeting, it was also decided that I should go into the clinic after lunch as it was quieter in the afternoons, allowing more time for discussions with staff. With this discussed, I then attended the staff meeting just before data collection to discuss what it would look like with clinic staff and have willing participants sign consent forms before official data collection commenced. The following chapter will discuss methodological considerations and the two overarching data collection phases.

Chapter Four: Methods

This study adopted a field-based mixed-methods research design where both quantitative and qualitative data collection methods were used to gain a deeper understanding of the research topic (DeJonckheere et al., 2019). The entire research process took place over two years and data collection took place in the second year through two phases of data collection as represented in **Figure 8** (along with the pre-methodological steps) described in detail later in this chapter.

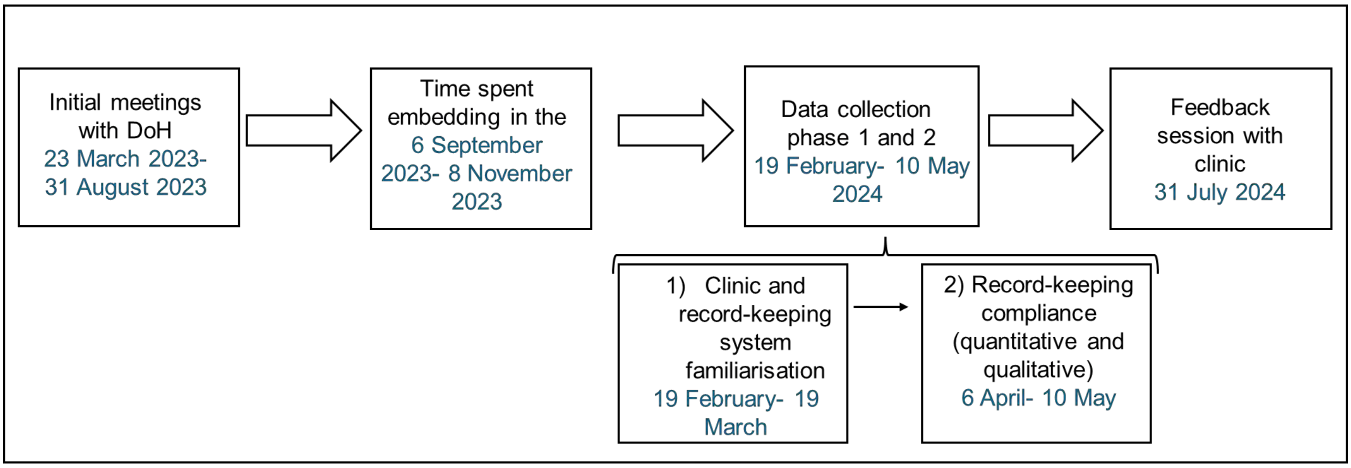


Figure 8: Methodological time-frame and phases of data collection

3.1 Collaborators and participants

This study adopted a Community-Based Participatory Research approach and, therefore, had both a community collaborator and research participants. The community collaborator involved in this study was a member of staff selected by the facility manager as an advisor to the researcher, who provided insights into the clinic and the design of research and data collection (described in Chapter 3). The research participants included the clinic staff through which information was gathered around the record-keeping process within the given clinic. The characteristics of the participants included the fact that they were clinic staff members involved in the record-keeping process and agreed to be part of the study. There were 11 participants, including administrative staff, pharmacy assistants, the lay counsellor (also the community collaborator), and clinicians, for phase one of the study, and only three participants (all clinicians) for phase two.

3.2 Ethical considerations

An ethics application (tracking number: 2023-7391-8094) was submitted and approved by the Rhodes University Ethical Standards Committee before the start of the project's data collection phase (**Appendix E**). Furthermore, approval to conduct the research was granted by the National Department of Health Research Committee (**Appendix F**). The facility manager of the clinic granted the gatekeeper permission, this letter can be found in **Appendix G**. Furthermore, before collecting data from individuals, participants gave informed consent (**Appendix H)**.

3.3 Participatory ergonomics/ CBPR considerations

As elaborated on in the review, HFE encourages the participation of relevant stakeholders in the design of work systems. This study aligns with the principles of a participatory ergonomics approach by adopting a CBPR approach to conduct research alongside healthcare workers as a community in the record-keeping process of a primary healthcare clinic. **Table 6** demonstrates how participatory ergonomics principles were used in this study with CBPR by outlining participatory ergonomics dimensions, the categories of each dimension and which category would best describe the use in this study.

Table 6: Participatory Ergonomics dimensions and its applications to this study

Dimension	Categories	Category best describing this study
Permanence	Temporary - Ongoing	Temporary (with on ongoing relationship)
Involvement	Direct participation - Partial direct participation - Representative participation	Direct participation
Level of influence	Department/work group - Entire organization	Department/work group
Decision making	Individual consultation - Group consultation - Group delegation	Individual and group consultation
Mix of participants	Operators - Supervisors - Middle management - Specialist/technical staff - Senior management	Mostly operators with influence from various levels of management
Requirements	Compulsory - Voluntary	Voluntary
Focus	Designing or specifying `equipment' or tasks - Specifying work organization issues - Formulating policies and strategies	Specifying equipment, tasks and organisation
Remit	Process development - Problem identification - Solution generation - Solution evaluation - Solution implementation - Process maintenance	Process development, problem identification and early stages of solution generation
Role of ergonomics specialist	Initiates and guides process - Acts as a team member - Trains participants - Available for consultation	Initiates and guides the process, acts as a team member and worked with team members

3.4 Phase 1: System familiarisation

1.3.1 4.4.1 Design

The first phase of data collection followed the embedding process, with the only difference being that data could now be collected. This part of the study adopted an ethnographic approach. Ethnographic research is field-based and emphasises the casual and improvisational nature that is important and unique to this method (Gusterson, n.d.). This ethnographic approach was used to understand, contextualise and map the record-keeping system of the clinic and the broader clinic system.

3.4.2 Data collection approaches

Data was collected in two parts to understand the clinic system and then, specifically, the record-keeping system. Firstly, informal discussions and observations were done while work was being done in the clinic. These discussions emerged from any questions the researcher had regarding how the clinic functioned, with a focus on the record-keeping process and were grounded in the SEIPS model components. As observations were made and discussions occurred, field notes on relevant information were recorded in a field diary, and further discussion often stemmed from researchers' observations. The second and larger part of system familiarisation was achieved through the researcher conducting semi-structured interviews with clinic staff members (baseline questions in **Table 7**), where notes were taken of interviews through brief field notes and voice recordings of interviews. The community collaborator was not present during interviews as they continued with their own work in the clinic. In addition to collecting data to become familiar with the clinic and record-keeping systems, the data collected allowed an understanding of the record-keeping process to emerge and populate a Hierarchical Task Analysis (HTA) (Shepherd & Stammers, 2005).

Table 7: Baseline questions for semi-structured interviews

Question	SEIPS components investigated	Rationale
What is your position in the clinic and role in the record-keeping process and what do and do not enjoy about your role?	People Tasks Environment	To understand where each person fits into the record-keeping process and start seeing what may or may not work within the process.
What internal or external factors impact you doing your job in a positive or negative way?	People Tasks Tools Environment Organisation	To see various system components that interact and impact the task of record-keeping.
How do the records and information flow through the clinic?	People Tasks Environment Procedures	To gain an understanding of the flow of records and record-keeping as a process.
Who do you work with in this process?	People	To see all the people involved in record-keeping and how they work together.
What is the purpose or outcome of the overall record-keeping system and specific processes within?	Outcomes Procedures	To understand the outcomes and processes of record-keeping.
What are the tasks you complete within the record-keeping process?	Tasks	To put together all tasks involved in the record-keeping process.
What tools and technology do you need to complete your task?	Equipment	To understand what tools and technology is used and for which tasks.
What are your working hours and who do you report to?	Organisation	To put together an understanding of organisational factors of the work system.
How would you describe the environment you work in in terms of both space and the people you work with?	Environment	To understand the work environment from both a physical and social aspect.
Can you explain the record-keeping process to me, how this process works well and/or how this process be made better?	Tasks Equipment Procedures	To get a perspective from workers of where improvements are needed and could be made.

3.4.3 Interview question development

An initial schedule of questions was formulated based on the components of the SEIPS model of people, tasks, tools, environment, organisation, processes and outcomes (Carayon et al., 2006). A descriptive/interpretative schedule was created following McIntosh & Morse, (2015) steps by identifying the domain of the topic (the clinic and record-keeping system), identifying the categories (SEIPS components) and then making the questions/ prompts based on the categories identified. This baseline of questions (**Table 5**), therefore, allowed for identifying and detailing discussions about the various work system components, processes and outcomes as well as system barriers and facilitators.

3.4.4 Procedures

Phase one of data collection began with the researcher going into the clinic and observing how the clinic runs and functions, particularly relating to the tasks involved in record-keeping and processes and steps in taking a record. Additionally, the researcher discussed with willing staff members involved in the record-keeping process based on the SEIPS model. During observations and discussions, the researcher took hand-written field notes of interactions and valuable information. The semi-structured interviews were conducted with staff members during breaks, with most interviews held in clinicians' consultation rooms or free consultation rooms. Here, the community collaborator guided the researcher in setting up interviews with various staff members by advising the researcher when clinicians would be free for interviews and sometimes setting up a time with the clinician for the interview. During the interviews, important points were written down by the researcher in the field notes, and every interview was voice recorded and saved for easy future reference.

3.4.5 Data analysis

After interviews, the voice recordings were put into a computer program (TurboScribe, powered by Whisper) which performed the initial transcription of these recordings; the researcher then checked and corrected these transcriptions. The corrected interview transcriptions were printed and analysed along with the supporting field notes. This data regarding the clinic system was analysed through deductive and inductive thematic analysis interviews following the steps from the Braun & Clarke (2006) method including familiarising oneself with the data, generating initial codes, searching for themes, reviewing the themes, defining and naming the themes and producing the report. For the deductive analysis, information gained from observations and informal semi-structured interviews and discussions were identified, organised and mapped out according to the elements of the SEIPS model. For inductive analysis, other emergent themes were identified through the interview and discussion data. This was done by taking the printed transcriptions and highlighting the identified themes (deductive and inductive) in different colours. Similar themes and identifying sub-themes by writing the themes and subthemes (as evidenced by interview quotes) on separate pieces of paper before transferring them into a Word document. A similar thematic analysis was done for data collected regarding the record-keeping process and the deductive themes were plotted into the selected SEIPS 101 tools. SEIPS 101 consists of seven easy-to-use SEIPS-based tools which can easily be applied in healthcare systems to help break down and understand the SEIPS models (Holden & Carayon, 2021). SEIPS 101 tools were selected to understand clinic record-keeping due to their simplicity and applicability in healthcare however, only three of the seven tools were selected based on the tool's relevance in relation to data collected and study outcomes. The selected tools for the deductive analysis are explained in **Table 8** below.

Table 8: The SEIPS tools used (adapted from Holden and Carayon, 2021)

Tool ***(type/ format of tool)***	**SEIPS components addressed**	**Primary uses for understanding record-keeping**
PETT scan *(checklist and documentation)*	All work systems components (people, tools, tasks, environment and their interactions)	Describing the overall complex record-keeping system and its barriers/ facilitators
People map *(map/ diagram)*	People and their tasks	Describing the people involved in the record-keeping process and how they interact within the broader clinic system
Tools and tasks matrices *(table)*	Tasks and tools	Describe tools and tasks involved in record-keeping in relation to who, why, how often and when record-keeping tasks are performed

In addition to the SEIPS 101 tools, the record-keeping process or, more specifically, the tasks involved in the record-keeping process were analysed using Hierarchical Task Analysis (HTA) as guided by Shepherd & Stammers, (2005) to systematically explore tasks. Firstly, the goals and operations of the record-keeping process were identified (a goal is a requirement of the business and the operation is what someone does to complete the task (Shepherd & Stammers, 2005)). The goal was then determined by human-task interactions (what staff members did to carry out the task successfully) before determining the order of operations and sub-operations that needed to be completed. The final consideration was the representation of the findings where a tabular format was initially chosen due to the large number of steps that became difficult to display on an A4 page clearly. One sub-task, the consultation, as the focus of the study, of the HTA was expanded into an HTA of its own and displayed in a hierarchical diagram. The HTA was created to understand and visually map out the tasks and subtasks of the record-keeping process until an adequate representation was formed (Sujan et al., 2022.). This HTA and mapping out of tasks was useful for this project as a clear visualisation and details of the record-keeping process and its related tasks were clearly displayed.

3.4.6 Iterative refinement procedures

Throughout the phase one data collection process, the researcher got feedback from clinic staff by asking, during interviews and informal discussions, whether they had understood what staff had told them correctly. This feedback was especially important in the construction of the HTA. After creating a draft HTA, the researcher got feedback from the community collaborator, admin clerk and clinicians (as guided by the community collaborator) to ensure an accurate representation of the record-keeping process was captured. Corrections were made to the HTA after this feedback, presented in results and the original draft of the HTA can be found in **Appendix I.**

3.5 Phase 2: Record-keeping compliance

3.5.2 Design

Phase two of data collection was divided into two parts: 1) a quantitative document analysis of patient files (6th and 7th of April) and 2) a qualitative investigation into the staff's perceptions on the reasons for the findings of the document analysis (ending on the 10th of May).

Through discussions with the DoH regarding the completion of patient files or, more specifically, what needed to be completed in patient files, the researchers were guided to a document called the Ideal Clinic Manual (Department of Health, 2021). This manual outlines what an ideal clinic would look like based on a variety of factors, one of which is what needs to be completed in a patient record. According to the Ideal Clinic Manual (Department of Health, 2021) commitment 15, all records should adhere to the Integrated Clinical Services Management (ICSM) prescripts. These prescripts can be found in a checklist provided in Annexure 14 of the Ideal Clinic Manual (**Appendix J**) to assess if the patient records are compliant. Therefore, the quantitative analysis was performed on the records where a frequency count was completed by looking at patient files and what information was completed or not completed as per the Ideal Clinic Manual checklist (example of female patient file: https://drive.google.com/file/d/1Akdv-VFzFg3qFT9z9cRgBBmE29biImOg/view?usp=sharing).

Based on the quantitative findings of the above document analysis which determined the adequacy of patient file completeness, further semi-structured interviews were conducted to assess and understand the perceptions of clinicians when completing files and reasons why the patient files may have been inadequately completed.

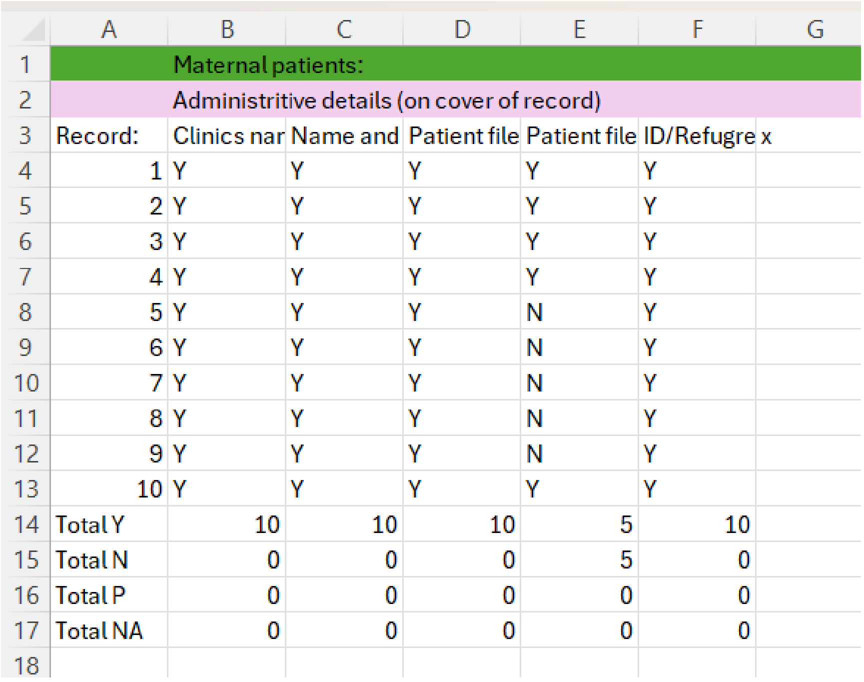
3.5.3 Data collection approaches

The checklist provided in the Ideal Clinic Manual requires all information in records to be completed. The researcher created a checklist primarily based on the Ideal Clinic Manual checklist with minor adaptations and some additions (such as the addition of the anti-retroviral therapy (ART) initiation and tuberculosis (TB) adherence sections based on information in the patient files) to determine how adequately the patient records in the clinic were completed. These additions to the checklist were made by the researcher as anti-retroviral therapy, and tuberculosis was a common part of patient treatments in primary healthcare clinics across the country. This adapted checklist can be found in **Appendix K**. After the analysis of records, the second part of phase two involved semi-structured interviews with clinicians, which attempted to understand clinician perceptions behind why records may or may not have been adequately completed.

3.5.4 Procedures for part 1

At the start of phase 2 the researcher went into the clinic (at a time agreed upon with the community collaborator) and randomly selected files from all file categories (male, female and child) and conducted a frequency count of what information was or was not completed in the various sections of the patient files. Patient file sections assessed included: administrative information, demographic, patient profile, clinical management, examination, patient management, ART initiation, TB adherence, prescription, consent forms, child health records, and antenatal care for relevant patients. Most categories in the patient files had to be completed at every or multiple patient visits. However, in the analysis of patient records, only the most recent visit was analysed as adequate record-keeping over time was not the focus of the study but rather the current state of record-keeping, allowing for more records to be assessed.

The adapted Ideal Clinic Manual checklist was placed into a Microsoft Excel document, with each information item in a column and the files in rows. Each information category was marked into one of four sections, namely 1) ‘complete’ (Y), 2) ‘incomplete’ (N), 3) ‘partially complete’ (P) or 4) not applicable (NA). An example is given in **Figure 9** below.



	A	B	C	D	E	F	G
1		Maternal patients:					
2		Administritive details (on cover of record)					
3	Record:	Clinics nar	Name and	Patient file	Patient file	ID/Refugre	x
4	1	Y	Y	Y	Y	Y	
5	2	Y	Y	Y	Y	Y	
6	3	Y	Y	Y	Y	Y	
7	4	Y	Y	Y	Y	Y	
8	5	Y	Y	Y	N	Y	
9	6	Y	Y	Y	N	Y	
10	7	Y	Y	Y	N	Y	
11	8	Y	Y	Y	N	Y	
12	9	Y	Y	Y	N	Y	
13	10	Y	Y	Y	Y	Y	
14	Total Y	10	10	10	5	10	
15	Total N	0	0	0	5	0	
16	Total P	0	0	0	0	0	
17	Total NA	0	0	0	0	0	
18							

Figure 9: Example of completing the adapted checklist in Microsoft Excel based on the Ideal Clinic Manual

The decisions about classifying the first three sections (Y, N and P) were guided by the instructions given in the Ideal Clinic Manual. Conversely, information categories marked NA were driven by other reasons as determined by the researcher, including no space to fill this information out in the file, the patient did not return for a follow-up visit or the date of birth had not been reached yet (in the case of maternal patients), previous information had not been completed (eg. could not provide test investigation results if no investigation was required) or the information category was needed for a sick baby but not a child in good health with the same patient files being used, for example.

This frequency count continued until saturation was reached, where a clear pattern emerged of what information was completed and what was not in various sections. This was coupled with the researcher not having time to look at more files, which resulted in the analysis of 55 files. Of these 55 files, 25 were chronic patients, 10 were maternal patients, 20 were children, 14 had ART treatment, and four had TB treatment (these were not distinct but rather intersecting categories; therefore, patients could fall into more than one of these categories).

3.5.5 Data analysis for part 1

For the quantitative data analysis, a frequency count of how many information categories in file sections were marked as 'Y', 'N', 'P, and 'NA' was completed and recorded. The frequency counts were then converted into percentages of the total number of files analysed for that file section. Information categories were placed into descending order of completeness (from most complete information category in the section to least) and put into stacked bar graphs showing the completeness of file sections and specific information details.

3.5.6 Procedures for part 2

Once an understanding of what was and was not adequately completed within patient records, it was important to understand the perceptions of staff and reasons as to why records were or were not adequately from clinicians as they completed the patient records. The researcher attended a staff meeting, as advised by the community collaborator, and explained the next collection phase before starting the semi-structured interviews. Based on the data collected in part 1, the semi-structured interviews were conducted with clinicians, during which the researcher and clinician looked through blank patient files and stopped at each file section for the researcher to ask questions regarding the sections that were or were not well completed and why. Baseline questions for the semi-structured interviews included:

1) What do you normally fill in? (and why)
2) What do you not normally fill in? (and why)
3) If you left something out of this section, what would it be?
4) Why would you fill in this information and not another?

5) Would you change anything in this section when filling in the record, and what would it be?
6) What would make this section easier to complete?

Unfortunately, only three interviews were conducted due to various constraints, including participant fatigue, the high patient load in the clinic, understaffing, and time constraints. A limitation was noted in this phase as only three interviews were conducted, one of which was with the facility manager, who may have differing views but still works with patients. Another interview was conducted with a staff member who predominately worked works with minor ailment patients and, therefore, did not work with patient files as often as other clinicians. None the less, valuable insights were gained and are still included as results of this study.

3.5.7 Data analysis for part 2

For the qualitative aspect of phase two, an inductive thematic analysis was completed from transcriptions of interviews in a similar manner as phase one (refer to phase one for details). The difference in thematic analysis for phase two was that it was done inductively rather than both deductively and inductively. Therefore, themes emerged from the analysis of interview discussions around reasons why differing parts of records may or may not have been adequately completed. Themes regarding what could be improved in records also emerged and will be discussed in the discussion chapter, accompanied by quotations from interviews as evidence.

3.6 Post data collection feedback

As part of the CBPR approach, it was important to close the loop and steps given by Israel et al. (2013) by giving feedback to the clinic. Therefore, a feedback session with the clinic staff was organised in consultation with the community collaborator.

3.6.2 Procedures

A lunch was held at the collaborating clinic on an afternoon during the clinic's weekly scheduled staff meeting with the staff members who were willing and able to attend. Firstly, the project co-supervisor and Human Kinetics and Ergonomics head of the department thanked everyone for being there and for their willingness to work together on this project, particularly the facility manager and community collaborator. Introductions were then made by all staff and researchers in attendance, stating their names and respective roles so that everyone could be familiar with each other. The purpose of the meeting was then presented, and two overarching intentions were outlines. 1) To give feedback on key findings from the study to clinic staff members and 2) to discuss what staff felt were the most important findings and what they would have liked to be further disseminated to the DoH. Key findings of the study were then shared based on a handout, as can be found in **Appendix L**. The session then was opened for discussion regarding what clinic staff felt were the most important findings and what they wanted to be disseminated to the DoH through a written report, as will be discussed in the results.

Chapter Five: Results

The following chapter presents the results of the study in four parts. Part one addresses objective one by describing the clinic system as a whole by detailing the various system components using the work systems model and processes and their interactions. Part two then addresses objective 2, understanding the record-keeping process and presents a hierarchical task analysis (HTA) of the record-keeping system, which shows the process and tasks involved in record-keeping. Part three continues detailing objective two by describing the various components and interactions within the record-keeping process, presented using the SEIPS 101 tools. Data for the first three parts of the results was ascertained through observations, discussions and semi-structured interviews with clinic staff members. Finally, part four addresses objectives 3 and 4 by capturing record-keeping compliance by presenting the completeness of various file sections before exploring reasons, as described by some of the clinicians, for the completeness of records by analysing patient files and conducting further semi-structured interviews.

4.1 Clinic system familiarisation

4.1.1 Clinic purpose and intended outcomes

When various clinic staff were asked about the purpose of the clinic and the ideal outcomes, several key points were highlighted. These included **helping people by providing optimal quality treatment, care and services to community members, which would prevent further illness and hospitalisations**. Optimal care to clinic staff meant that patients did not have long waiting times, all patients were attended to, medication was readily available, and everyone worked together smoothly in the system. However, one clinician commented that she believed optimal care was not being achieved: *"Well, according to me, [optimal care] is the availability of medication, which is non-existent at the moment. So I think if we can get like [more] staff and medication, then I think we can achieve that optimal care."*

4.1.2 Work system components

4.1.2.1 Work system components summary

Table 9 summarises the various system components found in the clinic system and categorised by the original SEIPS model components. The clinic systems barriers and facilitators are then summarised in **Table 9**. These components, interactions, a few of the major barriers, facilitators and other key identified themes will be discussed further and explained in the text below. It is important to note here that when staff spoke about facilitators or what made their job easier, they often spoke about them in theory, in other words, what 'would' make it easier; therefore, these facilitators were not always present in the clinic system.

Table 9: A summary of the work systems model components in the clinic system

Work system component	Clinic components
People	● Variety of professional staff
Organisation	● Clinic operating times – weekdays (7:30-16:30 with 1 hour lunch break) and weekends (8:00- 16:30 with 1 hour lunch break) ● Teamwork was essential ● Clinicians worked different patient programmes but helped each other ● 30minutes- 1 hour per consultation (dependent on programme and other factors) ● Patients were seen on an appointment and walk-in basis ● Ideally, patients would not wait for more than three hours- which was not always the case ● Ideal clinic assessments were conducted based on the Ideal Clinic Manual ● Files were divided into male, female, and child files as distinguished by colour ● Files should have been safely stored and kept for five years ● Patient files were paper-based and data was captured into computer systems
Tasks	● Medical tasks ● Patient education and counselling ● Facility manager tasks ● Pharmacy tasks ● Record-keeping/ admin tasks ● Other non-specific tasks
Tools and technology	● Medical equipment ● Pharmacy equipment ● Cleaning supplies ● Infrastructure and furniture ● Record-keeping tools and technologies
Environment	Physical ● Different sized and number of clinic rooms ● Broken lights and windows ● The clinic served a large community Social ● Predominantly positive environment

Table 10: Clinic system barriers and facilitators categorised by work system model components

SEIPS component	Barriers	Facilitators
People	• Short staffed (admin, when staff are on leave, a day off or on a short course, subcontracts expiring and frozen posts).	• Working with people (teamwork with other staff and enjoyment in helping and educating patients). • When staff listen • Leadership
Organisation	• Budget constraints in terms of equipment and waiting on supplies etc. • Shortage of medication. • Delays at the pharmacy. • Seeing many patients in a short space of time.	• Smooth running of the clinic with everyone playing their part. • Having enough clinicians and administrative staff. • Having good channels of communication. • Having different patient programmes. • Having a separate pharmacy department in the clinic.
Tasks	• Patient transfers (following up, getting the transfer letter, getting relevant information, contacting family, checking test results.	• When transfer letters are provided, follow-up workload is reduced.
Tools and Technology	• Not enough or broken equipment and unclear equipment maintenance reporting procedures. • Not enough functioning computers and no wi-fi connection. • Clinicians used personal phones and data to check lab results. • The clinic only had one landline phone.	• The SMARTcare system. • When medical trolleys are well prepared. • When all equipment and medication is available.
Environment	• Loadshedding (couldn't see, computers didn't work, couldn't capture data, print, or check lab results). • Impatient patient. • Size of clinic and moving/ improvising consultation rooms due to space constraints. • The large community the clinic served made it busy and high volume.	• no mentioned facilitators falling under environment

4.1.2.2 People

The clinic employed **nine clinicians**, one of whom was the facility manager, one was an outreach leader, and one enrolled nurse was also an outreach leader, along with **nine community healthcare workers** (who were assisted by volunteers). Further staff included **three lay counsellors**, **two community service nurses** who worked in the community, **two pharmacy assistants**, and **one data capturer**. There was also **one admin clerk** and **one property caretaker**. One of the clinicians had been a nurse for over 40 years and at the given clinic since 2010 (13 + years). One reported barrier was that sometimes the clinic was short staffed, for example, when staff were on leave or on a short course, as demonstrated by the data capturer being on maternity leave at the time of the study. These staff reported to the facility manager, who reported to a district nurse above her, and the pharmacy assistants reported to and worked with a pharmacy manager. Both the district nurse and pharmacy manager worked outside of the collaborating clinic.

There was also a **paediatric team**, with members such as a physiotherapist, speech therapist, dietitian and occupational therapist, who visited the clinic once a month. **Two doctors** also worked in the clinic weekly, one of whom visited the clinic on a Monday and Wednesday, the other on a Thursday, and **a dentist** who visited the clinic on a Monday and Tuesday.

Within this group, it was found that staff members enjoyed working and interacting with various people, including the community, and continually learning from their experiences. For example, the admin clerk was asked what she enjoyed about her role; she said, *"For me, it keeps me excited, and I learn new things every day here".* Other staff reiterated this: *"I actually enjoy working with people, like in general"* and *"[I] just [enjoy] working with people in general, knowing at the end of the day that you helped someone…"*. One staff member also highlighted a passion for helping and educating patients: *"It is a passion for me to help the patients"*, and *"I enjoy helping people, giving them knowledge and wisdom".*

Within the clinic, some adaptations made by clinic staff to cope with system challenges included simply accepting the way things were done, finding something to do during loadshedding (scheduled power outages in South Africa), working late and after hours to complete work.

4.1.2.3 Organisation

a. Clinic service times

The clinic was open on a **Monday-Friday from 7:30 until 16:30**. Patients started arriving at 7:30 and staff split into shifts (7:30- 16:00 and 8:00- 16:30), taking **an hour lunch break** (13:00-14:00). Normally, there was a scheduled 30-minute tea break, but staff reported that this was not often taken due to having too many patients to see. This splitting of shifts was a choice; however, staff and the facility manager had to coordinate shifts to distribute them evenly among staff. While staff members had to work eight hours, it was mentioned that the facility manager allowed changes in what hours staff worked in cases such as family emergencies or allowing a staff member to work through lunch and then leave an hour early, for example. All working hours were documented and signed for in a book in the facility manager's office. The **clinic was also open (8:00-16:30) over weekends** for minor ailments and emergencies, with two clinicians on duty as assigned on a roster basis. Furthermore, it was mentioned that staff often worked late and the admin clerk even went in over some weekends to complete her duties.

b. *Organisation of clinician tasks*

The tasks of clinicians were divided into various programmes such as minor ailments, babies/ children, antenatal care and chronic patients (where it was further divided, with one clinician working with tuberculosis (TB) patients most of the time and other chronic patients). An experienced clinician commented that the programme system had not always been how things were done, where, in the past, all clinicians consulted with any patient and all patient categories. The clinician said*, "And those days we were a supermarket, the supermarket approach",* meaning that any clinician would just see the next person in the queue; however, the current programmes were better for the running and functioning of the clinic. Clinicians working in the various programmes could change and rotate at any time, as initiated by clinicians; this was done a few months prior to the researcher working in this clinic.

The clinic serviced approximately around 200 patients daily, depending on various factors, including the weather, time of month based on when government grants were paid out, and day of the week. One patient consultation took between 30 minutes and 1 hour or longer. Longer appointments were usually the result of the clinician needing to open a file for a new patient. This also depended on the patient programme, as in some programmes, there were up to five different forms or documents to fill in, some of which were duplications. However, it was said that there was an expectation for each nurse to see up to 30 patients a day, but a more accurate estimation by a clinician was 10-15 patients, programme dependent.

Most patients were seen on an appointment basis across the programmes; however, walk-in patients and patients who missed appointments could not be turned away, leading to a combination of appointment and walk-in patients. Another expectation of the healthcare facility was that patients would not have to wait for longer than three hours before being attended to, which the clinic tried to abide by. However, this was not always the case due to the high volume of patients the clinic worked with. These and many other regulations, such as what needed to be completed in a patient file, were stipulated in the Ideal Clinic Manual. The DoH assessed the clinic on the various criteria specified in the Ideal Clinic Manual however, an exact time frame for the regularity of these checks was unclear.

Teamwork was also emphasised as a feature of the daily running of the clinic when completing tasks. On this theme, one clinician shared *“You can't be an isolated person, not in this profession”,* and another *“Everyone, we are connected”*, where the lay counsellor emphasised her involvement and assistance in all aspects of the clinic. For example, clinic staff also worked with people beyond their clinic environment when contacting other facilities regarding patient transfers.

c. Clinic record-keeping considerations

The same patient files were used nationally across healthcare institutions and for different programs. The files were divided into male patient files (blue), female patient files (pink) and child patient files (white), where all information had to be recorded. However, this clinic did not record or open files for minor ailment patients for various reasons, including a lack of file storage space, timesaving and the fact that these were often for once-off patients. The clinic files were kept and stored in the clinic for five years, where no one other than clinic staff had access to them; therefore, they had to be kept behind a locked door. However, this was not the case in the clinic due to a shortage of space.

Patient records in this clinic and across primary healthcare clinics in South Africa were physical paper-based records. However, there were various computer systems in which patient data was captured and received, summarised in **Table 11** below.

Table 11: An overview of the clinics computer systems abbreviations and system uses

Full name of system	System abbreviation	Use of system
Health Patient Registration System	HPRS	Basic information from the patient is captured when the patient enters the clinic. Eg. name, date of birth and address. Used to keep a record of patients entering the clinic. Contains same information as headcount register
TIER.net		Software used to capture and monitor HIV patients and their ARV treatments. This is important for national health statistics.
District Health Information System	DHIS	Details of what the patient is treated for is detailed here. Information is transferred from the tick registers into the DHIS.
Central Chronic Medicines Dispensing and Distributing	CCMDD	Patient follow up appointments are captured and kept track of here.
Lab Track		Laboratory results are recorded and checked here.
SMARTcare		Excel spreadsheet capturing all patients and file numbers- used in place of HPRS functions.

The Health Patient Registration System (HPRS) contained the same information as the headcount register (capturing essential patient information such as name, surname, address and date of birth in reception when the patient entered the clinic). The HPRS should have been used in place of the headcount register and given patient file numbers, which, at the time of data collection, was not being done and was used as a backup system. The headcount register information was retrospectively put into the system. However, soon after the data collection process, higher DoH management requested that the clinic make the correct use of HPRS and the headcount register and numbering system as a backup so that patient information could be accessed nationally.

The TIER.net was a system or software used to capture and monitor HIV and TB patient treatments, and the District Health Information System (DHIS) captured all information from the tick registers, which were completed by each clinician regarding what each patient got treated for. The Central Chronic Medicines Dispensing and Distributing (CCMDD) system captured follow-up appointments for the distribution of chronic medication. LabTrack was where clinicians got their laboratory results, while

SMARTcare was an Excel spreadsheet capturing all patients and file numbers, which (at the time of the study) was used in place of HPRS to give file numbers.

Adaptations made to counteract some organisational challenges include teamwork and helping/ filling in for one another, patients who missed appointments still needed to be fitted in and seen, patients taking their own file to the pharmacy to save time despite it not being recommended and getting extra staff members through contract NGO projects and volunteers.

4.1.2.4 Tasks

Within the clinic, there were many tasks to complete, both specific to one's role or position in the clinic and non-specific to position, as when there was a shortage in one area, staff stepped in and completed tasks that may not have been a part of their job description. For example, administrative staff were supposed to retrieve files from cabinets; however, when short-staffed, the clinicians often retrieved their own files, and a lay counsellor regularly assisted in the reception with various administrative tasks. The variety of tasks could be divided into several categories, including: 1) **medical tasks** involved in treating a patient and preparing the medical trolley, 2) the **education and counselling** of patients, 3) **facility manager tasks** including medical tasks, ordering, and supervising, 4) **pharmacy personal tasks** included ordering and dispensing medication and 5) **record-keeping tasks** as to be discussed in further detail below. **Other tasks** mentioned included patient follow-up, calling a patient for consultation and checking laboratory results. Staff interacted with their tasks to fulfil their role and worked with each other to complete them to ensure that the clinic functioned smoothly, as demonstrated in this quote: *“Starting from teamwork, everyone is supposed to do it, even how small or how less important it may seem. Each of us have different categories, but it all flows in hand. So if all of us do our jobs and do what we’re supposed to do, one will flow into the other one, and then it will go smoothly.”.*

4.1.2.5 Tools and technology

As with the tasks involved in the daily running of the clinic, several tools and technologies were required to complete tasks and the clinic's general functioning. These tools and technologies again could be divided into various categories, from **medical equipment** such as needles and syringes to machinery such as foetal scopes and blood pressure machines. Other categories included **pharmacy-specific equipment, cleaning supplies, furniture, and infrastructure**; not all equipment was always well-functioning. **Record-keeping and administrative** tasks also required various equipment to be discussed in more detail in a section 5.3.3 to follow.

However, tool and technology-related adaptations included checking lab results on one's personal phone, asking ambulances and the hospital to bring extra equipment such as bandages and making do with a lack of equipment/ furniture. *“So I find, because we’re supposed to have computers, so I find that I do it a lot on my phone to check [lab] results, because you would find that there is no data, no WI-FI…” “[If] there is something [we] don’t have, when the ambulance people come, [I] ask them if they do have.” “Then, sometimes I will phone the doctors and tell them, Doc, we would like to dress our patients, but we don’t have equipment. Can you please send down?”.*

4.1.2.6 Environment

The environment was divided into two sub-categories; the clinic’s physical environment and social environment, for which staff members had vastly different responses. Starting with the **physical environment**, the clinic had several consultation rooms, most of which were allocated by programme. For example, there was a doctor's room, a dentist's room, a room specific to antenatal care and a TB room, as a few examples. Thus, several consultation rooms only had one clinician working in them. However, this was not always the case, as there were more clinicians than consultation rooms *“I don’t have a set room. We have a few consulting rooms and sometimes there’s seven of us and then there’s five rooms.”* This coupled with the large community being served by the clinic, led to staff members shuffling rooms regularly and even using the kitchen or dividing the waiting area to consult and making the clinic a busy environment to work in. Clinicians also swapped consultation rooms for other reasons; for example, the doctor may have moved into the facility manager's office/ consultation room to use a working computer and access blood results if the printer was broken and blood results could not be printed. This was reflected in the adaptation of making more consultation space by using dividers in the waiting area and shuffling around a room to find a place for everything, even if against regulation (such as a medical trolley being under a window).

Each programme had a separate waiting area (or section of the passage) for easier patient identification. A common challenge identified was that the waiting area was too small and got congested easily. The idea of physical space in the clinic being too small was commonly reported and mentioned by multiple staff members; for example, the outlook window in the pharmacy and in the reception was too small, the reception was too small, and some consultation rooms were too small. *“Yho… it’s very small. Too small.” “Because this clinic, it’s very small and accommodates a large number of patients.”.* However, some staff were happy and said they had enough space in their consultation rooms for example, the TB consultation room had to be larger and well-ventilated due to the nature of TB. However, filing cabinets and files were also in this room due to space constraints, which led to space being taken up and staff regularly walking in and out of the room. Other physical environment issues raised included: 1) not having enough storage space in reception (as shown in that files were also stored in the TB room), 2) one consultation room having a broken window, 3) a broken light which had not been repaired and 4) heat in the clinic coupled with a lack of ventilation in some rooms and a lack of working air conditioners. All of these factors impacted staff and the clinic’s functioning in some way.

In contrast to the negative physical environment, clinic staff reported having a very **positive social work environment** where many of the staff enjoy working with people and the environment was described as *“good and healthy”, “teamwork”, “like family”, “love each other”, “peaceful”, “laugh a lot”* and a story quote capturing the social environment well: “*Fortunately I have nice colleagues, we get along just fine, we get along, we even create our own events just to make you know, to just motivate us, so we have our own events like for Valentines day. We had a Valentine's lunch where we sat, and then we had someone to make food for us, and we wore red and white, and we took pictures, and we played music. So it was very nice, so yeah, we get along. Yes, there would be conflict [here] and there but mostly we get along.”* This quote also captures that there was conflict at times yet, it got dealt with and put aside.

Negative aspects of the social environment included too many people in reception, which was reported to be *“loud”* and *“distracting”* as staff sometimes gathered in reception to have conversations and listen to the music played while working. Furthermore, multiple staff commented that a negative social aspect in the clinic was when patients got frustrated and impatient and could be rude and swear at staff, which was unpleasant.

Now that the general clinic system, its work system components, barriers and facilitators have been explored, a more specific focus turns to the clinic record-keeping system and process, using a Hierarchical Task Analysis (HTA) and selected SEIPS 101 tools.

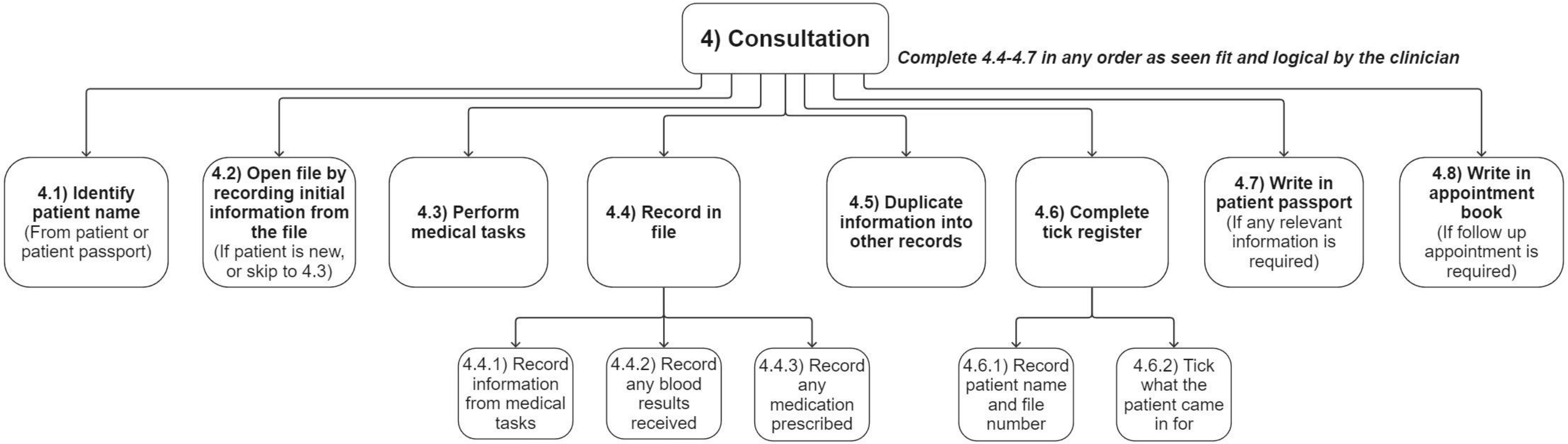
4.2 Hierarchical Task Analysis (HTA)

Record-keeping within the clinic occurred in a sequential manner that could be broken down into various tasks and subtasks, as reflected in **Table 12** below. The process started as the patient entered the clinic and reported to the reception window and ended with reports based on captured patient data being sent to the DoH via electronic systems. There were nine overarching tasks or steps in the record-keeping process, including completing the headcount register, retrieval of the files, taking files to consultation rooms, tasks within consultations, taking files to the pharmacy, files being returned to reception, capturing of data, files being stored and reports being sent from the computer systems.

Within the patient record-keeping process the completion of the actual patient record is performed during step 4, consultation, and 4.4, fill in the record, of the HTA. Therefore, to display this, an additional HTA is displayed in **Figure 10**, more clearly showing the details of this crucial step.

Table 12: A Hierarchical Task Analysis representing the tasks involved in the record-keeping process for new and existing patients

Task Analysis	Notes
0 Complete record-keeping	Complete all steps and sub-steps in sequence unless otherwise indicated
1 Complete headcount register 1.1 Receive patient *1.1.1 Ask which programme the patient is at the clinic for* *1.1.2 Write date on patient passport* 1.2 Find patient file number *1.2.1 consult SMARTcare* *1.2.1.1 Open SMARTcare excel sheet* *1.2.1.2 Search patient name* *1.2.1.3 Have patient file number* *1.2.2 Check TIER.net for patient file number* *1.2.3 Update file number on HPRS* 1.3 Fill in patient name 1.4 Fill in patient date of birth 1.5 Fill in patient address	(1.2) Obtain information from patient passport or patient if file number is not in patient passport (1.2.1.1) Where SMARTcare is a clinic created Excel spreadsheet keeping track of clinic patients and clinic issued file numbers (1.2.2) If file number is not on SMARTcare (1.2.3) If found on SMARTcare or TIER.net
2 Retrieve file 2.1 Search in cabinets for file 2.2 Search around the clinic for file *2.2.1 Walk around the clinic into various rooms the file could be in* *2.2.2 Search in piles of files for the given file*	(2) From filing cabinets (2.2) If file is not in the cabinets
3 File taken to consultation room	
4 Consultation 4.1 Identify patient name 4.2 Open file by recording initial information in the file 4.3 Perform medical tasks 4.4 Record in file *4.4.1 Record information from medical tasks performed* *4.4.2 Record any blood results received* *4.4.3 Record any medication prescribed* 4.5 Duplicate information into other records 4.6 Complete tick register *4.6.1 Record patient name and file number* *4.6.2 Tick what the patient came in for* 4.7 Write in patient passport 4.8 Write in appointment book	(4.1) From patient or patient passport (4.2) If the patient is new, or skip to 4.3 Complete 4.4- 4.7 in any order as seen fit and logical by the clinician (4.7) If any relevant information is required (4.8) If follow up appointment is required
5 Take files to the pharmacy	Clinician should take file but they are taken by patients
6 Files are returned to reception	From the pharmacy and clinician rooms
7 Data captured 7.1 Files updated 7.2 Files sorted 7.3 File number given from SMARTcare and from HPRS 7.4 Capture tick register data into DHIS *7.4.1 Tally daily totals of what patients came in for* *7.4.2 Put totals into the system* 7.5 Capture Tuberculosis (TB) and anti-retroviral therapy (ART) patient information into TIER.net 7.6 Capture headcount register into HPRS and DHIS systems 7.7 Capture follow up appointments into CCMDD	Order and completion of steps 7.4-7.7 varies according to differing information that needs to be captured
8 Files are put away back into cabinets	
9 Send reports from computer systems	



Complete 4.4-4.7 in any order as seen fit and logical by the clinician

Figure 10: Zoomed in Hierarchical Task Analysis to complete step 4: consultation of the record-keeping process

4.3 Record-keeping system familiarisation

This section describes the record-keeping system in further detail by exploring the record-keeping system components, component interactions and record-keeping barriers and facilitators within the wider clinic system using selected SEIPS 101 tools. The people, environment, tasks and tools (PETT) scan is used to display various components of the record-keeping process and barriers and facilitators related to the different components, a people map is used to capture different staff members involved in the process and their interactions, tools and task matrices are used to give details regarding tools involved and the interaction between tools and tasks in the record-keeping process.

4.3.1 PETT scan

The first SEIPS 101 tool used to describe the record-keeping system is the PETT scan which captures the people, environment, tools and technology and the tasks components of the work systems model. More specifically, barriers and facilitators to the record-keeping process are categorised into various components, as can be seen in **Table 13** below.

Two examples are highlighted here where barriers impact how the record-keeping process is done in the clinic. Firstly, on file storage space where administrative staff suggested it would be easier if all files were kept in the reception area, they would not have to walk up and down to retrieve files in the room across the passage. An adaptation to the lack of storage space, time constrictions and staff-shortages was that the clinic did not open files for patients with minor ailments. *“We've got challenges, Kirsten. The first challenge is that some of the patients, you will see the patient once and then that patient will disappear. For years, for instance, you were passing by and then you felt sick that day. You are not even from here. And then we'll open a file. We don't have enough space for that…”.*

A second barrier was that during the pre-data collection embedding process there were two part-time data capturers employed by NGOs and an intern who assisted the admin clerk and data capturer in reception and with admin tasks. However, at the start of the new year and when interviews began, there was only the admin clerk as the data capturer was on maternity leave, and the other contracts had yet to be renewed for the new year. During interviews, some spoke of these contracts possibly being

Table 13: SEIPS 101 tool PETT scan describing the work system factors, barriers and facilitators to record-keeping in the clinic

Work system factors	Barriers	Facilitators
People ● Healthcare facility staff ● Patients ● Others	● Shortage of staff- clinicians and particularly administrative staff (eg. Admin clerk performing the duties of four people) ● People make mistakes ● Impatient patients	● Some staff have a lot of experience
Environment ● Physical ● Socio-organisational ● External	● Distracting for administrative staff when people gather and make noise in the reception area ● Not enough file storage space ● The work environment can get busy and hectic ● Loadshedding	● Everyone works well together
Tools and technologies	● Lack of equipment (dividers to make files stand upright in cabinets, burglar bars and locks missing for security of files) ● Non-functional computers ● Wi-fi on only one reception computer	
Tasks	● Task juggling ● Duplication of information onto multiple records ● Files that are not in the cabinets ● The amount of information to fill in per consultation ● It is time-consuming for clinicians to wait for files from reception	● Everyone helps with record-keeping activities, such as clinicians retrieving their own files ● Patient take their own file to the pharmacy ● Information recorded on patient passport
Interactions between components	● When equipment breaks (eg. printer) (tools and technology) there is no clear reporting system (organisation) ● Delay in the arrival of new/ working computers (organisation and tools and technology) ● When contracts end it takes a long time to renew them (organisation), leaving the clinic short staffed (People) and increasing workload for others (tasks) ● When staff are off on short courses or a personal day (organisation/ people), the clinic is left short staffed and increasing work load on other (tasks) ● When the clinic is busy (environment) or a file is lost/ misplaced, information does not get recorded (tasks) ● Clinicians not adequately performing duties creates barriers for admin staff, ie.Untidy handwriting, not all information recorded and not returning files to the reception timeously (tasks and organisation) ● Due to lack of dividers (tools and technology), files fall over in filing cabinets making file retrieval more difficult (tasks) ● HPRS system gives unordered numbers (organisation) meaning SMARTcare is used instead (tasks) ● Patients (people) become frustrated by long waiting times (a result of other system components such as organisation and tasks) therefore, impacting clinicians' work environment.	● Some staff find paper based recording (as it is done) easier (tools and technology and tasks)

renewed, but there was uncertainty about whether or when they would be, leading to an increased workload for other staff members.

Due to the various barriers encountered in the record-keeping process, some adaptations were mentioned that enabled staff to continue to work as best as possible and complete the record-keeping process despite the challenges. Adaptations are how staff change the way they work or adjust their work to successfully complete their tasks which differs from facilitators in that facilitators are pre-existent and emerge within the work system that make work easier. Adaptations included that **clinicians retrieved their own files** to save time or help the admin staff when busy; all files should have been stored in one room, but due to a lack of space, there were also **storage cabinets in another room** and **sometimes information was only recorded on the patient passport** and not on the patient file. One clinician commented that when she was really busy and had information to duplicate into various documents, she took pictures of the information and **transcribed the information at a more convenient time**. The HPRS system should have been used to allocate file numbers and record the headcount information but for various reasons, including external factors such as loadshedding, non-working computers and the confusing way in which the HPRS issued file numbers, **a headcount register and excel spreadsheet called SMARTcare were used instead of the HPRS system**.

4.3.2 People map

The people map below, **Figure 11**, captures those involved in the record-keeping process and their interactions with one another. In this people map, the size of the sphere denotes the influence the person had on the record-keeping process, the type of arrow denotes the direction of communication, the boldness of the arrow denotes how pertinent the interaction was to the record-keeping process and the dotted circles show the micro, meso and macro levels of the record-keeping process. The administrative staff interact with all other staff in the record-keeping process for tasks including retrieving and delivering files to clinicians and receiving files back from clinicians and pharmacy assistants. Another interaction with administrative staff included receiving help from other willing staff, such as the lay counsellor or clinicians retrieving their files (where ‘other staff’ are considered in helping with administrative duties; therefore, interactions with others are the same as the administrative staff). A final administrative staff interaction was working with community healthcare workers to trace patients and send reports to the DoH superiors. Clinicians interacted with pharmacy assistants by sending files from consultations to the pharmacy, and pharmacy assistants also interacted with community workers for follow-up tracing. **Figure 11** captures important interactions between clinic staff in the record-keeping system.

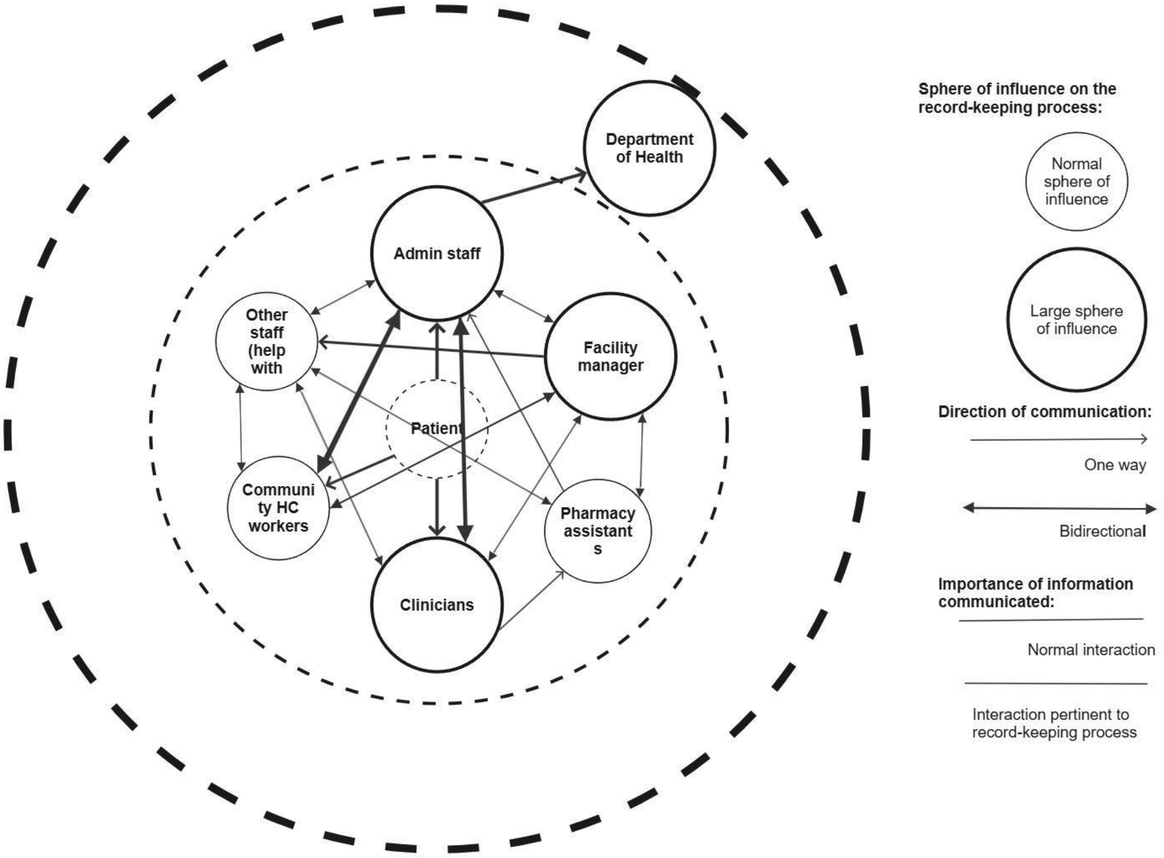


Figure 11: SEIPS 101 tool 'people map' displaying interactions among healthcare workers in the record-keeping process with increasingly thick dotted lines representing the micro (inner- patient), meso (middle) and macro (outer) levels.

4.3.3 Task and tool matrices

There are various tasks and tools related to the record-keeping process as specified in the PETT scan. These can be displayed in task and tool matrices to capture details of tasks and tools involved in the record-keeping process and how they interact to complete record-keeping. However, only the tools matrix and task X tools matrix are included while the tasks matrix is excluded as all relevant task information is captured in the HTA. Details of the various tools used in record-keeping, as displayed in **Table**

14 below, include the tool users, purpose of use, frequency of use, ease of access and usability. All tools in the record-keeping process were used frequently, whether that be on a daily basis or for each patient. However, not all tools were easy to access; computers had low accessibility as there were not enough computers connected to the internet. Additionally, some tools were easy to use with high usability. However, computers and storage cabinets were not difficult to use, but have some flaws with a medium usability rating. A medium rating of usability is also given to patient files due to the confusion of the WHO stages in the ART section of patient files. The task X tool matrix displays what tools were involved in which record-keeping tasks, highlighting that patient files and other registers, such as the tick register and headcount register, were particularly important as they were used for every step of the record-keeping process.

Table 14: SEIPS 101 tool task and tool matrices demonstrating the tasks, tools and their interactions in the clinic record-keeping process.

A) Tools matrix					
	Users	***Purpose of use***	***Frequency of use***	***Ease of access***	***Usability***
Patient files and various registers (eg. headcount and tick registers)	All clinic staff	To record all necessary patient information	For every patient (excluding minor ailments)	Medium	Medium
Stationary	All clinic staff	To record all necessary information	For every patient	Medium	High
Computers	Admin staff	To capture information and send reports	Daily	Low	Medium
Storage cabinets	Admin staff, clinicians and other assisting staff	To store all patient files	Daily	Medium	Medium

B) Tasks X tools matrix				
	Patient files and various registers (eg. headcount and tick registers)	*Stationary*	*Computers*	*Storage cabinets*
Complete headcount register	Yes	Yes	-	-
Retrieve file	Yes	-	-	Yes
File taken to consultation room	Yes	-	-	-
Consultation- record information	Yes	Yes	-	-
File taken to pharmacy	Yes	-	-	-
File returned to reception	Yes	-	-	-
Data captured	Yes	Yes	Yes	-
Files put away back into cabinets	Yes	-	-	Yes
Reports sent from computer systems	Yes	-	Yes	-

4.4 Record-keeping compliance

After understanding the record-keeping process as discussed above, the compliance in patient records was analysed using the Ideal Clinic Manual, as agreed upon with the DoH and collaborating clinic facility manager. Therefore, how adequately records were completed before understanding why the records and various file sections were or were not adequately completed will be discussed in this section.

4.4.1 Patient record analysis

This section of results forms the quantitative element where 55 files were assessed based on an adaptation of the Ideal Clinic Manual checklist (**Appendix K**). The categories assessed were distinct, but some patients could fall under multiple categories. Hence, the number of files presented differs for each category. A breakdown of the number of patient files assessed based on overarching categories is stipulated in **Table 15** below. This breakdown shows the number of files assessed (n) for more specific file sections, further details in the graphs to follow. Most file sections had space to complete the same information at every patient visit; therefore, only the most recent visit to the clinic was assessed.

Specific information categories and the percentage of files assessed were grouped into one of four different categories: complete, incomplete, partially complete (where only some relevant information was completed) or not applicable (NA). The results for this section start with file sections that were required by all patient files including sections related to administrative details such as patient name and file number, demographic details (divided into adult and child), patient profile (divided into adult and child files) and prescriptions. After this, results for file sections specific to a certain patient are presented such as for maternal records and ART initiation.

Table 15: The number of files assessed in various broad categories

Overarching category	Number of files assessed(n)
Total files	55
Chronic adult patients	25
Maternal patients	10
Adults	35
Children total ● Sick children ● Well babies	20 7 13
Antiretroviral therapy (ART) patients	14
Tuberculosis (TB) patients	4

Administrative details

Administrative details were captured on the front cover of patient files, indicating essential details for patient and file identification. **Figure 12** shows that three information categories were completed on all 55 files while ‘identification number’ was completed on 96,4% of files and ‘HPRS patient file number’ was only completed on 61,8% of the files.

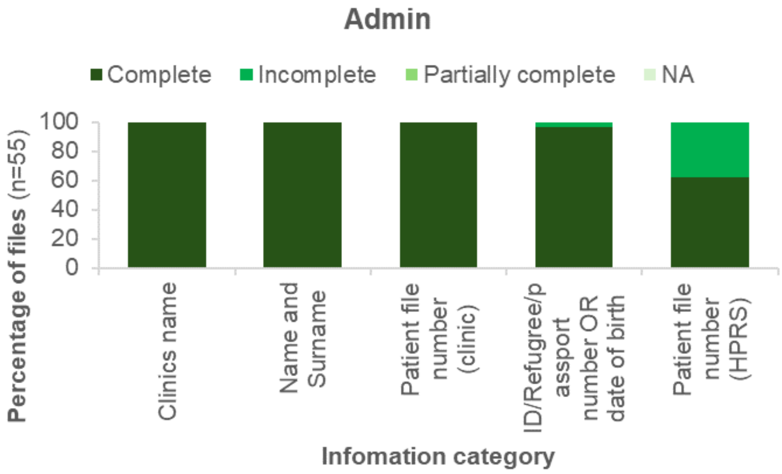


Figure 12: Number of files where admin details were completed, on the front cover of the file.

Demographic information

Demographic details have been divided into adult files and children files, as different information was required for the adult compared to children files. Where ‘employers contact details’ consisted of both name and contact details. The patient's demographic details were essential for patient follow-up care. **Figure 13** shows that in adult files ‘patient residential address’ was 97,1% completed while ‘employment details’ was only 62,9% completed. Similarly, in children's files, ‘residential address’ was 100% completed while ‘parent/ guardian contact details’ was only 35% completed. In this case, partially completed information most often reflected only one parent's contact details being filled out.

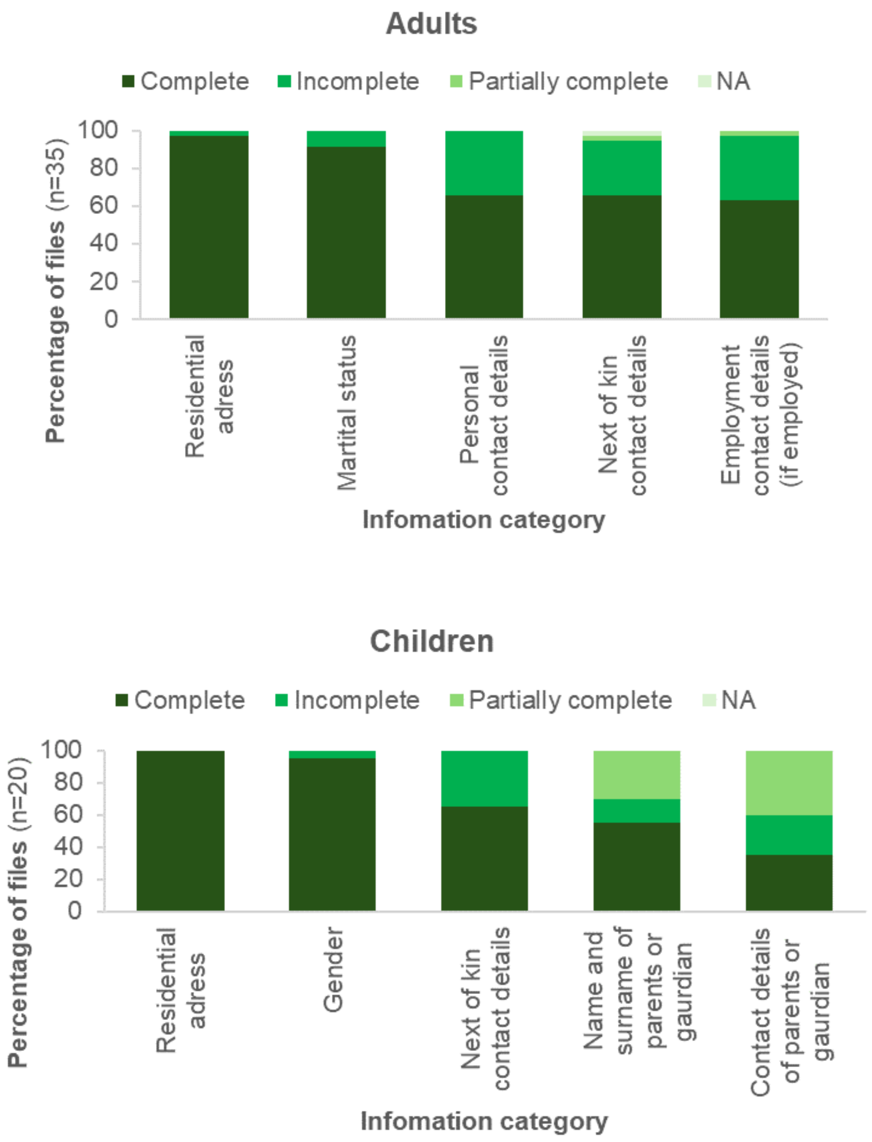


Figure 13: Demographic details completed on adult and child patient records.

Patient profile

The patient profile section, like demographic details, was also present in both adult and child patient files and displayed in separate graphs due to the requirement of different information. This information gave further details regarding a patient's lifestyle and medical risks and history, which was important for treating patients. **Figure 14** shows that the most complete file section in adult files was ‘surgical history’ at 60% complete, while the least complete information category was ‘family history of chronic diseases’, which was only 17% complete. In children's records, ‘social’ (social details of the patient such as living conditions, cooking method and social assistance grants) was 75% completed in files. ‘Known chronic diseases’ and ‘surgical history’ were not necessary for healthy babies, therefore, was 0% complete in those files and reflects as higher NA rates below.

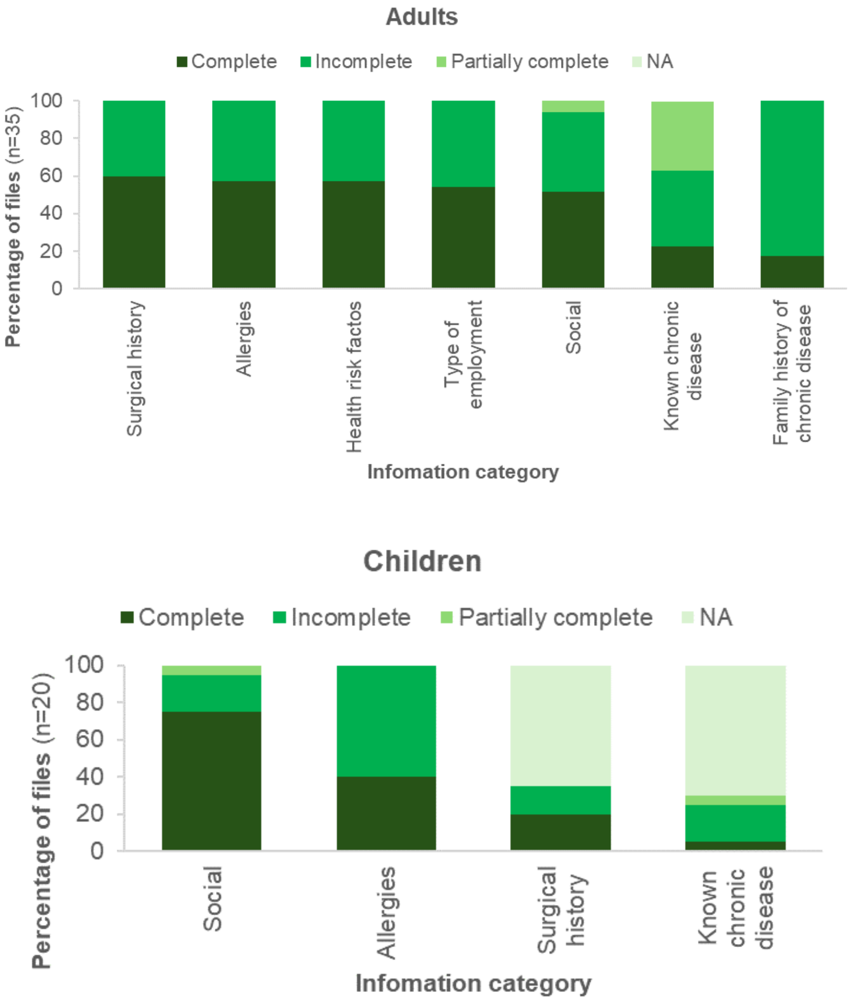


Figure 14: Percentage of adult and child patient profile information completed in files.

Clinical management

The clinical management section of a patient file was completed at every patient visit, alongside the examination and management plan on each visit. This section detailed general medical information here basic screening includes screening for HIV, TB, STIs and diabetes and diabetes are where MUAC stands for mis-upper arm circumference. **Figure 15** shows that the highest completed category in adults was ‘reported side effects of medication’ at 82,9%, and other information categories ranged from 80% to 0% completed. On the other hand, in children’s records ‘weight’ was 87,5% completed and ‘current chronic condition’ was only 12,5% completed. The ‘respiratory rate’ in children had a 0% completion rate (and 100% NA) as there was no area to fill this in on patient records.

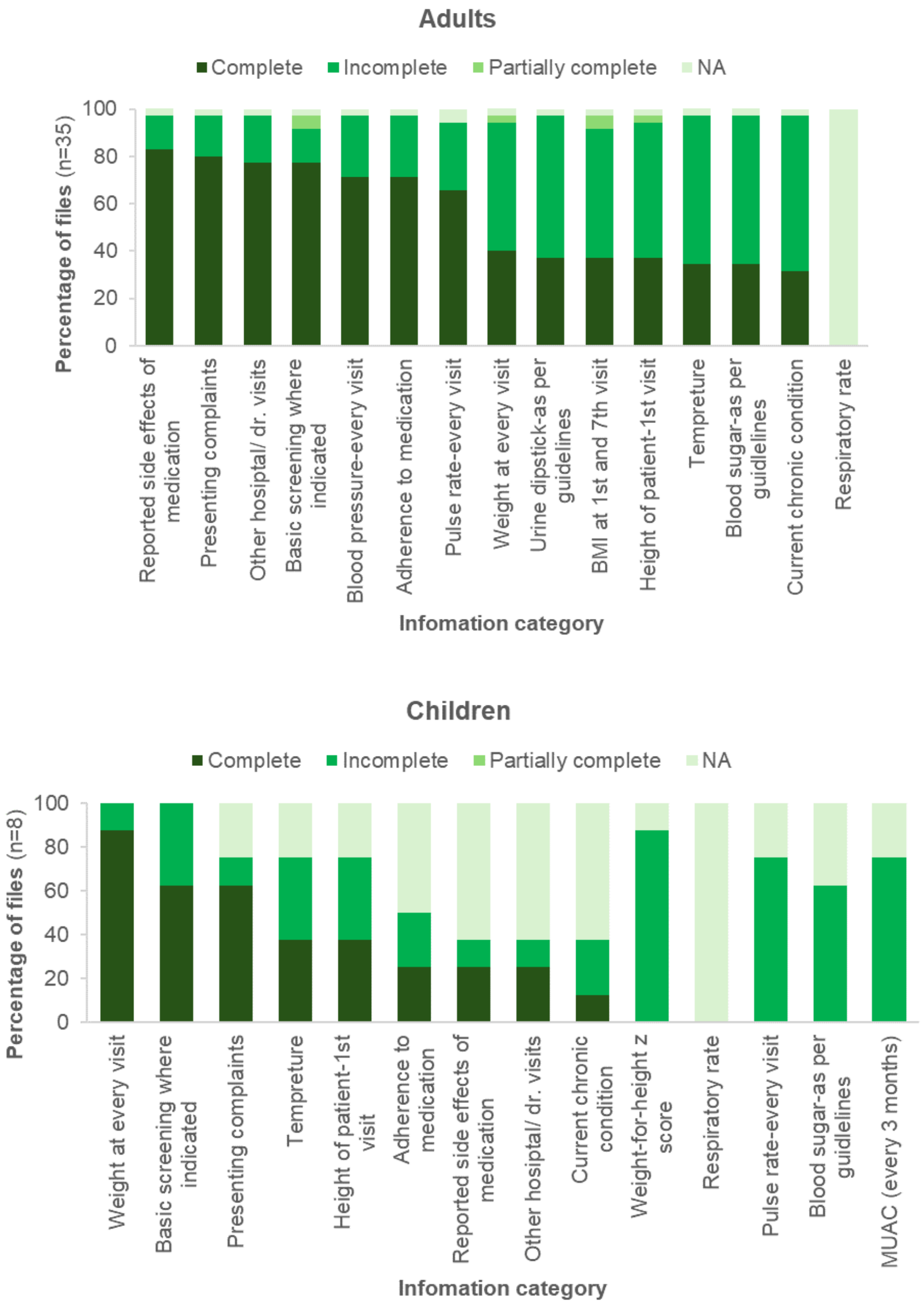
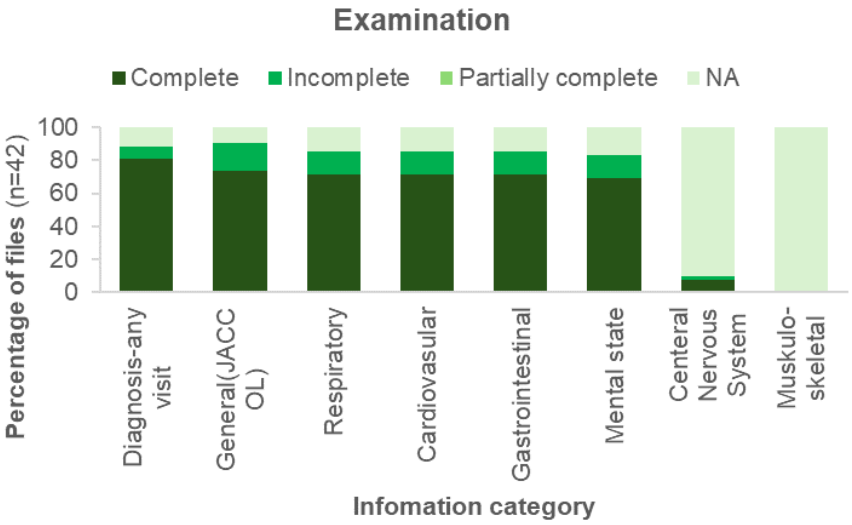


Figure 15: Completeness of clinical management information for adults and children in patient files.

Examination and patient management

The examination section in the patient profile was completed alongside the clinical management and management plan, where the results of various physical examinations of the patient should have been recorded at each visit. Where JACCOL is a mnemonic standing for Jaundice, Anemia, Clubbing, Cyanosis, Oedema and Lymphadenopathy. The patient management section required information related to follow-up steps from the patient appointment and the healthcare (HC) practitioner details to be captured. As shown in **Figure 16** most examination categories were well completed with 'diagnosis' being 80,9% complete. Patient management was also mostly completed with the 'date signed' and 'HC practitioners details' being 90,9% complete while the lowest completion rates were 63,6% for 'date of investigation' and 29,6% for 'results of investigation' as there were not always tests required. However, for the examination section, there was no designated space to complete a 'musculoskeletal examination' in files and the 'central nervous system' in adult files. Likewise, there was no designated space to complete a section on 'rehabilitation' in the patient management section of the files. This explains the low completion rates and high NA rates.



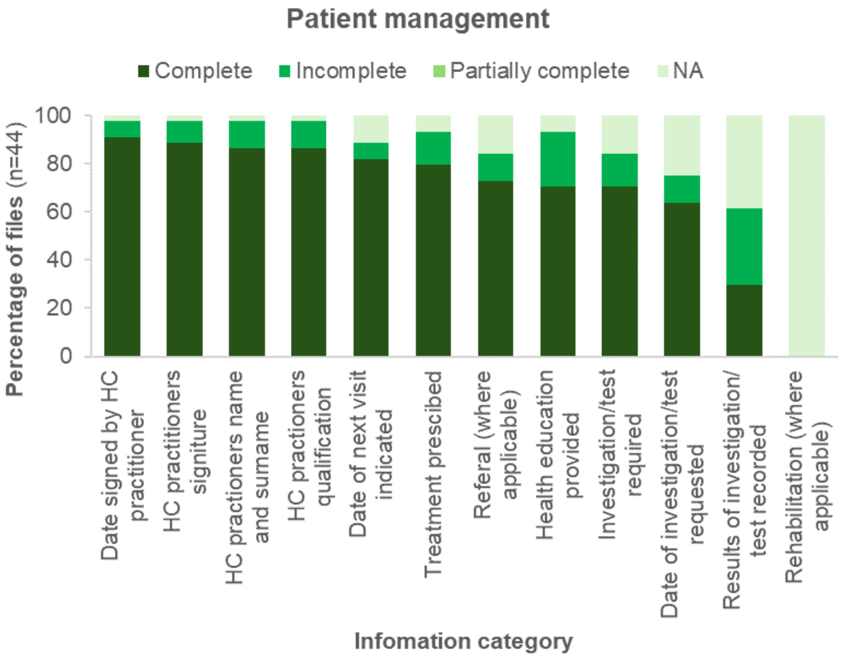


Figure 16: Percentage of information completed in the examination and patient management sections of patient files.

Anti-Retroviral Therapy (ART) initiation

The ART initiation section was completed for patients that had begun with anti-retroviral treatment where SANC/ HPCSA number was a healthcare practitioner's registration/practising number. For ART initiation **Figure 17** shows that ‘transfer details’ were 71,4% completed while all other information categories had completion rates as low as 7,1% for ‘community healthcare worker’ and ‘clients understanding of HIV’. ‘Guardian status disclosure’ was not required to be completed in adult files and therefore, had a low completion rate in the ART initiation section.

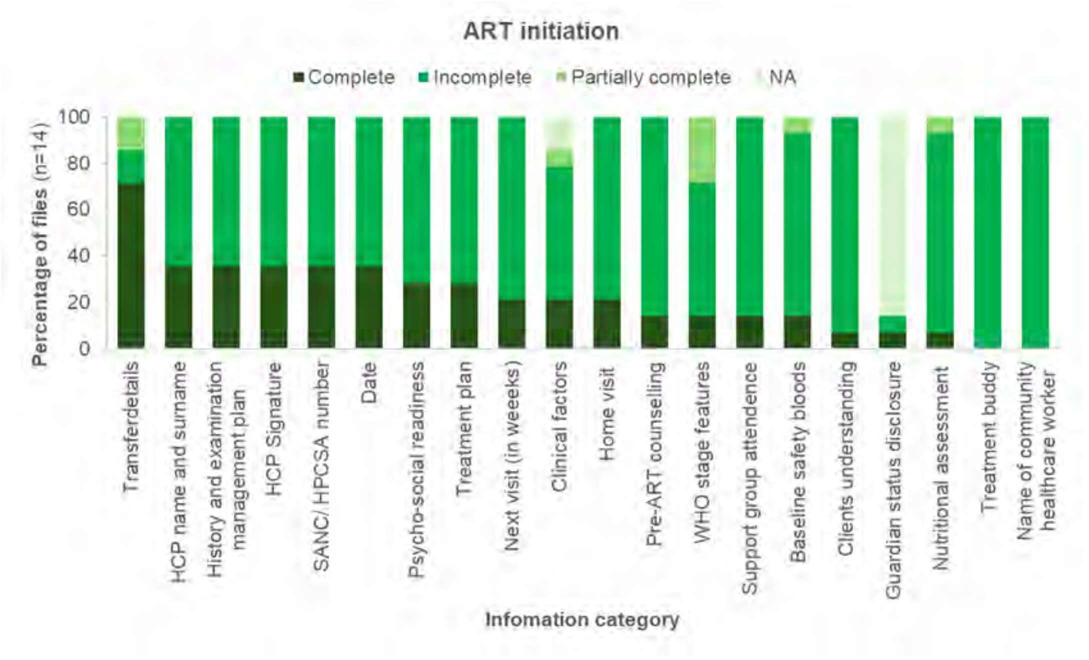


Figure 17: Information completed in HIV patients in the ART initiation section.

Tuberculosis (TB) adherence

The TB adherence section was completed to track TB patient's treatment and medication adherence. In this section the SANC/ HPCSA number was a healthcare practitioner's registration/practising number and TB treatment was divided into an initiation phase (IP) and continuation phase (CP) as represented in patient files. **Figure 18** shows he TB sections with the highest completion rates included ‘initiation phase treatment drug and dosage’, ‘treatment completion’, healthcare provider ‘name and surname’, ‘signature’, ‘SANC/HPCSA number’, ‘Continuation phase treatment drug and dosage’, ‘bodyweight at start of continuation phase’, ‘treatment completion’ and healthcare provider ‘name and surname’, ‘signature’ and ‘SANC/HPCSA number’ all at 75% complete. In contrast, the least completed information categories were ‘treatment supervisor details’ and ‘referrals’ at 0% complete, the reason for which was unclear.

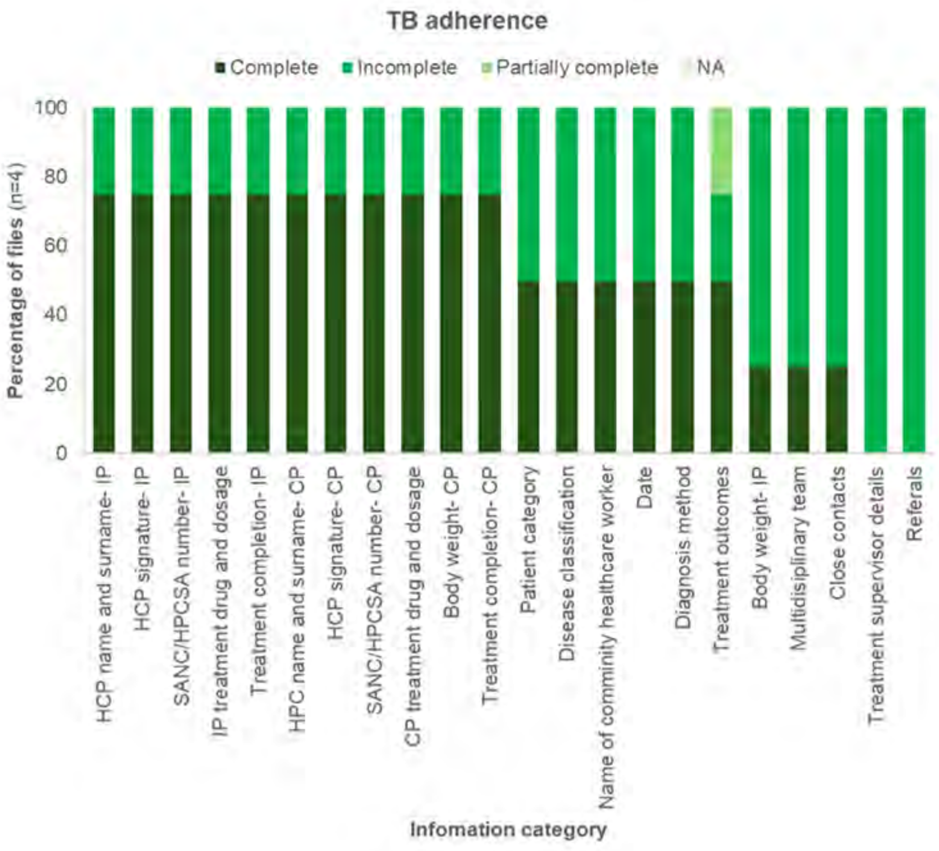


Figure 18: The percentage of information completed in the TB adherence sections of patient files.

Prescription

The prescription section of a patient file recorded any prescriptions for the patient and was dealt with by both the clinician who gave the prescription and the pharmacy assistant who was dispensing the medication. As shown in **Figure 19** the most completed information category in prescriptions was the ‘name of medication’ at 85,7% and the lowest categories were ‘dispenser SANC/HPCSA number’ at 4,8%, ‘dispenser name and surname’ at 7,1% and ‘dispenser signature’ at 11,9%.‘Dosage form’ was 0% complete as there is nowhere to display this information in the file.

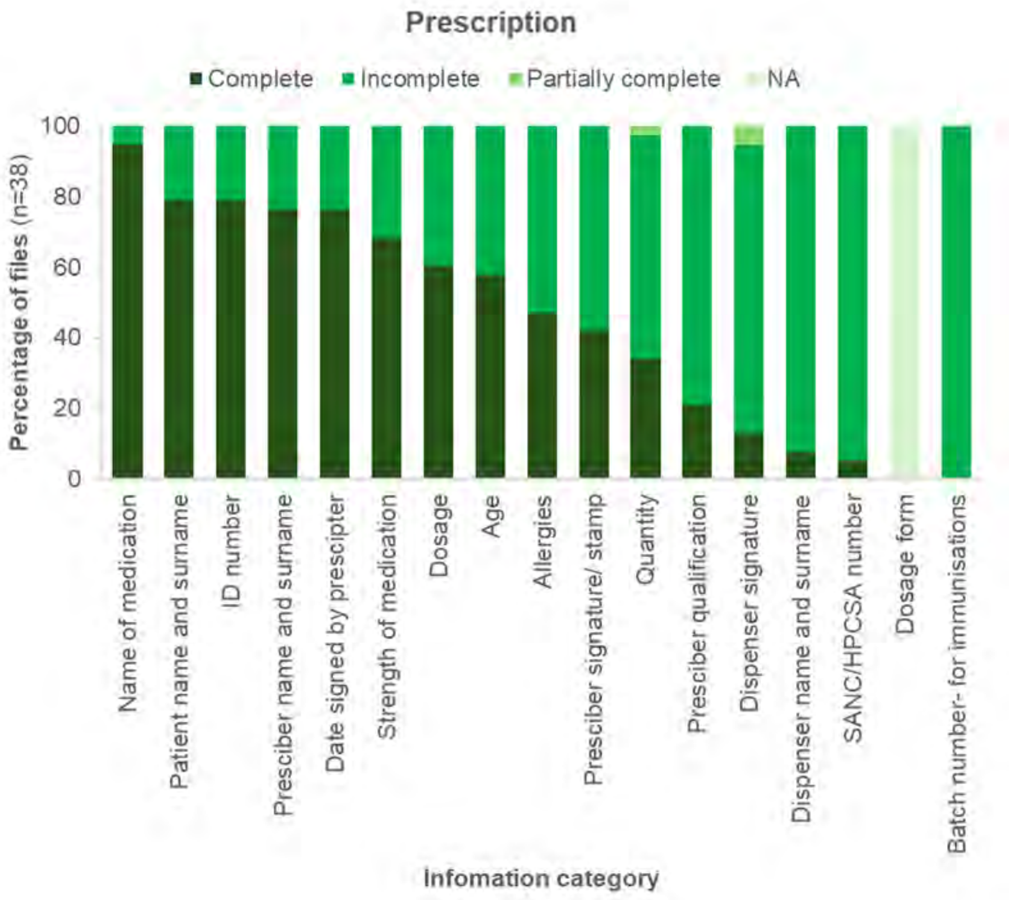


Figure 19: The details that are completed for prescriptions section in patient files. Where SANC/ HPCSA number is a healthcare practitioners registration/ practising number.

Consent form

Consent forms were presented at the back of the patient file for any tests requiring consent, the majority of which was for HIV testing and had to be completed for maternal patients as an HIV test was required at the first antenatal care visit. As shown in **Figure 20** the most well-completed categories were ‘patient name’ and ‘date’ at 92,9% complete and ‘information was legible’ (as determined by the assessor) at 92,6% of files. The least complete category was the ‘exact nature of the test’ at 21,4% as there was no designated space for this information to be completed and most tests were for HIV testing. For example, one patient file had nothing completed in the consent form, but it was shown in the file that an HIV test had been done. ‘User age, Date of Birth or ID number’ in consent forms were 0% complete as there is nowhere to display this information in the file.

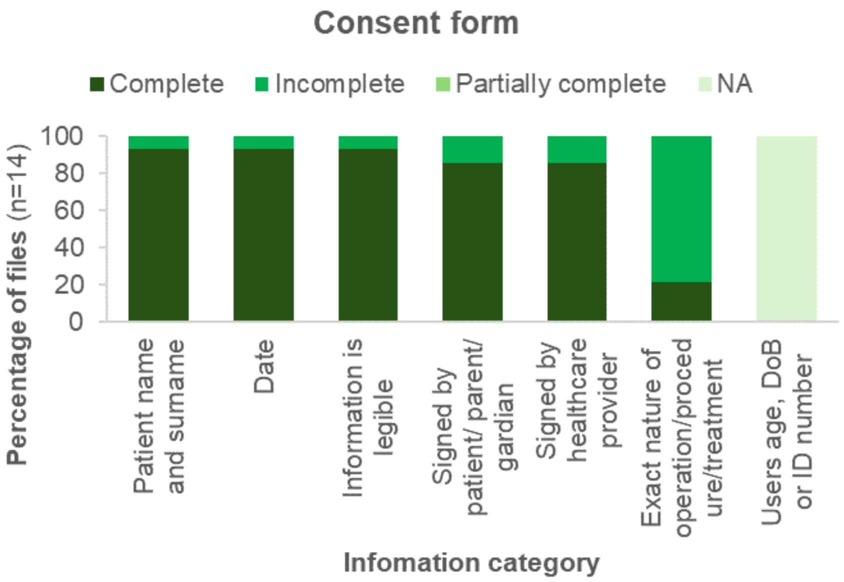


Figure 20: The percentage of completed information details in the patient file consent forms.

Child health records

This section of a patient file was only present in children's files and mostly tracked the early stages of a baby's life and immunisations. **Figure 21** shows that the highest completion rate was 80% for 'history of immunisations' and the lowest was 10% for 'deworming treatment'. Partial completion rates were found across information categories as not all child files assessed were at that age yet or did not continue with follow-up visits until reaching the given age or developmental stage. Some sections were classed as 'not applicable' as the child may have only come to the clinic for treatment after the age required for immunisations ie. would be classified under sick child.

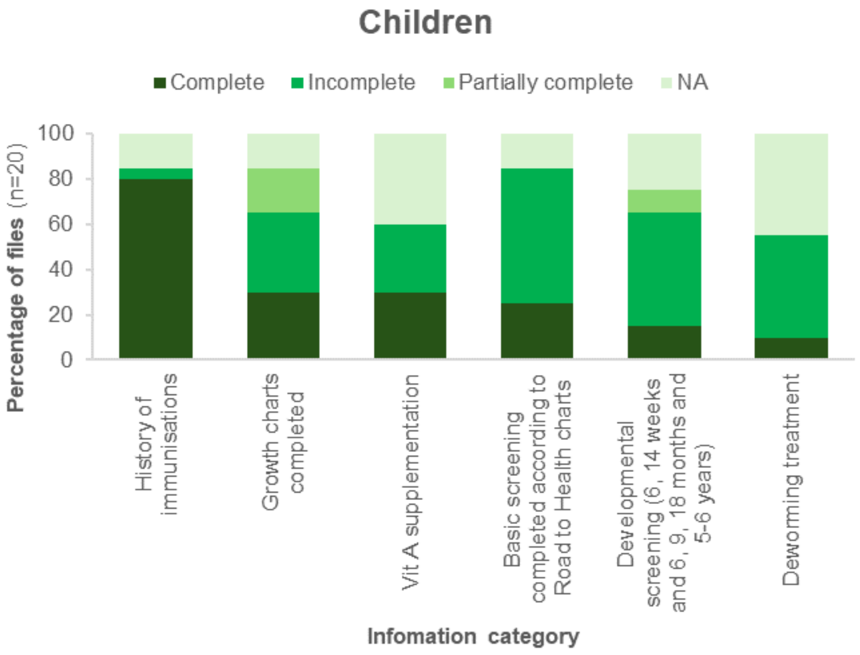


Figure 21: Completeness of information in child health records section of patient files.

Maternal

The maternal section of a file was present in female adult files and completed during pregnancy and after childbirth. This broad section was divided into four sections (where BANC stands for basic antenatal care)- BANC 1st visit, BANC follow-up, delivery summary (completed 3-6 days after birth) and postnatal care. Many maternal patient files assessed only reflected a patient's first visit. Then, some patients seemingly did not return for further visits (for a variety of patient-related reasons eg. patient moved towns/ clinics or patient was seen at hospitals), as there were no other inputs after the patient's first visit. **Figure 22** shows that the most well-completed information for the **first visit** was 100% complete for ‘obstetric history’ and ‘previous obstetric history and family’ while the least complete was 40% for ‘abdomen examination’. The highest completion rate for **follow-up visits** was 30% across most information categories, and the lowest category was ‘gestational graph plotted’ at 20% completed. Across all **delivery summary** information categories, only 10% was completed, and 30% was incomplete. The highest completion rate for **postnatal care** was 10% for ‘general examination’ for both age categories, ‘healthcare practitioner name, surname’ and ‘qualification’ and the most incomplete section was ‘healthcare practitioner signature’ all at 40% complete. ‘Health education’ at the first visit, ‘HIV status retest’ and ‘feeding practices’ in the follow-up visit had nowhere to be completed in the file and, therefore, a 0% completion rate and 100% NA. The low completion rates and high NA rates for delivery summary and postnatal care are partially due to patients having these check-ups at the hospital after giving birth.

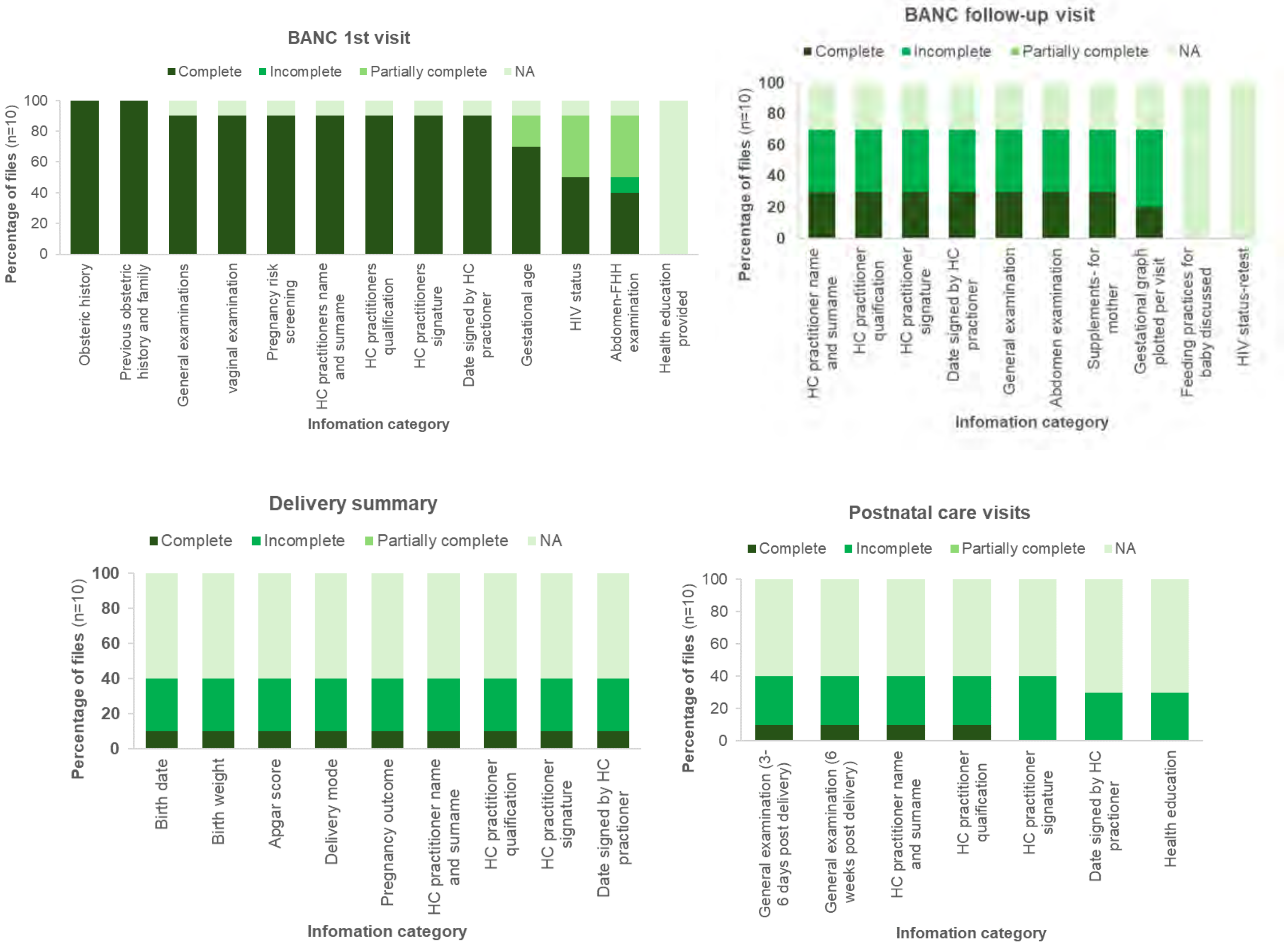


Figure 22: Percentage of information completed in all maternal patient file sections.

4.4.2 Reasons for incomplete records

This section describes reasons, as found through post record analysis semi-structured interviews with clinicians, as to why certain elements of patient records were not well-completed. Only three interviews with clinicians were conducted in this phase. However, valuable insights were gained and are, therefore, still included as results of this study. It is important to note that these reasons do not occur in isolation but often occur in conjunction with one another and therefore, overlap exists between reasons.

Before exploring the reasons for incomplete records, it is important to note that an important theme emerged when asking clinicians what information is completed or what they sometimes find blank is that two of the three repeatedly commented that they completed everything and that they did not know why others did not. *"With me, I fill in everything because in this page everything is important" "I do it all".* However, without explanation, the third clinician was more upfront about what she did not complete or skipped over, as will be shown through the results. Therefore, many of the reasons that emerged through interviews were brought up as to why they thought others might not complete information or why there may have been gaps or blank spots in patient records when they opened them, as discussed in the following themes.

4.4.2.1 Duplication of information

Information duplication was raised as a reason why certain patient information was not completed in certain patient file sections. The first type of duplication was duplication within a patient file. For example, the patient's identification (ID) number needed to be completed on the front cover of the file and was requested in demographic details; therefore, clinicians may not have completed it under demographic details as it had been previously recorded. Regarding maternal patients and antenatal care, there was also duplication of information required in the clinical management and antenatal care sections. This may explain why antenatal care was not completed, as it was recorded under the clinical management section.

The second form of duplication was across maternal and child patient files. The same information had to be recorded across multiple files or documents, e.g. the child's road to health card, a tracer card and the clinic patient file (and sometimes with the mother's file). This was *"too much"* to fill everything in, given time constraints. Therefore, clinicians reported that the road to health card was often prioritised as the patient needed to take it home while the clinic record could be completed later. However, it was reported that completing the record later did not normally happen despite the intention. Duplication across documents was also applicable to TB patient files with a card that kept track of their TB compliance which contained the same information that was required in the patient file.

4.4.2.2 Time-related reasons

A category of reasons raised regarding certain information not being completed was time-related reasons. This included staff being in a hurry to complete the record or patient consultation due to a possible long queue of patients still waiting to be seen as demonstrated in the following quotes. *"I am sure a [clinician] is in a hurry or a person is afraid of the [patients] waiting outside.", "But [clinicians] are always in a hurry, that's the problem.".*

More specifically, related to prescriptions as dispensed by the pharmacy, one clinician commented that pharmacy assistants did not have the time to complete all the information as all clinic patients went to only two pharmacy assistants. Information was recorded on the pharmacy computer system, so they may not have completed some duplicate information in the patient records.

Related to the duplication of information for child health records, the process of copying information was said to be time-consuming and therefore, sometimes skipped over. Regarding patient examinations, clinicians reported that the actual examinations could also be time-consuming and, therefore, examination information may not have been recorded, as demonstrated in this quote: *"But sometimes it is quite… it's not doable sometimes. Now you've got a lot of clients that are coming [to you- the clinician] that you just like look [at], okay this client, oh, you can say that he is fine. You look at the ankles, okay, he is not swollen. You just skip that one and you go to the next one, you see.".*

In specific sections, like the ART initiation file section, clinicians explained that the amount of information that needed to be completed in a file was too much, for example, *"… maybe it's because there is a lot of stuff that we need to fill, but we don't."* and *"but it seems like a lot".* As can be seen through these various examples, time-related concerns were a prominent reason for not completing certain patient information, as shown in this final quote: *"And sister [ ] has not enough time to fill in this.".*

4.4.2.3 Work ethic and accountability

The theme of work ethic and accountability as a reason for why certain information was not completed was discussed in interviews but not related to any particular section. To best illustrate this theme several direct quotes will be used for the remainder of this paragraph. *"It is well filled in by a person who cares. That is how I can put it." "It is just that we are sometimes lazy to do our job." "I think it's a culture of doing what you want to do instead of doing what is expected of you to do. And we have excuses to do that. And we blame somebody else, not ourselves, unfortunately." I'm not sure whether we are just lazy…".*

4.4.2.4 Patient dependent information

It was emphasised that all information needed to be recorded for the first visit in the clinical management, patient management and examination sections of the files. However, depending on the patient's condition being treated and observed condition/ presenting symptoms on the day of the visit, some of these sections were skipped over, or very brief comments were recorded. As shown in these quotes: *"Then if [they] come for the second [visit], then you see that the blood pressure now is controlled. There is no need to go to do a height, it will remain the height.", "Because if I see that [the patient is] healthy and there is no need that I [take the] weight [of the patient].".* Moreover, it was mentioned that some patients were on the 'fast lane' where the patient did not need to see a clinician but only needed to collect their medication or their medication was 'collected by other', here a date would be written for a consultation but nothing else was recorded as the collector only stopped at the pharmacy.

4.4.2.5 Equipment-related challenges

There were two equipment-related challenges given as reasons for certain information related to the recording of vital signs. The first was that there was not enough equipment or equipment used to take vital signs, which was broken. The example given was that there was only one scale in the clinic, making taking a patient's weight more *"difficult".* However, it was taken more often for patients such as TB patients who needed their weight taken. The lack of vital sign information related to equipment challenges was coupled with the fact that it was time-consuming to do vital signs and that the clinic was supposed to have someone designated to take and record all vital signs. The second equipment-related challenge was in connection with the recording of urine-related vital signs. This was equipment related as it was mentioned that the clinic's toilets were often out of order, there was no water, or there was no toilet paper; therefore, this was not done or recorded unless necessary (such as in patients with high blood pressure or suspected urinary tract infection).

There were also technological equipment-related challenges. For example, there were limited computers in the clinic and only one connected to the internet. This meant that access to information that may have been required to complete a file section, such as ART initiation, was limited. Access may have been limited as someone else was using the computer, or it took time to go to reception to use the computer, leaving the patient alone in the consultation room, which was mentioned as a problem.

4.4.2.6 Other information-specific reasons for incomplete records

Above these overarching themes of why certain information was not recorded in patient files, several reasons were mentioned related to specific details that were often not recorded. These are included in the list below:

- HPRS file numbers on file covers were not completed due to confusion around the HPRS numbering system, as previously discussed (section 5.1.2.3c and 5.3.1).
- Postnatal care visits were scarcely filled in as mothers sometimes did not return for these visits partly because this checkup could have been done at the hospital. One clinician also did the postnatal care visit for both the mother and child, doing more work and making it difficult for the clinician to carry out medical checks. Therefore, the records were sometimes left out as there was a lack of time to complete them.
- Religion, in demographic details, may have been incomplete as a clinician felt that sometimes patients got offended when this question was asked and may not have understood why their religion was being asked therefore, taking time to explain this increased workload and time pressures.
- Healthy eating, in the patient profile may not have been complete as if these questions were asked; patients sometimes lied in hopes of getting assistance, given that the clinic had a program that provided porridge to those who needed it.

- The ART initiation section was often skipped, particularly when a patient was transferred to the clinic, as there was a lot of information to complete, and above this, not all information could be collected from the patient. For example, some information was needed from TIER.net, which makes this section *"a headache"* to complete with the limited computer and internet access.
- ICD10 codes for TB patients (related to the type of TB) were not always known by clinicians and therefore, not always completed in files.
- Laboratory results (not a section specified by the Ideal Clinic Manual) were raised as a concern by a clinician as it was not completed in files as it was *"too much work",* and therefore, the printout of results was rather just put at the back of the file.
- Clinician signatures were often completed as clinicians may have recognised each other's handwriting and followed up with one another to sign if they saw it was not done (however, this did not have to be done often).

4.5 Clinic feedback session

During the feedback session, clinic staff confirmed all findings by only adding general space constraints (e.g. desk space) within the reception area as a barrier to the record-keeping process. Once the discussion began regarding important findings, the staff wanted to be disseminated to the DoH, a few important points emerged. Firstly, and specifically relating to the record-keeping process the staff mentioned that they needed more computers which they have previously been promised and a stronger move toward digital record-keeping however, this could not be done without more computers, better internet access and technological training. Another important point was that there was often a lack of resources such as paper, printer ink and printed registers, which hindered the record-keeping process. Staff members also highlighted that there was a mismatch in consent forms where new and more detailed consent forms had been released; however, the clinic did not have access to them. Patient waiting times were also highlighted as a problem that needed to be addressed. It was suggested that this could be partly addressed through patient education, which could be important to explore in future research.

Despite the multiple negative emergent points and issues within the clinic, the clinic staff had a few positive and hopeful sentiments. Firstly, the HPRS system was being used more despite the time it took to become completely reliant and efficiently used.

The clinic was also going to expand into a new building shortly after the feedback session, and the clinic staff were grateful and excited about the possibilities it brought and the challenges it had the potential to address.

Chapter Six: Discussion

This research project set out to achieve several objectives:

1) To understand how the collaborating clinic works, including its work system components, barriers and facilitators.
2) To gain further insights into the record-keeping process and the barriers and facilitators influencing it.
3) To determine if patient records were adequately completed.
4) To understand why patient records may or may not have been adequately completed.

There were several important findings in this study. Firstly, many barriers were encountered within the record-keeping process and clinic system that were closely intertwined and interacted with one another. For example, common challenges influencing the record-keeping process included the high number of patient visits, the need to duplicate information across records and a lack of file storage space. The record-keeping process was further influenced by clinic challenges such as a lack of or broken equipment and a staff shortage. Since the record-keeping system functions within the clinic system, the challenges in the record-keeping process cannot be understood in isolation from broader clinic system challenges. Despite these challenges, the clinic continued to capture patient information and provide services to patients.

With respect to the degree of completion of the files, the results highlighted that some patient file sections were better completed than others; for example, administrative details were one of the most completed sections of the files, while ART initiation was one of the least completed file sections, often due to the large amount of information that needed to be completed in this section coupled with the general reasons for incomplete records. These included the need for the duplication of information, equipment-related challenges, patient-dependent information and various time pressures. Additionally, the results highlighted several areas where records were not well completed, that could be improved upon in collaboration with the DoH and clinic.

This discussion will first look at the record-keeping approach used by the clinic to establish details of the record-keeping process before discussing the adequacy of patient record completion, the reasons for inadequate completion, and broader influencing factors, which are the key focus areas. After this, the adaptations of the clinic system and record-keeping process will be explored to show how the clinic continued functioning despite clinic and record-keeping barriers. The experiences of both the researcher and community collaborator in applying CBPR will then be reflected on. The discussion closes by proposing several recommendations that emerged from this study while also stating the limitations of this research project.

5.1 The record-keeping approach

Record-keeping in the clinic took a hybrid approach, where information was manually recorded in patient files and other registers. Then, a data capturer or other administrative staff transferred certain information to computer systems. For example, details recorded on the headcount register and the tick register were put into the HRPS system, and details recorded in files of patients being treated for TB and HIV were recorded into the TIER.net system. This was a commonly found method of record-keeping in public health systems in South Africa, where paper-based records were and are still used, with some information being put into centralised electronic databases (Cline & Luiz, 2013; Ohuabunwa et al., 2016). The hybrid record-keeping system is, therefore, designed to be a hybrid system in response to the various systemic challenges (eg. loadshedding), which will be discussed, as well as being an emergent characteristic of the complex clinic and record-keeping systems and related unpredictable challenges (eg. staff preferring manually issuing file numbers due to complications with the HPRS system).

The complexity of the record-keeping system, along with its hybrid design and associated challenges, often led workers to adapt the way in which they do their work; adaptations will be discussed in more depth throughout this discussion. However, this highlights the lack of alignment between work-as-imagined or work-as-prescribed by the DoH and the work-as-done by the clinic staff members. Two key examples are the mismatch between the Ideal Clinic Manual and the patient files and staff members using manually issuing file numbers using SMARTcare and using the headcount register rather than using the HPRS system as ‘intended’. Therefore, in future, worker adaptations and how work is done should be considered in the design or redesign of the record-keeping process.

The analysis of actual patient records (or files) found that several important sections were inadequately completed using the hybrid record-keeping approach. The reasons discussed as to why specific sections of patient records or more generalisable reasons as to why files may not have been adequately or consistently completed do not occur in isolation but were a result of or emerged out of a complex system. As understood through an HFE approach, these challenges (and emergent outcomes) cannot be fully understood or explored without acknowledging and understanding the constraints under which the broader clinic system functions. This relates to the second notion presented by (Wilson, 2014) - ‘a system-of-systems’ where, in this case, the record-keeping process is one system that falls within and makes up the parent system, the entire clinic system, as demonstrated in **Figure 23** below. The many challenges to be discussed in the following section will show the difficult conditions under which staff completed the hybrid record-keeping process. In this case, the parent system (the clinic) and the child system (the record-keeping process) were complex, with many interacting components and emergent challenges, from which the possible reasons for inadequate record completion stem. These influencing factors will be presented by organising them into the various SEIPS model components. However, clear distinctions cannot be made between each component, therefore, some overlap exists.

5.2 Adequacy of patient record completion and influencing factors

5.2.1 People factors

One reported barrier about people was a shortage of staff, which corresponds with challenges found throughout the South African public healthcare system (Dookie & Singh, 2012; Kautzky & Tollman, 2008; Maphumulo & Bhengu, 2019) and more specifically in the Sarah Baartman district of the Eastern Cape (Card, 2020). This general staff shortage added to clinicians' workload, which may have influenced the time available to see each patient and, in turn, affected how attentive clinicians were when filling in details of patient records. There were also reports of a shortage of administrative staff which correlated to previous literature (Bizimana & Bimerew, 2021; Marutha, 2021; Mutshatshi et al., 2018; Wegner, 2013) which likely increased

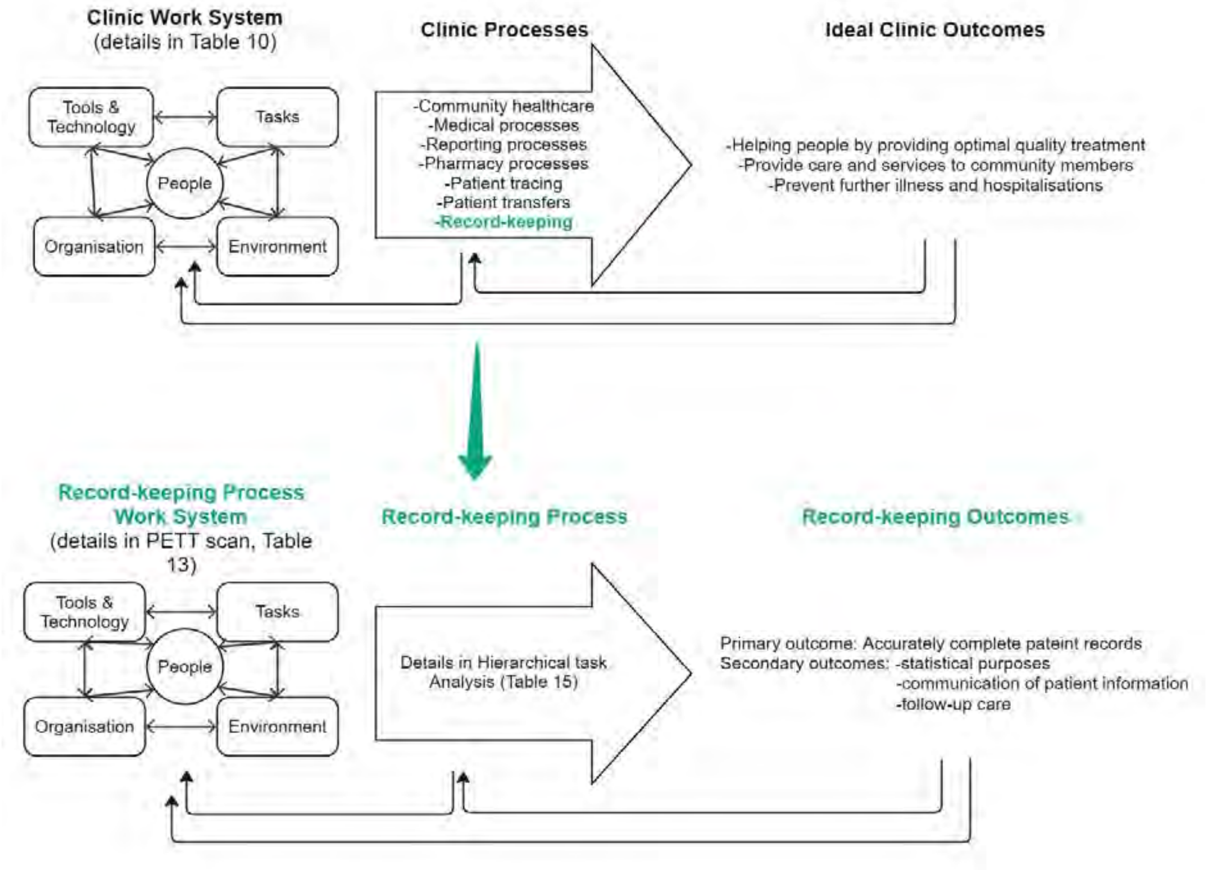


Figure 23: SEIPS model of clinic system and record-keeping process

workload for the limited number of administrative staff in the clinic, which led to a file backlog during data capturing, a finding that aligns with those of Marutha, (2021).

A uniquely reported challenge in this study was managing the need for the clinicians and support staff to complete multiple tasks, which was likely also the result of a shortage of staff. This was driven by challenges related to contract expiry and staff renewal complications, which were other uniquely reported challenges in the clinic that may have contributed to the shortage of staff as commonly reported in South Africa (Bizimana & Bimerew, 2021; Marutha & Ngoepe, 2017; Mutshatshi et al., 2018; Shihundla et al., 2016).

Patient-dependent information also emerged as a reason for inadequate record-keeping, where only certain information was taken and recorded, depending on the patient's condition or reason for visiting the clinic. For example, some information requested in the patient file was dependent on the patient's condition and, therefore, may be skipped over if the clinician felt it was unnecessary given the patient's condition based on observation. For example, a clinician may have seen that a patient's weight was okay and taking or recording it was not essential (i.e., they did not have TB). Despite this explanation and the importance of body weight in TB patients, it was among the lowest completion rates in the second phase of the **tuberculosis (TB) adherence** section. It was mentioned that there should be and it would be easier if one person in the clinic was dedicated to taking patients' vital signs. This may be an area that the clinic could explore to improve this particular part of the record-keeping process.

The theme of **work ethic and accountability** also emerged as a more general reason for incomplete patient records. However, as shown, the clinic and record-keeping system were complex, with several challenges making the work challenging. Therefore, the work ethic and accountability of workers may not be a reason in itself for incomplete records. Rather, it could be seen as an emergent result and product of the system's complexity and the many challenges that staff in the clinic face (expanded upon below). For example, high workloads have been shown to lead to demotivation in clinicians and in the completion of patient records (Shihundla et al., 2016), which may have been perceived and reported as poor work ethic and accountability. It is important to note here that this reason was only mentioned by one person, which limits the validity of this particular claim. Due to work ethic and accountability emerging from other system challenges and only being mentioned by one person, blame and judgment should not be passed, and the concept should be further explored in future research to understand the culture of the organisation from which work ethics and accountability and a lack of attention to detail may emerge. Furthermore, several clinicians claimed they **filled in everything** and were uncertain why other staff members did not. They gave hypothetical reasons why they thought the information might not have been completed.

5.2.2 Task factors

Starting with task-related factors and reasons impacting the adequacy of patient record completion, the **duplication of information** was presented as a challenge in the record-keeping process, which was a key reason why certain patient information was not being completed in records. This has also been reported as a common challenge across LMICs specifically investigating maternal health records and primary health records in South Africa (Landry et al., 2014; Shihundla et al., 2016). Similarly, in the current study, **maternal records** and **child records** or consultations had up to five different documents that needed to be completed by the clinician, with a large overlap of information being required in each. These included the child's clinic file, the road to health card kept by the mother, the mother's clinic file, a record kept by the mother and a tracer card for the child's vaccinations. The duplication led to information not being completed in some of the documentation, which impacted patient follow-up care. This finding possibly offers another area of possible intervention to streamline the patient record-keeping process, particularly for these population groups. Additionally, duplication of information was found within maternal files across the clinical management and maternal visit sections; therefore, it may not have been completed in the maternal sections as the information was already documented in clinical management. Unlike other reports in the literature (Landry et al., 2014; Shihundla et al., 2016), the duplication of information was also found to be present for **prescriptions** as all information the dispenser was required to complete on the file was also recorded into their system, potentially doubling their workload. This excessive burden of work is not unique to the clinic, Makhanda area and Sarah Baartman district or South Africa as high workloads and contributing factors such as overburdened and understaffed healthcare facilities with high patient loads have been commonly reported in South Africa and other LMICs (Almeida et al., 2021; Bizimana & Bimerew, 2021; Kebede et al., 2017; Landry et al., 2014; Marutha & Ngoepe, 2017; Mutshatshi et al., 2018; Shihundla et al., 2016). The duplication of information and the creation of a high workload for clinicians may have led to skipping over some information and other reported barriers, such as pharmacy delays. Therefore, the DoH should consider reducing the duplication by revising the patient file design and information required in these sections.

Over and above the need to duplicate information across different points of interaction with patients, the high workloads as a challenge in primary healthcare clinics across South Africa (Bizimana & Bimerew, 2021; Kautzky & Tollman, 2008; Maphumulo & Bhengu, 2019) and more specifically in the Sarah Baartman district (Card, 2020) results from other systemic challenges mentioned by the collaborating clinic staff. These include but are not limited to, difficulties with patient transfers, the servicing of a large community, having to see many patients in a short space of time, having to move around consultation rooms and when other clinicians did not adequately complete tasks. Increased workloads and reduced time for clinicians and administrative staff to do their jobs caused some rushing and inaccuracy or skipping over completing certain parts of the records that may have been perceived as unimportant or requiring an excessive amount of time to complete (such as the ART section).

These high workloads could also relate to having increased demand for and pressure on public healthcare services, as mentioned by Maphumulo & Bhengu (2019), likely exacerbated by challenges stemming from the inequality and divide between public and private care in the South African healthcare system resulting from apartheid and the history of the country’s healthcare system. This divide is unique to the South African healthcare context but not the collaborating clinic (Achoki et al., 2022; Coovadia et al., 2009; Kautzky & Tollman, 2008; Mayosi & Benatar, 2014; Peltzer, 2009; Young, 2016).

5.2.3 Equipment factors

Another influencing factor was **equipment-related reasons,** often as a result of necessary equipment not being available. A lack of equipment has been reported as a barrier to providing primary healthcare services in the Sarah Baartman district (Card, 2020) however, it has not been reported as a barrier to the record-keeping process. The lack of equipment means that specific tasks could not be performed and, therefore, the required information could not be obtained and recorded. For example, related to the clinical management section with clinical equipment-related reasons or challenges, as reported by the clinic staff members, not being previously reported as a barrier to the record-keeping process. This could be unique to the context or a unique perspective of the clinic's staff, seeing how a lack of equipment as a systemic or clinic barrier impacts the record-keeping process.

Relating to technology in consultations (step 4 of the HTA), one staff member told a story of when the clinic was given several tablets to check laboratory results (which were predominantly checked on clinician's private phones), make phone calls and access other patient information; however, after some time, the tablets were removed from the clinic as the contract with the network provider had ended. A wider clinic system challenge that impacted the use of technology in the clinic was a lack of budget or restricted spending, which has previously been reported as a challenge to the provision of care (Coovadia et al., 2009; Kautzky & Tollman, 2008; Maphumulo &

Bhengu, 2019) resulting in the Department of Health or clinics not having the budget to provide adequate resources to increase the application of technology. Despite these reports, throughout discussions with various clinic staff, there was mention of ‘promised’ computers to the clinic over many years. Budget constraints were also reported by clinic staff as a challenge to performing their roles to the best of their ability, which is consistent with research in other primary healthcare facilities in South Africa (Dookie & Singh, 2012). Some staff members mentioned wanting to have an increased application of technology or that moving towards a more electronic system would be a positive change for them. However, one clinician (with over 40 years of experience) mentioned she preferred the paper-based system. This showed the contrast between various clinicians' perspectives on integrating technology or, rather, a greater reliance on technology and the potential benefits and challenges that could emerge, as discussed by Ohuabunwa et al. (2016), with challenges associated with implementing new technology. However, as shown, the reality may be that with the current limited resources and other complications within the national healthcare system, a complete or even greater use of electronic record-keeping may not be possible.

Other areas that equipment-related challenges presented include the lack of completion of the ART initiation section and when data was being captured (point 7 of the HTA). This was the case as there was limited access to technology, the internet and, therefore, access to patient information to adequately complete the sections and not being able to efficiently record information necessary for national monitoring of HIV and TB patients. These challenges both delayed the record-keeping process and could increase a clinician's workload by having to leave the patient in the consultation room, which was not ideal for the smooth functioning of the clinic and record-keeping process. Having a lack of information completed in this ART initiation section and computer systems meant that clinicians could not refer back to this pertinent information, therefore potentially impacting clinical decisions and patient care.

The clinic, therefore, faced similar challenges and problems as other South African healthcare facilities with a lack of record-keeping materials, the use of manual records and theft of patient files, all of which have been reported across South Africa and the Eastern Cape (Card, 2020; Maphumulo & Bhengu, 2019; Marutha & Ngoepe, 2017). Wider systemic challenges, such as load-shedding and other electrical outages further influenced the ability of clinic to use technology. This was not mentioned in previous literature because load-shedding is a uniquely South African concept and some South African research was done before load-shedding became particularly severe in the country or Makhanda area.

Due to the challenges faced with technology in the record-keeping process, manual records continued to be used, as demonstrated. The continued use of manual records created an interaction between challenges of task and equipment related challenges. Where there was a lot of required for each patient, and therefore, it took a lot of time to complete these manual records. The amount of time required to complete manual records was previously reported in South African public healthcare (Mutshatshi et al., 2018), which impacted the completion of patient records.

5.2.4 Environmental factors

The first environmental factor impacting the completion of patient records was a lack of space in the clinic. This lack of space impacted patient waiting areas, the number and size of consultation rooms, and, more specifically, the record-keeping process, where the reception area, in particular, lacked space. The lack of reception space affected the ease and efficiency of work for professional and administrative staff. The most significant problem with the lack of space in reception for the record-keeping process was that this led to a lack of file storage space, as Marutha & Ngoepe (2017) also reported. Files were then not only stored in reception but also in a consultation room across the passage, which decreased the efficiency of locating files and contributed to files that could not be located in cabinets (lost and movement of files) and increased time pressure on administrative staff and clinicians drawing their own files. These challenges are also found across other South African primary healthcare clinics (Luthuli & Kalusopa, 2018; Marutha & Ngoepe, 2017; Mutshatshi et al., 2018). This lack of space is often the result of the actual building that houses the clinic not being fit for purpose. Previous research (Card, 2020) found that many of the local clinics in the Sarah Baartman district were re-purposed buildings, which makes it difficult to re-design the space to make it more conducive.

Impatient patients were also reported by clinic staff as an environmental barrier. This may be a result of them having to wait for extended periods, as reported by Peltzer (2009). The reaction by patients was likely exacerbated by other challenges mentioned above, but also by what Card (2020) refers to as ‘patient complexity’. This refers to the fact that patients often presented with several health challenges, as opposed to just one, which meant that information about and treatments related to these ailments all needed to be covered in the consultation. The interaction between clinicians and patients may have also been influenced by patient literacy levels and language barriers, which may also contribute to the extended waiting times and frustration among patients. Patient waiting times in the clinic were reportedly not meant to be longer than three hours; however, this was not always possible. Long patient waiting times in primary healthcare facilities in the Sarah Baartman district were similarly found and reported by Card (2020). The clinicians reported being aware of the list of patients still to be seen, and combined with other challenges, this awareness of patients' frustration and lack of time impacted how thoroughly clinicians completed the patients' files. It was highlighted in the clinic feedback session, as to be discussed, that patient waiting times and the impatient nature of patients due to the broader clinic system challenges were issues that needed addressing. Still, there was uncertainty about how best to educate patients in this regard, leaving space for future research to investigate and potentially improve.

5.2.5 Organisational factors

Many organisational barriers were reported to influence the completion of patient records in this study. In relation to the TB section, a specific organisational reason or explanation was given for poor completion of ‘disease classification’ where one clinician mentioned that this was recorded as an ICD 10 code, which related to the classification that clinicians do not always know. This could have resulted from a lack of skills and training and insufficient professional knowledge of the process, as Almeida et al., (2021) reported. However, it should be acknowledged that these reasons and challenges form part of broader systemic challenges in both primary healthcare facilities and the DoH. Therefore, context-specific interventions could be implemented to assist clinicians in remembering the codes.

As the most poorly completed section, the **Anti-Retroviral Therapy (ART) initiation** section often only had a date recorded, as reported by clinicians. One clinician commented that it was usually the case that nothing was completed in this section, not even a date; therefore, there could have been files that should have had information completed in this section, but it was left blank. Clinicians also commented that this section of the patient file was confusing in some aspects; for example, there was a section listing the WHO stages of HIV that needed to be ticked according to the patient's HIV stage and symptoms. However, this was unclear so that clinicians may have omitted this part, making the records more difficult to use. The lack of clarity in this file , so may have resulted from the WHO process/checklist being adopted into an unintended context that may not have received it as intended, and therefore, there was a lack of clarity in what was required in this section. Additionally, a lack of skills and training could also explain the uncertainty around the WHO stages of HIV to be completed in the **ART initiation** in combination with the section not being fit for purpose, with a lack of skills and training having been previously reported in the literature as a record-keeping challenge (Marutha & Ngoepe, 2017) leading to clinicians not completing this file section.

The lack of clarity in this file section most likely results from a complex interaction of the above two mentioned explanations.

As the most well-completed section, most details in the **administrative details** section were complete, apart from the HPRS file number. It is important to note that most of the details were completed by the clinician who was opening the file. This was not the case for the clinic patient file number and the HPRS patient file number which was completed by administrative staff. This is related to completing the headcount register (step 1 of the HTA) where complications with the HPRS numbering system were reported. The complication of the HPRS system not issuing chronological file numbers resulted in the clinic using a Microsoft Excel spreadsheet (SMARTcare) to manually keep track and issue unique clinic file numbers rather than electronically issuing file numbers, as found by Marutha (2021). This difference shows the contrast between the collaborating clinic and other South African primary healthcare facilities. For example, a push was made for increased use of the HPRS system by the Department of Health for better national access to patient information which would come with benefits and challenges for the collaborating clinic system and staff where the implications of this change could have interesting emergent outcomes.

Relying predominantly on the HPRS system would benefit provincial and national primary healthcare systems as patients could be more easily traced and access health records more easily if they move or visit a different healthcare institution. However, the impact of this change on the clinic would initially increase administrative staff workload as they would have to reorganise the entire filing system to rely on the HPRS numbering system rather than their unique clinic numbering system. Furthermore, administrative staff found it quicker and easier to manually record details, particularly when the clinic was busy, and transfer the information when they had more time. The recording of patient information at a later stage to the consultation with the patient have been previously found in South African primary healthcare institutions (Shihundla et al., 2016). It is closely linked to several wider systemic barriers that have also been found in South Africa and the collaborating clinic such as the time it took to manually record in patient files and a high number of patient admissions (Bizimana & Bimerew, 2021; Mutshatshi et al., 2018) which would decrease the completion of information in patient records. Another challenge in becoming more reliant on the HPRS system is the time it would take for staff to adapt and be comfortable with a new way of work. This could also be related to getting all staff to buy into a new record management system and a lack of budget for record-keeping materials as found by Marutha & Ngoepe, (2017).

Time-related reasons were another organisational challenge that came through strongly as a challenge in adequately completing records and can be partly caused by the previously discussed high workload. Time constraints, like many other reasons, have been previously reported in the literature and, therefore, were not a unique reason or challenge to the collaborating clinic (Kebede et al., 2017; Mutshatshi et al., 2018). However, in the example of the **prescriptions** section, time-related reasons have not been commonly reported in the reviewed LMIC literature. In the collaborating clinic there were only two pharmacy assistants servicing the patients of all the clinicians and completing the details of every prescribed medication for every patient which was commented to be too much with potentially not enough time. This would impact the completion of patient record sections, as previously discussed.

The final point regarding the completeness of patient records is that when adapting the Ideal Clinic Manual, on which clinics were assessed by the Department of Health, to establish the adequacy of patient records completeness. It was noted that there was information in the patient record that was not reflected in the Ideal Clinic Manual (some of these were added for this research project's assessment). However, of more significant concern would be that there was information in the Ideal Clinic Manual that there was no space in the patient files to fill in. This was found, for example, in respiratory rate in clinical management, Musculo-skeletal examination, rehabilitation in patient management and users age, DoB or ID number in the consent form. This discrepancy meant that the information was 100% incomplete, which is of concern as the Department of Health is auditing clinics for information that inaccurately represents the completeness of patient records.

As discussed above, there were many systemic challenges in the record-keeping and broader clinic system that influenced the record-keeping process and completion of patient files. These challenges intersected and interacted with one another and created possible positive or negative emergent outcomes for the parent clinic system, the child record-keeping system or process and even other sibling and parent systems. These interacting challenges do, however, offer opportunities for intervention within the record-keeping process. Furthermore, despite the challenges discussed, the clinic staff continue to provide healthcare services to a large population as reflected in patient information recording. This was only be done by healthcare staff adapting and overcoming some of these challenges, therefore, the adaptations made by clinic staff will now be discussed alongside system facilitators.

5.3 Facilitators and adaptations to the record-keeping process

Across LMICs and more specifically South Africa, there has been extensive research into challenges for national primary healthcare (Achoki et al., 2022; Card, 2020; Coovadia et al., 2009; Dookie & Singh, 2012; Kautzky & Tollman, 2008; Maphumulo & Bhengu, 2019; Mayosi & Benatar, 2014; Peltzer, 2009; Young, 2016) and national healthcare record-keeping processes (Bizimana & Bimerew, 2021; Luthuli & Kalusopa, 2018; Marutha & Ngoepe, 2017; Mutshatshi et al., 2018). However, little acknowledgement has been made to show the balance between challenges and facilitators in primary healthcare clinic systems and the record-keeping system. In this regard, Card (2020 pg. 136) suggests that facilitators should also be explored above the challenges as they “may offer areas for improvement or learning, contributing to improved performance and positive health outcomes”. This research project extends the argument that exploring facilitators and adaptations made by staff to demonstrate the balance of healthcare systems.

A key facilitator found in this clinic was leadership where clinic staff reported being satisfied with the facility manager of the clinic, being a positive trait for this clinic. This finding contradicts literature where Coovadia et al. (2009) find and discuss poor leadership to be a common challenge found in areas the South African healthcare system. It is, however, important to note here that staff reports may not have represented a full view of clinic management and may be biased in not wanting to speak poorly of their facility manager. It is also important to point out that 'leadership' may extend beyond just the clinic facility manager and go higher into the management hierarchy, which captures the poor leadership found by Coovadia et al. (2009). The higher management hierarchy was not directly discussed with clinic staff. However, unclear reporting lines when the equipment was broken, for example, may indicate some challenges with management and leadership on a broader scale. Acknowledging these staff work within their own complex systems which presents its own emergent challenges, again pointing towards the notion of a 'system-of-systems', where the wider district, provincial and national healthcare systems were beyond the scope of this research project and should be considered for future research.

Unfortunately, clinic systems, record-keeping systems and process facilitators and adaptations in these systems have not been extensively reported on in previous literature. However, notable and prominent adaptations in the clinic may include teamwork, working late, checking results on personal phones and getting equipment from ambulances. Linked to these are the facilitators and adaptations of the record-keeping process of the collaborating clinic, which has not been previously reported on in literature. Some adaptations included having patients take their own files to the pharmacy, the use of the SMARTcare system, not having files opened for minor ailments patients, taking pictures and recording information at a more convenient time, having files stored in another room and helping each other out for example, clinicians sometimes drawing their own files from storage. These summarised adaptations or workarounds were necessary for clinic staff to make both the clinic system and record-keeping process run as smoothly as possible, where without making adaptations, the challenges faced by the clinic would hinder providing healthcare services and completing patient information even more than in the current clinic. This shows that these adaptations are intrinsically linked to the challenges of the record-keeping process and that despite facing a variety and extensive list of barriers and challenges in the clinic system and record-keeping process, primary healthcare facilities continue to provide care to a large number of patients and record patient information. It is, therefore, encouraged that exploration into healthcare facilitators and adaptations should be continued in future research.

The above insights into reasons for inadequate completion of sections of patient files under the discussed constraints of the record-keeping process were gained using an HFE perspective, tools, and methods in combination with a participatory research design. Therefore, the discussion will now focus on applying CBPR and HFE in-situ by reflecting upon experiences and important lessons learnt.

5.4 Reflections on applying HFE and CBPR in-situ

In the review, a parallel was drawn between the concepts of participatory ergonomics (involving workers in improving their work systems) and taking a participatory research approach when applying an HFE approach and method. This study also demonstrated the importance and benefits of applying HFE tools and methods in research as a systems perspective is used and therefore, the complexity of the system can be acknowledged and understood. A fundamental aspect of HFE is adopting a participatory approach whereby workers are involved in conceptualising and re-designing their work systems (Burgess-Limerick, 2018; Hignett et al., 2005; Wilson et al., 2005). However, this research project argues that the involvement of workers should be taken a step further by conceptualising workers as a ‘community’ and involving them from the onset of the research process in order to ask the right questions in the attempt to understand the community's challenges and working collaboratively to optimise the work systems and outcomes for workers, the organisation and, in this case, the patients. CBPR involves workers as a community from the onset of research and shifts power from having the researcher extract data to having community-led research. Shifting power through the involvement of the community in research is particularly important in a country such as South Africa and the context of public healthcare, with a history of exclusion that still impacts the system today. This collaboration can reveal challenges and hopefully lay the foundations for sustainable solutions and meaningful future change. Additionally, the intersection between a participatory research design and the HFE discipline in healthcare systems also speaks to what Card (2023) refers to as ‘slaying the dragon of patient safety’ by not just investigating patient safety challenges but working within the messiness and complexity of healthcare, which a participatory research framework assists in. Therefore, this combined use of HFE and CBPR was carried out in the unique setting of a primary healthcare clinic in Makhanda, South Africa by gaining insights into the clinic system, record-keeping system and reasons as to why certain patient file sections may not have been adequately completed in relation to clinic challenges. This combined approach and working alongside community partners allowed for rich insights and findings in the abovementioned areas. The experience of conducting this unique research will now be explored from the researcher's and community collaborators' perspectives.

5.4.1 My (the researchers') reflections

At the onset of this research project, we broadly aimed to explore some challenge(s) within primary healthcare clinic(s) in the local Makhanda area. Therefore, we began having discussions with a connection my supervisors had at the local Department of Health, as I have previously mentioned. As we started having meetings and discussions around challenges faced by local primary healthcare clinics, the need to work with people to truly understand the system in question was highlighted. With this in mind, we explored literature around participatory research and the CBPR approach, which became more and more relevant as discussions continued with the DoH, data collection commenced, and results of the study were interpreted, continuing to highlight the importance of applying CBPR and HFE in combination. I will begin these reflections with lessons I learned through applying CBPR, namely; patience and flexibility, listening and empathy and appreciation which have proved to add value to the research process, outcomes and researchers.

5.4.1.1 Patience and flexibility

The first important lesson learnt was patience and the ability to be flexible when working with people. This was highlighted in two main ways. Firstly, when going into the clinic to do interviews, the clinic continued functioning; for example, phone calls often interrupted interviews, other clinicians walked into the room, the person being interviewed quickly had to leave, or talking to a patient. The second is what Minkler (2005, pg.9) refers to as ‘constraints on community involvement’ where the people the researchers need to work with are often not in the position to give their time and energy. I experienced this when going into the clinic. When the clinic was particularly busy or understaffed for various reasons, they did not have the time to have discussions with me, and I had to return on another day. These community involvement constraints partially demonstrate the system's complexity and the flexibility required to work within this complexity.

5.4.1.2 Listening

Parajón et al. (2021) refer to an iterative cycle of listening, dialogue, action, re-listening and reflection. This highlights the importance of listening, as I experienced when working in the clinic. I found listening particularly important when conducting CBPR for two main reasons. Firstly, it empowered clinic staff members (the community) to co-construct knowledge with the researchers (DeJonckheere et al., 2019; Telleria, 2021). This was done by building trust by listening and caring about what staff members had to say, which instilled a willingness to continue working together in co-constructing knowledge. The second important reason to truly listen to what clinic staff members were saying was that any insights were valuable, even if they were not answering exactly what I was asking. This was particularly true in trying to understand the design and various components of the clinic and record-keeping systems therefore, any insight into the system helped me understand how the systems functioned (or did not function) and how staff overcame or planned to overcome these challenges.

5.4.1.3 Empathy and appreciation

As demonstrated throughout this project, healthcare systems and their record-keeping systems/processes and the clinic staff working in these systems functioned under various barriers and challenges both unique to the context and more broadly to South African public healthcare and globally reflected by multiple authors (Marutha & Ngoepe, 2017; Luthuli & Kalusopa, 2018; Mutshatshi et al., 2018; Bizimana & Bimerew, 2021). However, despite these challenges, clinic staff could still provide primary healthcare services to the large population they served. Above this, many staff members were willing to take the time to help me with my research project and have discussions and interviews with me. Therefore, I now appreciate the difficult work of primary healthcare staff and hope others may also gain a new perspective and appreciation for our country's public healthcare providers.

5.4.2 Reflections from the community collaborator

As part of the feedback process, the community collaborator was also asked about her reflections on working with researchers throughout the process. Both critical and positive reflections were given.

5.4.2.1 Critical reflections

The critical reflections given by the community collaborator allude to a disconnection between community partners and researchers when applying CBPR in primary care, as discussed by Tapp et al.(2013).

The first critical reflection was that the collaborator, as a result of not being a clinician, did not work with the patient files as regularly as clinicians, for example, might have. This meant that she felt it was sometimes difficult to advise the researchers and uncertain what she could do with/for them. However, despite this, researchers felt that her ability to guide them to the correct people, who possibly did work with files more regularly, and having good rapport and relationships with other clinic staff members outweighed the fact that she did not always work directly with files.

The above critical reflection may have been in part caused by the reflection that at the start of working together, the collaborator mentioned that she was not clear on exactly what her role was and exactly what was expected of her. This critical reflection shows the disconnect in communication between researcher and community collaborator. However, her role became clearer through working together and the practical elements being discussed and playing out. Therefore, it would be important that clarity be considered and ensured with community partners at every step in the research process for future research.

5.4.2.2 Positive reflections

Various positive reflections emerged out of the research process for the community collaborator, including an overall positive experience was found in that working together and sharing ideas came easily. This was positive because the collaborator could guide and facilitate research as she knew the clinic and staff members well. This was particularly important in relation to aspects such as the best times to visit the clinic, helping set up interviews and guiding the researcher as to the best people to ask for feedback.

The second positive reflection was that the research being conducted in the clinic highlighted the importance of record-keeping and what some of the challenges the clinic faced were for the community collaborator and other clinic staff members. Having issues revealed within the community is important as in order for change within the community and policy to occur, challenges need to be uncovered (Minkler, 2005; Tapp et al., 2013). The collaborator mentioned that this had already resulted in some positive changes in the clinic's record-keeping process. This reflection is of particular importance because it shows that the practical benefits of conducting participatory research are not only revealed at the end of the research process in having successful interventions but can emerge and have a positive effect throughout the process. This is shown by Minkler (2005), who mentions that benefits emerge from the onset to completion of a CBPR project, starting with developing relevant research questions.

Having a community collaborator in this study created a sense of empowerment found in the literature (DeJonckheere et al., 2019; Telleria, 2021; Parajón et al., 2021) and was reflected upon by the collaborator. The empowerment was shown as the collaborator mentioned that it helped her understand her role in the clinic as she liked when things were done well, being able to oversee things, assisting others, and then feeling like she had weight and say in meetings. Overall, the researcher's presence in the clinic was also well received by staff members as per feedback from clinic staff to the collaborator, particularly regarding the fact that the researcher was able to give one-on-one time during interviews and discussions with clinic staff members. These reflections again demonstrate the positive impact conducting CBPR can have throughout the research process.

Now that the reflections from both the researcher and community collaborator have demonstrated the value of applying a CBPR framework and where future improvements can be made, the important aspect of feedback in the CBPR approach, as one of the final stages of the framework, will now be discussed.

5.5 Clinic feedback session

Adopting a CBPR approach comes with many challenges, including challenges related to disseminating and translating research findings (Minkler, 2005; Tapp et al., 2013). These challenges capture the importance of ensuring that the findings have been correctly interpreted, how best to accurately and sensitively disseminate findings and to whom. Therefore, through careful consideration and discussions with the community collaborator, a feedback session with the clinic was necessary following the data collection and analysis processes. This feedback session was particularly important in completing the CBPR framework's last step and continuing collaboration with the clinic.

By having a feedback session, it was reinforced that researchers did not want to extract data from the clinic but collaborate throughout the research process, including through the interpretation and dissemination of feedback, as an important CBPR consideration. Furthermore, a prospective Masters student from the Department of Human Kinetics and Ergonomics also joined the session as she was interested in continuing working with and sustaining the relationship with the clinic in other challenging areas, as was discussed at the feedback session.

5.6 Limitations and recommendations

5.6.1 Research limitations and recommendations

This study had various limitations. First and foremost, due to the approach adopted of embedding within the clinic and working alongside clinic staff, there was only time to work with one clinic, therefore, the results and the findings of this study were specific to only the collaborating clinic and not necessarily generalisable to other primary healthcare clinics in the area or country. Furthermore, due to these time limitations the implementation of recommendations was, unfortunately, not possible. Further research, therefore, needs to be conducted in the Sarah Baartman district and across the country to understand patient-record-keeping challenges, if records are adequately completed in primary and other healthcare facilities and implementing and testing co-constructed solutions.

A second important limitation is that the perspectives surrounding the record-keeping challenges and barriers were only gained from clinic staff (sharp-end workers) and not other relevant stakeholders. This was advantageous as sharp-end workers are involved in the record-keeping process on a daily basis. However, further insights and different perspectives could be gained from other stakeholders, including local Department of Health management, and even clinic patients could provide important and valuable insights. Based on this limitation, a recommendation for future research is to gain insights into the primary healthcare facility record-keeping process from a greater variety of stakeholders for a wider view and perspective on the topic.

As explored in Chapter 3, the researcher's positionality may have influenced their perspective of working with the clinic and interpretation of data. This subjective perspective is a limitation of the study. However, it was partly overcome by involving and interacting with the community collaborator, clinic facility manager and research supervisors throughout the research process and data collection.

Time restrictions in the analysis of patient files allowed for only 55 files (less than 1% of the clinic files) to be assessed and compared to the Ideal Clinic Manual with some file sections having as few as four files, such as the TB adherence section. However, this analysis was still important in gaining insights into the completion of patient records and should continue to be done in future research. Unfortunately, due to ethical constraints, it was not possible to observe clinicians recording patient information info files during consultations, which would have been interesting as the actual completion of files was a key focus area of the study.

Additionally, when assessing the patient files for the quantitative component of the study, there was not always a clear distinction between partially complete and not applicable, as the researcher decided what was considered partially complete (the Ideal Clinic Manual did not detail what was classified as partially complete), and not applicable. For example, if a patient did not return for a follow-up visit the researcher was not always aware of the reasons for this (eg. still to return, didn’t need a follow-up visit or did not come to the follow-up visit) or if employment details were not completed, the researcher was not aware if the patient was or was not employed. Therefore, in future, it is recommended to ensure a clear understanding and predetermined distinction of the various possible scenarios to categorise completed information. This may require having a community collaborator assist in this data collection process.

Furthermore, only three interviews were conducted in the second round of interviews for various reasons, including participant fatigue, with one clinician remarking, *“Do you have to interview me?”*. Other reasons included that the clinic was busy and understaffed, as well as the research project having time limitations. A further limitation of these three interviews is that one clinician interviewed was the facility manager, and another worked in the minor ailments programme and, therefore, did not work with files as frequently as other clinicians. Therefore, the decision was made that rather than asking clinicians about file sections they currently worked with, the researcher asked questions about all file sections the clinicians had previously worked with. Future research should consider this if similar challenges are encountered. These data collection limitations could be corrected or improved upon in future research with appropriate time, ethical clearance and willingness from research participants and collaborators.

5.6.2 Practical recommendations

In addition to recommending expanding this research to the wider Sarah Baartman district and beyond, several practical recommendations emerged from this research to improve the design of the hybrid record-keeping process in response to emergent challenges. These recommendations have emanated from clinic staff (underlined) and recommendations from the researcher that emerged based on observations and discussions with clinic staff.

Firstly, a recommendation related to the people includes having a designated person in the clinic to take vital signs, having more staff members in the clinic and creating openings for posts. All three of these suggestions would reduce the workload of clinicians and allow them more time to engage in the record-keeping process and adequately and accurately complete patient files, as time restrictions emerged as a prominent reason for incomplete file sections.

The second recommendation concerns equipment, where some clinic staff suggested using tablets to access information necessary to accurately complete records. Therefore, clinicians would not be as reliant on and restricted to the limited computers in the clinic and have access to all relevant patient information to complete patient records. Additionally, the clinic computers would be more readily available for the administrative and data-capturing tasks of the record-keeping process, reducing patient file backlog and easing the use of the HPRS system. This would allow clinicians better access to information, saving time and preventing them from using personal devices.

Concerning the environmental challenges of the clinic's record-keeping process, the clinic needed more space, particularly regarding the storage of files overflowing into consultation rooms and dividers to allow files to stand upright for ease of storage and access to files. This would mean that all files would be in one space, reducing the time it would take to find files and the amount of lost or missing files. During the clinic feedback session, it was mentioned that the clinic was expanding into another building, which would relieve some space issues.

Several recommendations emerged related to the organisational aspects of the record-keeping system. Firstly, it is recommended that improvement or redesign of actual patient records or files be made as agreed upon with clinicians:

1) A redesign of the ART initiation section, including making the WHO symptom checklist more straightforward to complete.
2) A larger area to describe patients' presenting symptoms under the clinical management section.
3) Consulting clinicians regarding what additional information they feel should go into the consent form as they felt some crucial information was 'missing'.
4) Some information categories across patient files are unclear (e.g. a heading of 'other' under the general examination of maternal patients); this should be clarified for clinicians to easily understand.
5) Have larger or various blocks for the prescribers' information in the prescription section.

Despite these suggestions by clinicians, some did not want to change the design of the file as they were confident that the multidisciplinary design team involved knew what they were doing. This came particularly from the clinician with over 40 years of experience and had seen changes in the clinic and record-keeping system and process through apartheid years and, therefore, could not fathom anything being done any better, including the design of patient files.

Secondly, a large amount of duplication within and across patient files was identified as a challenge hindering the record-keeping process. Therefore, the DoH (alongside sharp-end workers) should reconsider how to capture all relevant information in as few documents as possible, allowing clinicians time to complete patient files accurately without having to duplicate this. Additionally, redesigning of certain patient file sections should be considered to reduce the repetition of information within patient files (for example, the duplication of information in clinical management/ examination of maternal patients).

Furthermore, a recommendation can be made for integrating the clinic's unique file numbering system and the HPRS numbering system to benefit both the clinic in ease of filing and finding files and the national healthcare service in widely accessible patient information.

The Ideal Clinic Manual checklist also needs to be updated so that the details and the actual patient files correspond with one another, and clinics can be accurately audited based on what is reflected in the patient files. For example, the respiratory rate in clinical management, Musculo-skeletal examination, rehabilitation in patient management and users age, DoB or ID number in the consent form were present in the checklist but not in the patient files.

Finally, it is suggested that the Department of Health continually collaborates with sharp-end workers to improve the clinic and record-keeping systems. For example, one area that clinic staff suggested in the feedback session could be improved and focused on in future research is patient literacy and understanding of clinicians' work. Investigating patient literacy is related to record-keeping in that it helps reduce frustration, improve the work environment and encourage more accurate completion of patient records.

5.6.3 What I would do differently

Above the lessons learnt, reflections from the community collaborator, limitations and recommendations, there are a few important points that have not yet been raised regarding what I, as the researcher, would do differently if I conducted an in-situ study combining HFE and CBPR approaches, such as this one, again. These include: involving the community collaborator from earlier on in the project and involving the community collaborator more in the quantitative data collection for increased clarity of files during the process and assistance assessing an increased number of files. Furthermore, allowing more time to get more detailed and collaborative recommendations to implement and evaluate, get feedback as to how to get more buy-in and better design the follow-up interviews. Lastly, I would suggest to future researchers to embed further in the record-keeping process by asking to do more steps/ iterations of the record-keeping tasks and to get ethical clearance to sit in on consultations when the patient record gets completed, for further insights into how records are completed and why they may or may not be adequately completed.

Chapter Seven: Conclusion

This project highlighted the concerns and importance of the patient record-keeping process and its impact on the wider local primary healthcare clinic system. Therefore, several important conclusions can be drawn through the combined application of HFE and CBPR in a primary healthcare clinic in Makhanda, focusing on the record-keeping process, as will be discussed in the following paragraphs. In sum, information in sections of patient records is completed to varying degrees of adequacy, with some sections being better completed than others. Several reasons emerged as to why patient record sections are well or poorly completed, which cannot be separated from the systemic challenges within the wider clinic systems and the record-keeping system.

Firstly, the clinic's patient record analysis established that some file sections were better or more adequately completed than others. For example, one of the best-completed file sections was administrative details; on the other hand, ART initiation was one of the most poorly completed file sections, predominately due to the amount of information required in the section coupled with more general reasons. The inadequate completion of certain patient file sections is a concern as it impacts clinic staff in access to patient information, patients in the quality of healthcare services and follow-up care and the DoH as incomplete records could lead to medico-legal litigation costs. Therefore, the DoH and clinic staff should collaborate in finding solutions to improve the completeness and accuracy of patient files.

Secondly, when comparing the Ideal Clinic Manual record-keeping checklist and the patient file, it was noted that details on the checklist did not always correspond with details in patient files. This should also be a point of concern and consideration, particularly for the DoH, as clinics are assessed based on this checklist, and if inconsistencies are present, assessments may be inaccurate. From this investigation and analysis of patient files, numerous reasons came to light for why this may be the case.

The results of the study revealed multiple reasons that hindered the completion of patient records. These reasons for inadequate completion of patient records could not be separated from the broader systemic issues that emerged through work system component interactions in both the broad clinic system and the record-keeping process. These results emphasised the importance of studying systems and processes like those involved in record-keeping, using a systems approach given the impact that broader constraints have on the accurate completion of patient files. Identifying these reasons and wider challenges was important as a starting point in developing interventions for improvements in the record-keeping process in primary healthcare clinics nationally for an improvement in ease of the record-keeping process, patient safety and a decrease in medico-legal litigation costs.

Despite these and many other challenges faced by healthcare workers in the clinic and within the record-keeping system, the clinic continued to provide healthcare services and complete record-keeping tasks for the large community they served. This was possible as, along with barriers to providing healthcare and completing record-keeping, several facilitators and adaptations emerged. The facilitators and adaptations discussed highlight that clinic staff worked around the many barriers they faced while maintaining a positive work environment and should be considered in future system improvements.

While the envisaged co-construction of interventions was not possible during this study, several recommendations were suggested by clinic staff and the researchers. The recommendations the researchers and clinic staff suggested were well aligned and could form the base for developing interventions to improve the record-keeping process. Some of these recommendations for the record-keeping process included continuing working with clinic staff in system improvement, having a designated staff member to take vital signs, some suggesting the use and integration of tablets, design changes to the patient files and an updated and fully corresponding Ideal Clinic Manual checklist to assess clinics and integration of the HPRS and unique clinic file numbering systems.

A final and most important point is that this project has demonstrated the usefulness and importance of integrating HFE and a participatory research approach by understanding the record-keeping system of a primary healthcare clinic in Makhanda. These lenses have been applied together in situ and helped deepen the insights into the system, hopefully increasing the veracity of findings and conclusions made when working alongside communities, while offering an important platform for appropriate recommendations to be made for the improvement of the record-keeping process.

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Appendices:

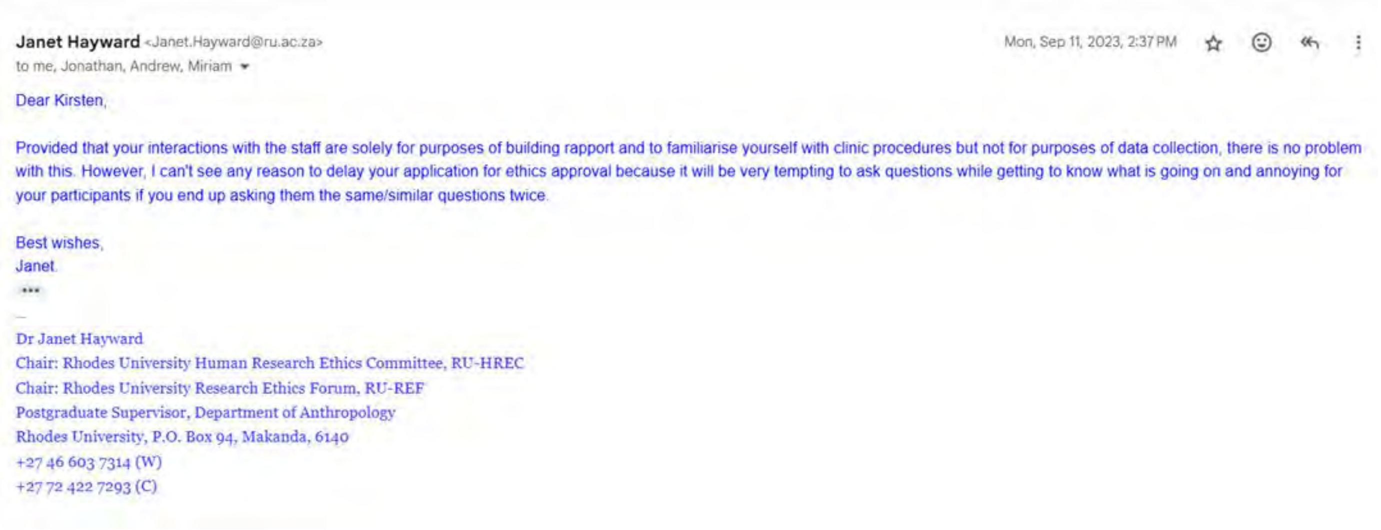
Appendix A: Studies applying the SEIPS model

Reference	Area of application	Data collection methods	SEIPS focus area	Country	Interventions/ solutions emerged from study (yes/ no)	Conclusions
(Faiola & Holden, 2017)	Understanding barriers to use of eHealth technologies, more specifically a diabetic patient	No data collection method	SEIPS 2.0	US	No	Individuals will have a greater role in their own healthcare with eHealth technologies which has been understood through the SEIPS 2 model.
(Wheway & Jun, 2021)	The ingestion of superabsorbent polymer gel granules and the interruption in use of high nasal flow oxygen	Video training, workshops and interviews	No specified SEIPS components	England	No	Accimap and SEIPS 2 are both good in terms of utility but through user training could be more useable.
(Wust et al., 2022)	Older adults visiting a hospital emergency room	Observations, meetings, focus groups	Work systems components and patient journey	US	No	A map of the patient journey, in mapping older adults in the ED who have fallen, has been better understood through the application of SEIPS 2.
(Wilson et al., 2017)	Understanding the overuse of nonsterile clinical gloves leading to cross contamination	Observations, interviews, thematic analysis	System components	England	No	Applying HFE factors may be more effective in improving safety than traditional approaches.
(Strauven et al., 2020)	Investigating medicine pathways to understand the frequent medication errors in nursing homes	Observations, interviews, flowchart	Work systems component and processes	Belgium	Yes	Interventions come up with that could improve patient safety and effective medicine pathways.

(Steele et al., 2018)	Analysis of medication errors in mental health community setting	Interviews, disruption logs, questionaries	Broad systems analysis	US	Yes	A number of interventions were concluded on that could improve quality the safety of medication.
(Loh et al., 2017)	To investigate the high number of incorrect lens implants in cataract surgeries	Case reports, qualitative description,	Work systems component, processes and impacts on output	Singapore	Yes	HFE perspective and interventions improved the safety of patients in the case study.
(Berger & Scott, 2020)	The creation and use of health and care records	No data collection method	Work systems model factors and processes	England	Yes	The SEIPS model needs further validation but is a useful framework for system design and intervention implementation.
(Tevaarwerk et al., 2018)	Identification of barriers and facilitators to care of cancer survivors	Case study	Work systems components, processes and outcomes	Not indicated	Yes	Barriers in the system can be identified using the SEIPS model while the integration of engineering can lead to improved care quality and efficiency.
(Berman et al., 2021)	Increase effectiveness and sustainability of health hygiene	Questionaries, interviews, observations	Work systems model components	Ethiopia	No	SEIPS helped identify barriers to hand hygiene and interventions were shown to improve hand hygiene compliance.
(Abraham & Morris, 2019)	Understanding medication needs of patients with cystic fibrosis and the perceptions of their care teams on pharmacists providing support	Interviews	Work systems component	US	No	Pharmacists were found to be useful for CF patients in a number of regards.
(Carman et al., 2022)	Reviewing and understanding out-of-hours work	Survey, data extracts from online task manager, observation	Work systems components and outcomes	England	No	SEIPS can be used to identify barriers and facilitators to 24 hours hospital services using systems components.

(Carman et al., 2021)	Barriers and facilitators to the transition of care	Incident reports, Observation of meetings, focus groups	Work systems components	England	Yes	Barriers and facilitators for community and staff members in the discharge process can be identified using SEIPS.
(Carman et al., 2020)	Understanding multidisciplinary cancer teams	Observation of meetings, interviews	Work systems components	England	Yes	Barriers and efficient working ways creating positive outcomes can be identified and mapped out using SEIPS.
(Woolward et al., 2022)	Patient identification improvement in radiography	Observations, document review, workshops, failure mode and effect analysis, walk-throughs and discussions	Micro, Unit and Organisational levels	England	Yes	A multi-level systems approach can reduce risk in the healthcare industry.

Appendix B: Ethical approval to partake in the embedding process by Janet Haywood (Rhodes University human ethics research chair)



Janet Hayward <Janet.Hayward@ru.ac.za>
to me, Jonathan, Andrew, Miriam

Mon, Sep 11, 2023, 2:37 PM

Dear Kirsten,

Provided that your interactions with the staff are solely for purposes of building rapport and to familiarise yourself with clinic procedures but not for purposes of data collection, there is no problem with this. However, I can't see any reason to delay your application for ethics approval because it will be very tempting to ask questions while getting to know what is going on and annoying for your participants if you end up asking them the same/similar questions twice.

Best wishes,
Janet

Dr Janet Hayward
Chair: Rhodes University Human Research Ethics Committee, RU-HREC
Chair: Rhodes University Research Ethics Forum, RU-REF
Postgraduate Supervisor, Department of Anthropology
Rhodes University, P.O. Box 94, Makanda, 6140
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Appendix C: Time spent embedding in the clinic

Date	**Time**	**Hours**
18 September 2023	10:30 – 13:00	2,5 hours
19 September 2023	13:00 – 16:00	3 hours
21 September 2023	8:00 – 10:30	2,5 hours
27 September 2023	9:00 – 12:00	3 hours
29 September 2023	8:00 – 10:00	2 hours
3 October 2023	14:00 – 16:00	2 hours
4 October 2023	9:00 – 11:30	2,5 hours
12 October 2023	9:30 – 10:30	1,5 hours
13 October 2023	8:00 – 10:00	2 hours
17 October 2023	13:30 – 16:00	2,5 hours
18 October 2023	10:30 – 12:00	1,5 hours
20 October 2023	8:00 – 9:30	1,5 hours
30 October 2023	10:30 – 12:00	1,5 hours
31 October 2023	8:00 – 10:00	2 hours
3 November 2023	11:30 – 13:00	1,5 hours
7 November 2023	13:00 – 15:00	2 hours
8 November 2023	8:30 – 10:00	1,5 hours
TOTAL HOURS:		35 hours

Appendix D: Minutes of first meeting with the community collaborator

19 February 2024: Initial meeting with community collaborator

Present- Sesethu (community collaborator) and Kirsten (researcher)

The meeting started with the researcher thanking the community collaborator for meeting and explaining that the facility manager suggested her to advise/guide the researcher through data collection and interpretation when the idea of having an advisor/ community collaborator was proposed. She was suggested as she is very involved in the clinic and has a good rapport with clinic staff.

The role of the community collaborator was then discussed in that it will be an evolving role from guidance and support to feeding back, filling in gaps and interpreting findings. The community collaborator was happy and agreed.

The three phases of data collection were then explained and agreed on with the first being understanding the broad record-keeping system through observation, semi-structured interviews and discussions, here it was clarified that discussions would occur with clinic staff and not patients to get the staff perspective and that the researcher would not be able to go into any consultations. The second collection phase would be to gain a deeper understanding of the tasks involved in record-keeping through the same collection methods. The final step would be to look at patient records and what information is filled in (the exact information to be looked at would be discussed and decided on) and then go back to staff and discuss what was found and why.

It was decided that the community collaborator and researcher would meet each Monday morning at 10 am at the clinic to discuss the week past and the week moving forward as well as expectations and any arising matters. It was also suggested that the researcher come in in the afternoons after lunch (2 pm) as the clinic is quieter then and would allow for more discussions with staff as compared to busy mornings.

The community collaborator commented that she is excited about the research as it challenges what happens in the clinic. Often, staff just do what they know and because it is how things are done, but this project could hopefully challenge and improve record-keeping. She also emphasised she is very involved in the clinic with both patients and staff and often checks up on things, so she would be good in the role.

The researcher and community collaborator discussed the start of data collection and it was decided that the researcher would go to the staff meeting on Wednesday of that week (with the consent of the facility manager) where the data collection process could be discussed, the role of the subject matter expert could be explained and willing participants could sign consent forms before collection begins.

Appendix E: Rhodes University ethical approval letter

RHODES UNIVERSITY
Where leaders learn

Rhodes University Human Research Ethics Committee
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https://www.ru.ac.za/researchgateway/ethics/

13 November 2023

Miss Kirsten Kingwill

Email: g19v0922@campus.ru.ac.za kirstenkingwill@gmail.com

Review Reference: 2023-7391-8094

Dear Miss Kirsten Kingwill

Title: Applying Human Factors and Ergonomics to understanding and optimising healthcare clinic record-keeping using a Community-Based Participatory Research approach in Makhanda.

Researcher: MissKirsten Kingwill

Supervisor(s): Dr Jonathan Davy, Mr Andrew Todd,

This letter confirms that the above research proposal has been reviewed and **APPROVED** by the Rhodes University Human Research Ethics Committee (RU-HREC). Your Approval number is: 2023-7391-8094

Approval has been granted for 1 year. An annual progress report will be required in order to renew approval for an additional period. You will receive an email notifying you when the annual report is due.

Please ensure that the ethical standards committee is notified should any substantive change(s) be made, for whatever reason, during the research process. This includes changes in investigators. Please also ensure that a brief report is submitted to the ethics committee on the completion of the research. The purpose of this report is to indicate whether the research was conducted successfully, if any aspects could not be completed, or if any problems arose that the ethical standards committee should be aware of. If a thesis or dissertation arising from this research is submitted to the library's electronic theses and dissertations (ETD) repository, please notify the committee of the date of submission and/or any reference or cataloguing number allocated.

Sincerely,

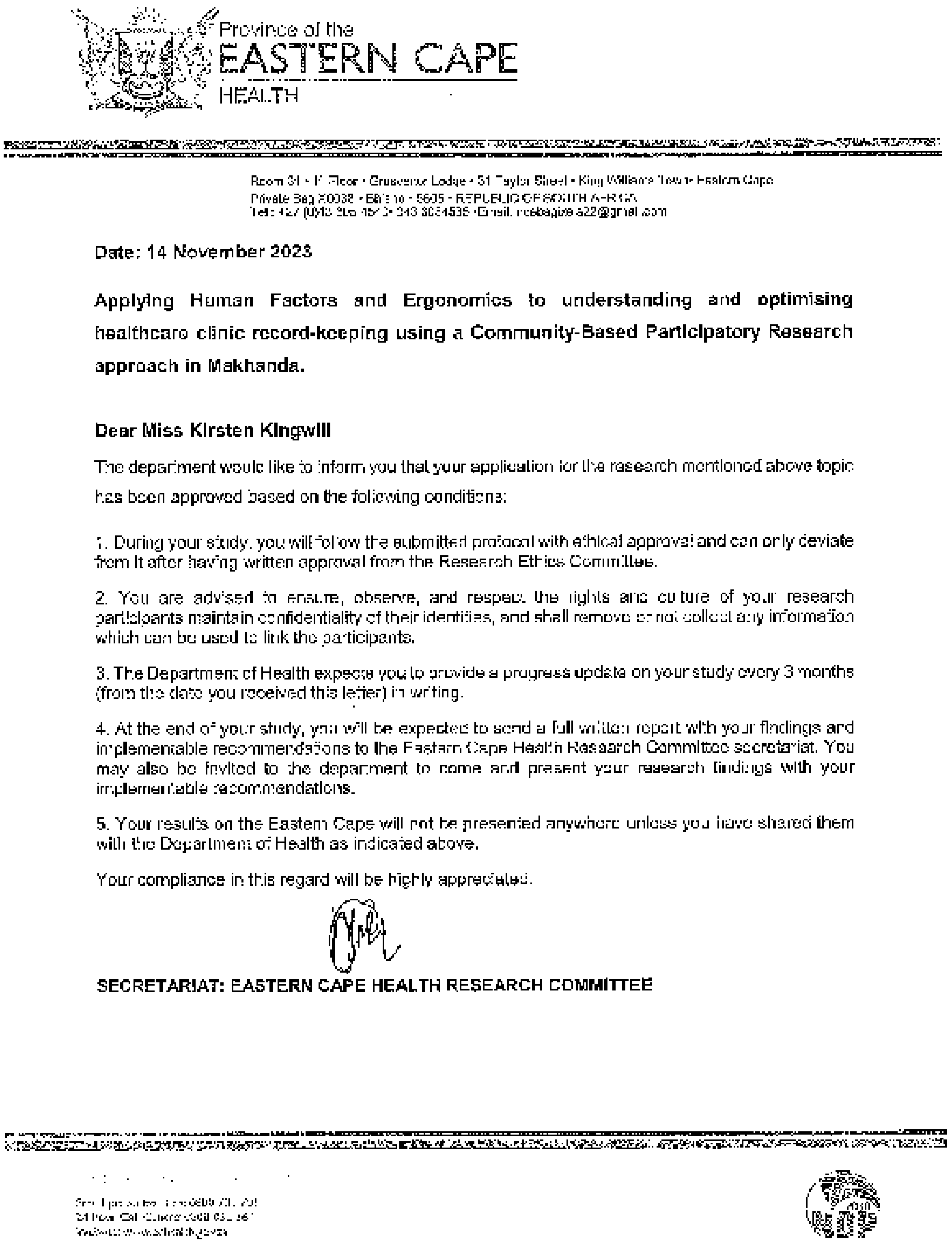
Dr Janet Hayward

Chair: Rhodes University Human Research Ethics Committee, RU-HREC

cc: Ethics Coordinator

Page 1 of 1

Appendix F: Research approval letter from the Department of Health



Province of the
EASTERN CAPE
HEALTH

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Tel: +27 (0)43 [illegible] • 043 3054535 • Email: [illegible]

Date: 14 November 2023

Applying Human Factors and Ergonomics to understanding and optimising healthcare clinic record-keeping using a Community-Based Participatory Research approach in Makhanda.

Dear Miss Kirsten Kingwill

The department would like to inform you that your application for the research mentioned above topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having written approval from the Research Ethics Committee.

2. You are advised to ensure, observe, and respect the rights and culture of your research participants maintain confidentiality of their identities, and shall remove or not collect any information which can be used to link the participants.

3. The Department of Health expects you to provide a progress update on your study every 3 months (from the date you received this letter) in writing.

4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Eastern Cape Health Research Committee secretariat. You may also be invited to the department to come and present your research findings with your implementable recommendations.

5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

SECRETARIAT: EASTERN CAPE HEALTH RESEARCH COMMITTEE

[illegible]
[illegible]
Website: [illegible]

Appendix G: Gatekeeper permission letter

PERMISSION TO CONDUCT RESEARCH

Study: Applying Human Factors and Ergonomics to understanding and optimising healthcare clinic record-keeping using a Community-Based Participatory Research approach

Student researcher: Kirsten Kingwill

Supervisors: Dr. Jonathan Davy and Mr. Andrew Todd

This letter serves to confirm that the Joza Healthcare Facility is a willing participant of the abovementioned study under the student researcher Kirsten Kingwill and supervisors Dr. Jonathan Davy and Mr. Andrew Todd.

I hereby grant the researchers permission to work with the appropriate members of the abovementioned organisation to conduct their data collection.

Should you require any further information please feel free to contact

Yours sincerely,

Sister Xotyeni
Facility Manager
Joza Healthcare Clinic
khanyixotyeni@gmail.com

Appendix H: Participant informed consent form

PARTICIPANT INFORMED CONSENT DECLARATION

(To be signed by research participant/s)

Project Title: Human Factors and Ergonomics and Community-Based Participatory Research applied to a healthcare clinic record-keeping system

Kirsten Kingwill from the Department of Human Kinetics and Ergonomics, Rhodes University has requested my permission to participate in the above-mentioned research project.

The nature and the purpose of the research project and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

1. The purpose of the research project is to understand record-keeping in a clinic using a participatory approach and if issues are identified to co-construct possible solutions.

2. Rhodes University has given ethical clearance to this research project 7391 and I have seen/may request to see the clearance certificate by contacting the Ethics Coordinator (ethics-committee@ru.ac.za)

3. By participating in this research project I will be contributing towards gaining holistic insights into how the record-keeping system of the clinic works and being able to contribute to co-constructed solutions therefore, having potential to improve clinic outcomes for all.

4. I will participate in the project by continuing my work as per usual and talking to the researcher.

5. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences.

6. I will not be compensated for participating in the research.

7. The following risks are associated with my participation: feeling uncomfortable with the researcher being present however, be assured that no information collected will be traced or reported back to management and the researcher will keep distance and not get in the way of work when necessary.

8. The Researcher intends to publish the research results in the form of a thesis. However, confidentiality and anonymity of records will be maintained and my name and identity will not be revealed to anyone who has not been involved in the conducting of the research, ***unless I indicate to the contrary/recognize that as a public figure my identity will inevitably be/become known, in which case I***

agree to accept the loss of anonymity.

9. In terms of the Protection of Personal Information Act (No. 4 of 2013) it remains my right to request the Researcher to provide me with a detailed explanation of exactly how confidentiality and anonymity of the data I provide will be achieved. I may also request to know exactly how my personal information will be stored securely, for how long it will be stored.

10. If any data collected from me for this research project is to be used by the Researcher for any further study, I am to be informed in writing and my written consent requested again. I need not give consent for the new research if it is incompatible with the initial purpose of the present study (POPIA, s15(3)). Equally, I can simply reject the request. In such cases, a formal request needs to be made to me by the researcher via the Ethics Coordinator (ethics-committee@ru.ac.za).

11. In terms of the POPI Act, I possess the right to receive feedback about this research. This will take the form of brief report summarising the main findings related to the record-keeping process and co-constructed possible solutions unless ***I elect not to receive this feedback.***

12. Any further questions that I might have regarding the nature of the research and/or my participation in it will be answered by Kirsten Kingwill, g19v0922@campus.ru.ac.za

13. By signing this informed consent declaration, I am not waiving any legal claims, rights, or remedies. A copy of this informed consent declaration will be given to me, and the original will be kept on record by the Researcher.

14. I ***agree*** to the Researcher's request to take photographs, or videoing me as part of this research project, recognizing that agreement here is likely to raise the risk of compromising my anonymity and that steps will be taken to ensure this will not happen if my consent is given.

15. I ***agree*** to the Researcher's use of voice recording of my comments and opinions during interviews, the purpose of which is to ensure the accurate recording of my views/responses. Furthermore, I have the right to request a copy of the interview transcriptions to confirm that my opinions are accurately recorded

I, ………………………………………………………………………., have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask, and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

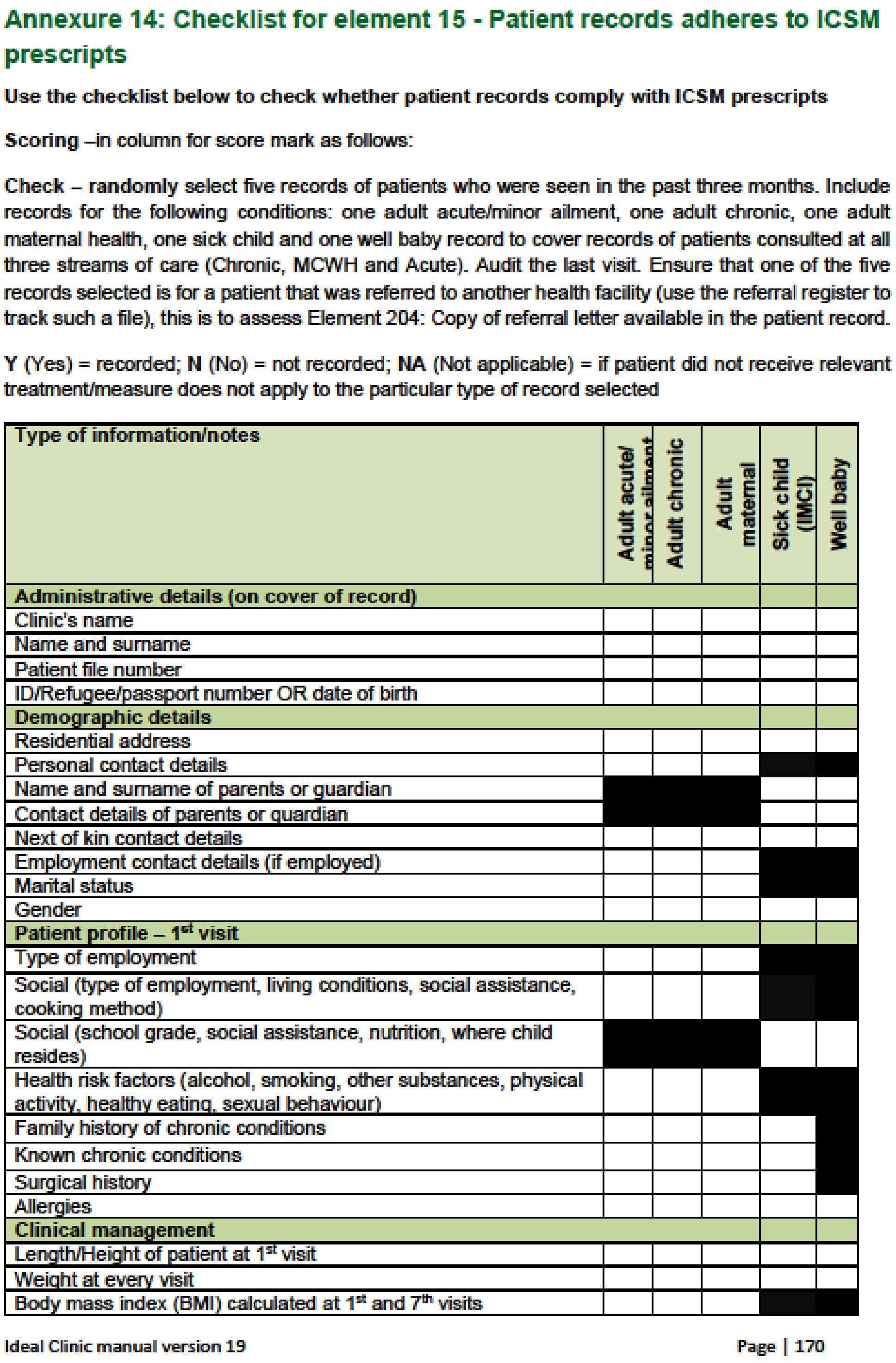
……………………………………	……………………………	……………………………
Participants signature	**Witness**	**Date**

Appendix I: Draft HTA

The draft HTA that was checked by clinic staff and amended into the final HTA found in results

Task Analysis	Notes
0 Complete record-keeping	Complete tasks and sub-tasks sequentially unless otherwise indicated
1 Complete headcount register 1.1 fill in patient name 1.2 fill in patient address 1.3 fill in patient date of birth 1.4 find patient file number *1.4.1 consult SMARTcare* *1.4.1.1 open SMARTcare excel sheet* *1.4.1.2 search patient name* *1.4.1.3 have patient file number*	Obtain information from patient passport or patient If file number is not in patient passport
2 Retrieve file 2.1 Search in cabinets for file 2.2 Search around the clinic for file *2.2.1 walk around the clinic into various rooms the file could be in* *2.2.2 search in piles of files for the given file*	If file is not in the cabinets
3 Consultation 3.1 open file by recording initial information in the file 3.2 perform medical tasks 3.3 record in file 3.3.1 record information from medical tasks performed 3.3.2 record any medication prescribed 3.3.3 record any blood results received 3.4 duplicate information into other records 3.5 complete tick register 3.5.1 record patient name and date of birth 3.5.2 tick what the patient came in for 3.6 write in patient passport **3.7** write in appointment book	If the patient is new, or skip to 3.2 If any relevant information is required If follow up appointment is required
4 File taken to pharmacy	Should be taken by clinician but is taken by patient
5 File returned to reception	From the pharmacy and clinician rooms
6 Data captured 6.1 files sorted 6.2 files updated 6.3 file number given from SMARTcare 6.4 capture tick register data into DHIS *6.4.1 tally daily totals of what patients came in for* *6.4.2 put totals into the system* 6.5 capture TB patient information into TIER.net 6.6 capture headcount register into HPRS 6.7 capture follow up appointments into CCMDD	Order varies according to differing information that needs to be captured
7 Files put away back into cabinets	
8 Reports sent from computer systems	

Appendix J: Ideal Clinic Manual record-keeping checklist



Annexure 14: Checklist for element 15 - Patient records adheres to ICSM prescripts

Use the checklist below to check whether patient records comply with ICSM prescripts

Scoring –in column for score mark as follows:

Check – randomly select five records of patients who were seen in the past three months. Include records for the following conditions: one adult acute/minor ailment, one adult chronic, one adult maternal health, one sick child and one well baby record to cover records of patients consulted at all three streams of care (Chronic, MCWH and Acute). Audit the last visit. Ensure that one of the five records selected is for a patient that was referred to another health facility (use the referral register to track such a file), this is to assess Element 204: Copy of referral letter available in the patient record.

Y (Yes) = recorded; **N** (No) = not recorded; **NA** (Not applicable) = if patient did not receive relevant treatment/measure does not apply to the particular type of record selected

Type of information/notes	**Adult acute/ minor ailment**	**Adult chronic**	**Adult maternal**	**Sick child (IMCI)**	**Well baby**
Administrative details (on cover of record)					
Clinic's name					
Name and surname					
Patient file number					
ID/Refugee/passport number OR date of birth					
Demographic details					
Residential address					
Personal contact details				■	■
Name and surname of parents or guardian	■	■	■		
Contact details of parents or guardian	■	■	■		
Next of kin contact details					
Employment contact details (if employed)				■	■
Marital status				■	■
Gender					
Patient profile – 1st visit					
Type of employment				■	■
Social (type of employment, living conditions, social assistance, cooking method)				■	■
Social (school grade, social assistance, nutrition, where child resides)	■	■	■		
Health risk factors (alcohol, smoking, other substances, physical activity, healthy eating, sexual behaviour)				■	■
Family history of chronic conditions					■
Known chronic conditions					■
Surgical history					■
Allergies					
Clinical management					
Length/Height of patient at 1st visit					
Weight at every visit					
Body mass index (BMI) calculated at 1st and 7th visits				■	■

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Weight-for-height z score	■	■	■		
MUAC (every 3 months)	■	■			
Temperature					■
Blood pressure at every visit				■	■
Respiratory rate					■
Pulse rate at every visit					■
Blood sugar as per guidelines					■
Urine dipstick as per guidelines				■	■
Basic screening where indicated (HIV, TB, STI, Diabetes)					
Current chronic condition					■
Adherence to medication					■
Reported side effects of medication					■
Other hospital/doctor visits					■
Presenting complaints					■
Examination					
General (JACCOL)					■
Respiratory					■
Cardiovascular					■
Gastrointestinal					■
Mental state					■
Central nervous system (CNS)					■
Musculo-skeletal					■
Diagnosis					■
Patient management					
Investigation/tests requested					
Date of investigation/test requested					
Results of investigations/test recorded					
Health education provided					
Treatment prescribed					
Rehabilitation (where applicable)					
Referral (where applicable)					
Date of next visit indicated (where applicable)					
Health Care Practitioner's name and surname					
Health Care Practitioner's qualification					
Health Care Practitioner's signature					
Date signed by Health Care Practitioner					
HPCSA Number (where applicable)					
Child health records					
History of immunisations	■	■	■		
Deworming treatment	■	■	■		
Vit A supplementation	■	■	■		
Developmental screening (6,14 weeks and 6, 9, 18 months and 3, 5-6 years)	■	■	■		
Growth charts completed	■	■	■		
Basic screening completed according to Road to Health Charts	■	■	■		
Maternal health records					
BANC 1st visit					
Obstetric history	■	■		■	■
Previous obstetric history and family	■	■		■	■
Gestational age	■	■		■	■
General examinations	■	■		■	■
Abdomen – FHH examination	■	■		■	■
Vaginal examination	■	■		■	■
HIV status	■	■		■	■
Pregnancy risk screening	■	■		■	■

Health education provided, including information on MomConnect					
Health Care Practitioner's name and surname					
Health Care Practitioner's qualification					
Health Care Practitioner's signature					
Date signed by Health Care Practitioner					
BANC PLUS follow-up visits					
HIV status (retest)					
General examination					
Abdomen examination					
Supplements (for the mother)					
Feeding practices for baby discussed					
Gestational graph plotted per visit					
Health Care Practitioner's name and surname					
Health Care Practitioner's qualification					
Health Care Practitioner's signature					
Date signed by Health Care Practitioner					
Delivery summary					
Birth date					
Birth weight					
Apgar score					
Delivery mode					
Pregnancy outcome					
Health Care Practitioner's name and surname					
Health Care Practitioner's qualification					
Health Care Practitioner's signature					
Date signed by Health Care Practitioner					
Postnatal Care visits					
General examination (3-6 days post delivery)					
General examination (6 weeks post delivery)					
Health education					
Health Care Practitioner's name and surname					
Health Care Practitioner's qualification					
Health Care Practitioner's signature					
Date signed by Health Care Practitioner					
Prescription					
Patient's name and surname					
ID number					
Age					
Allergies					
Name of medication					
Strength of medication					
Quantity					
Dosage					
Dosage form					
Batch number (applicable for immunizations)					
Prescriber's name and surname					
Prescriber's qualification					
Prescriber's signature					
Date signed by prescriber					
Dispenser's name and surname					
Dispenser's signature					
SANC/HPCSA number					
Consent form (where applicable)					
Patient's full names and surname are written on the consent form					

The user's age or date of birth or identity number is documented in the consent form					
The exact nature of the operation/procedure/treatment is written on the consent form					
The consent form is signed by the patient or parent/guardian					
The consent form is signed by the health care provider					
The consent form is dated					
The information is legible					
Total					
Total maximum possible score (sum of all scores minus those marked NA)					
Score (Total ÷ Total maximum possible score)					

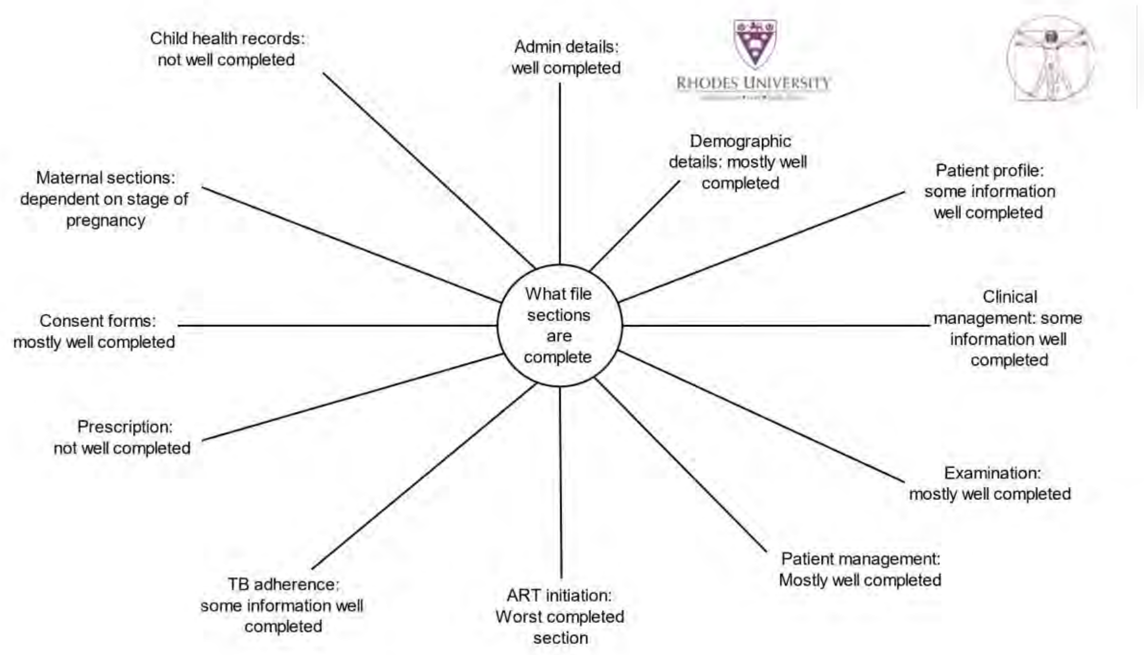
Appendix K: Adapted Ideal Clinic Manual checklist

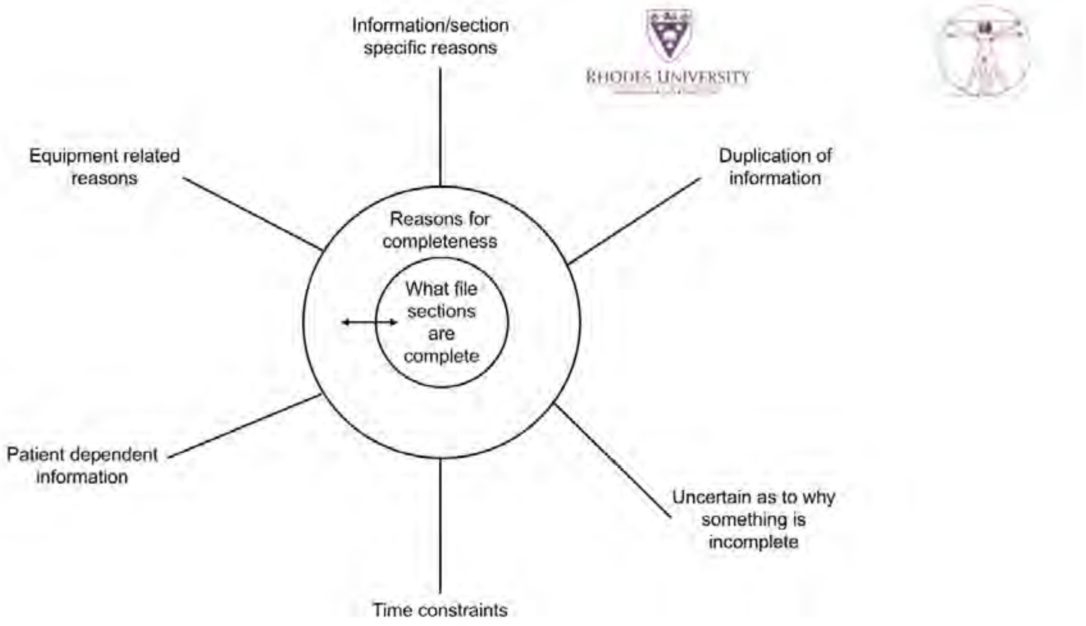
File section	Information details required
Administrative details	● Clinics name ● Name and Surname ● Patient file number (clinic) ● Patient file number (HPRS) ID/Refugree/passport number OR date of birth
Demographic details	Adult: ● Residential address ● Personal contact details ● Next of kin contact details ● Employment contact details (if employed) ● Marital status Children: ● Residential address ● Name and surname of parents or guardian ● Contact details of parents or guardian ● Next of kin contact details ● Gender
Patient profile	Adult: ● Type of employment ● Social Health risk factors ● Family history of chronic disease ● Known chronic disease ● Surgical history ● Allergies Children: ● Social ● Known chronic disease ● Surgical history ● Allergies
Clinical management	Adult: ● Height of patient-1st visit ● Weight at every visitBMI at 1st and 7th visit ● Temperature ● Blood pressure-every visit ● Respiratory rate ● Pulse rate-every visit ● Blood sugar-as per guidlelines ● Urine dipstick-as per guidelines ● Basic screening where indicated- HIV, TB, STI, Diabetes ● Current chronic condition ● Adherence to medication ● Reported side effects of medication ● Other hospital/doctor. visits ● Presenting complaints Children: ● Height of patient visit ● Weight at every visitWeight-for-height z score ● MUAC (every 3 months) ● Temperature ● Respiratory rate ● Pulse rate-every visit ● Blood sugar-as per guidelines ● Basic screening where indicated- HIV, TB, STI, Diabetes ● Current chronic condition ● Adherence to medication ● Reported side effects of medication ● Other hospital/doctor. visits ● Presenting complaints
Examination	● General(JACCOL) ● Respiratory ● Cardiovascular ● Gastrointestinal ● Mental state ● Central Nervous System ● Muskulo-skeletal ● Diagnosis-any visit
Patient management	● Investigation/test required ● Date of investigation/test requested ● Results of investigation/ test recorded ● Health education provided ● Treatment prescribed

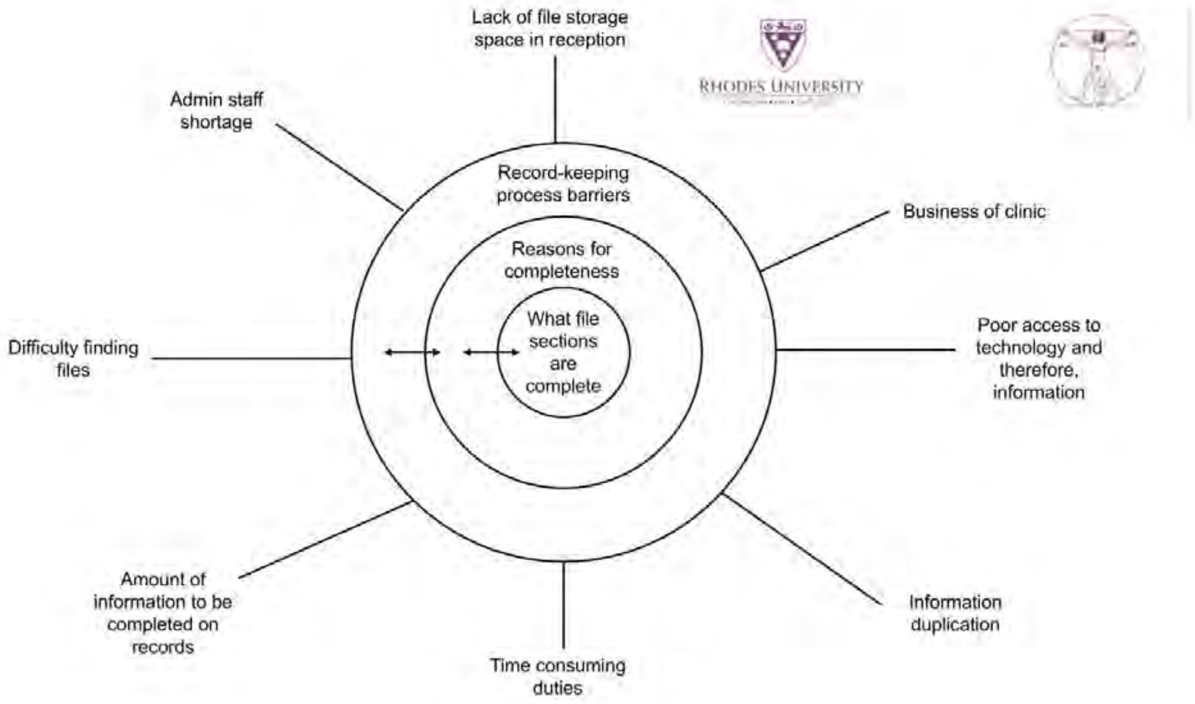
	● Rehabilitation (where applicable) ● Referral (where applicable) ● Date of next visit indicated (where applicable) ● HC practitioner name and surname ● HC practioners qualification ● HC practitioners signiture ● Date signed by HC practitioner
ART initiation (added section)	● Transferdetails ● WHO stage features ● Guardian status disclosure ● Nutritional assessment ● History and examination management plan ● Psycho-social readiness ● Pre-ART counselling ● Treatment buddy ● Home visit ● Name of community healthcare worker ● Support group attendance ● Clients understanding ● Baseline safety bloods ● Clinical factors ● Treatment plan ● Next visit (in weeks) ● HCP name and surname ● HCP Signature ● SANC/ HPCSA number ● Date
TB adherence (added section)	● Diagnosis method ● Patient category ● Disease classification ● Multidisciplinary team ● Name of community healthcare worker ● Date ● IP treatment drug and dosage ● Body weight- IP ● Treatment completion ● HPC name and surname ● HCP signature ● SANC/HPCSA number ● CP treatment drug and dosage ● Body weight- CP ● Treatment completion ● Treatment supervisor details ● Close contacts ● Treatment outcomes ● Referals ● HCP name and surname ● HCP signature ● SANC/HPCSA number
Prescription	● Patient name and surname ● ID number ● Age ● Allergies ● Name of medication ● Strength of medication ● Quantity Dosage ● Dosage form ● Batch number- for immunisations ● Prescriber name and surname ● Prescriber qualification ● Prescriber signature/ stamp ● Date signed by prescriber ● Dispenser name and surname ● Dispenser signature SANC/HPCSA number
Consent form	● Patient name and surname ● Users age, DoB or ID number ● Exact nature of operation/procedure/treatment ● Signed by patient/ parent/guardian ● Signed by healthcare provider Date ● Information is legible
Maternal health records	BANC 1st visit: ● Obstetric history ● Previous obstetric history and family ● Gestational age ● General examinations

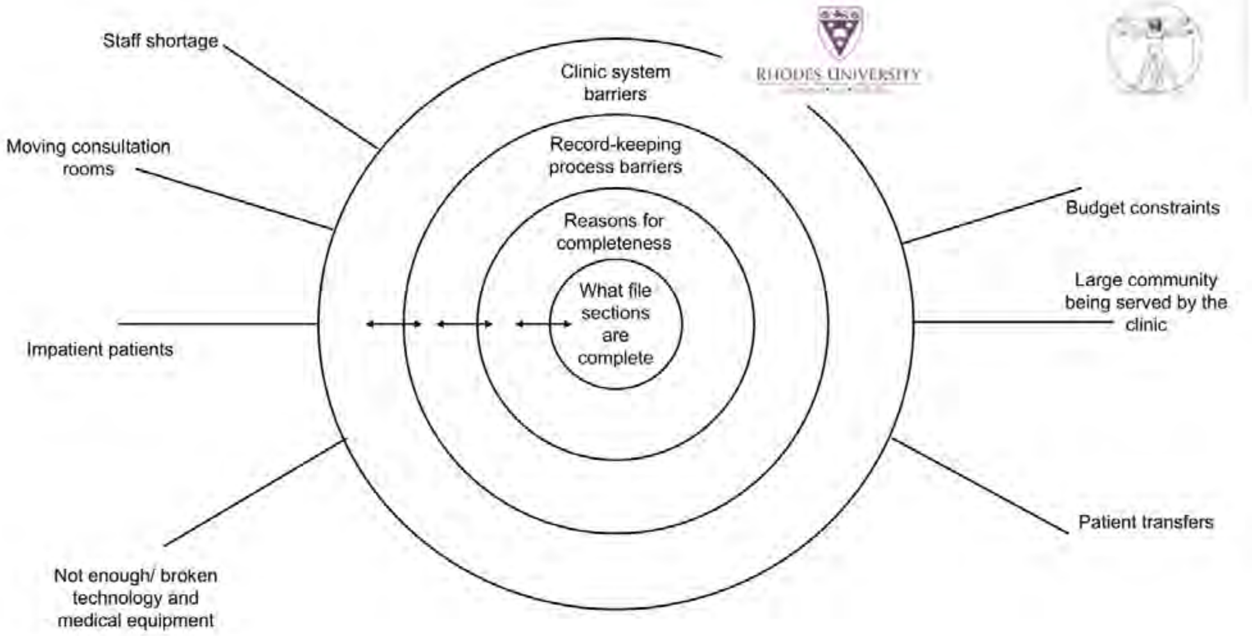
	● Abdomen-FHH examination ● vaginal examination ● HIV status ● Pregnancy risk screening ● Health education provided- including information on MomConnect ● HC practitioners name and surname ● HC practitioners qualification ● HC practitioners signature ● Date signed by HC practitioner BANC follow-up visit ● HIV status-retest ● General examination ● Abdomen examination ● Supplements- for mother ● Feeding practices for baby discussed ● Gestational graph plotted per visit ● HC practitioner name and surname ● HC practitioner qualification ● HC practitioner qualification ● Date signed by HC practitioner Delivery summary ● Birth date Birth weight ● Apgar score ● Delivery mode ● Pregnancy outcome ● HC practitioner name and surname ● HC practitioner qualification ● HC practitioner signature ● Date signed by HC practitioner Postnatal care visits ● General examination (3-6 days post delivery) ● General examination (6 weeks post delivery) ● Health education ● HC practitioner name and surname ● HC practitioner qualification ● HC practitioner signature ● Date signed by HC practitioner
Child health records	● History of immunisations ● Deworming treatment ● Vit A supplementation ● Developmental screening (6, 14 weeks and 6, 9, 18 months and 5-6 years) ● Growth charts completed ● Basic screening completed according to Road to Health charts

Appendix L: Clinic feedback session handout






Lack of file storage space in reception
RHODES UNIVERSITY
Admin staff shortage
Record-keeping process barriers
Business of clinic
Reasons for completeness
What file sections are complete
Difficulty finding files
Poor access to technology and therefore, information
Amount of information to be completed on records
Information duplication
Time consuming duties


Staff shortage
RHODES UNIVERSITY
Clinic system barriers
Moving consultation rooms
Record-keeping process barriers
Budget constraints
Reasons for completeness
What file sections are complete
Large community being served by the clinic
Impatient patients
Patient transfers
Not enough/ broken technology and medical equipment