INVESTIGATING THE USE OF ELECTRONIC REFERRALS TO FACILITATE THE PATIENT REFERRAL PROCESS IN SOUTHERN AFRICAN PUBLIC HOSPITALS

by

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(SHVMEK001)

A thesis submitted in fulfilment for the requirements for Degree of Doctor of Philosophy in Information Systems

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DECLARATION

I, Meke Iyaloo Kapepo, hereby declare that the thesis

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is my original work, (and that contributions to, and quotations in this thesis from the work of other people has been acknowledged through citations and references. Neither the
whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

Signature: Date:

Meke. I. Kapepo

DEDICATION

Oshinyolwa shino osho uumbangi kutya Meke Lya Jesus timbu, noMewiliko lyOmuwa, otwakala twa dhiginina (Dama) eitaalo (Meitavelo). Oshoka ondjila nando yakala ondhigu, nonda longo nomazigudhe, Omuwa okwa pendje Oshalihenda (Shali) yomagano gethimbo, oshowo okwasilendje ohenda (Tufilonghenda) opo ndi adhe oshilalakanenwa.

(Translation)
A praise poem dedicated to my family for their unwavering support throughout my academic journey.

To Shali, my beloved husband. Thank you for being my anchor and for your enduring support to our family during my time away. This project would have not been a success without you!

To my children, Mewiliko, Meitavelo and Metumo Kapepo. Thank you for understanding that Meme (Mommy) needed to work long hours. Your support during this journey means everything to me. May this work inspire you to believe that with determination and perseverance, you can achieve your greatest dreams!

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At the right time, the LORD, made this happen!

Isaiah 60:22b

PUBLICATIONS

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
ActAD	Activity Analysis and Development
AIDS	Acquired immunodeficiency syndrome
AT	Activity Theory
BYOD	Bring your Own Device
COVID-19	Coronavirus disease
DHIS	District Health Information system
DOH	Department of Health
DOI	Diffusion of Innovation
DRG	Design-reality Gap
e-health	Electronic health
EHR	Electronic Health Records
EMR	Electronic Medical records
EPMS	Electronic Patient Management System
EU	European Union
ePMS	Electronic Patient Monitoring System
e-referral	Electronic referrals
GDPR	General Data Protection Regulation
HCIMS	Health Care Information Management System
HCPs	Healthcare Providers
HIPAA	Health Insurance Portability and Accountability Act
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HL7	Health Level Seven
HPCN	Health Professional Clinical Number
ICT	Information and communication Technology
IS	Information systems

Abbreviation	Meaning
IT	Information Technology
ITU	International Telecommunication Union
LMIC	Low- and Middle-Income Countries
m-health	Mobile health
MO	Medical Officer
MoHSS	Ministry of Health and Social services
NDoH	National Department of Health
PRISMA	Systematic Reviews and Meta-Analyses
PMIS	Pharmacy Information System
POPIA	Protection of Personal Information Act
SADC	Southern African Development Community
SEIPS	Systems Engineering Initiative for Patient Safety
SIT	Shadow Information technology
SMS	Short Message Service
USAID	United States Agency for International Development
WHO	World Health Organisation

ABSTRACT

Digital health interventions, particularly electronic referrals (e-referrals) and health information systems, have revolutionised clinical workflows in public hospitals by automating processes. However, the utilisation of e-referrals has yielded mixed outcomes, with varying levels of success in organisational processes. While most healthcare providers (HCPs) in high-income countries have effectively leveraged the benefits of e-referrals, those in low- and middle-income countries have been slower in their adoption and implementation. Consequently, there is a dearth of comprehensive studies documenting the successes and advantages of e-referrals in these contexts. Most studies highlight constraints and challenges related to the significant infrastructural challenges in low- and middle-income countries, ranging from limited internet access, insufficient user involvement, and design limitations within existing health information systems. Consequently, studies conducted in these settings primarily highlight rather than present the potential benefits of e-referrals.

In the face of these limitations, HCPs resort to workarounds and improvisations in the form of Shadow Information Technologies (SIT) by using platforms such as WhatsApp to complete their work. Such workarounds, while practical, may not offer the same level of information security as they are neither mandated nor supported by the Information Technology (IT) department.

The purpose of this study is to investigate the use of electronic referrals to facilitate the patient referral process in Southern African public hospitals. Employing a multiple case study strategy, the research examined use of e-referrals in two tertiary public hospitals in South Africa's Western Cape Province and Namibia's Khomas region through a comparative study. Additionally, the study explored workaround practices related to mandated health information systems in order to understand their occurrence and effect on referral outcomes. Semi-structured interviews were conducted with 31 HCPs in these settings, and a thematic approach was employed to analyse the data.

The theoretical explanation of empirical findings was provided through the lens of the design-reality framework, the Process framework for Healthcare Information System Workarounds and Impacts, and the Systems Engineering Patient Safety model (SEIPS 3.0).

The study findings show substantial evidence indicating design reality gaps between the HCP's requirements to complete work and the design of the referral applications in public hospitals where the research was conducted. As a result of these gaps, HCPs enacted workarounds in various forms, including the utilisation of Shadow IT, augmenting existing systems with alternative computer-based, telephonic, and paper-based referrals, and adapting the existing e-referral applications to accommodate work-related misfits. These practices suggested design-reality gaps. For instance, the e-referrals were inadequately designed and were not accommodating some of the real needs of HCPs. Furthermore, the design-reality gaps were attributed to inadequate functionalities of health information systems, poor management systems and structures, lack of end-user involvement and IT support, and the absence of relevant IT policies and policy awareness among HCPs. These gaps resulted in ineffective use of e-health applications and enactment of workarounds to these e-health applications in both case studies.

Additionally, the study found that electronic applications were introduced in these hospitals without a comprehensive understanding of the context and needs of HCPs. Existing e-health applications, such as the District Health Information Systems (DHIS 2) and the Vula application, did not fully support the referral process in public hospitals. In the one case study, Vula's implementation lacked adequate involvement from HCPs, failing to address their unique needs and contextual requirements. In the other case study, although DHIS2 was implemented as the national Health Information system in Namibia, it was not utilised for referral purposes but rather for administrative tasks.

These challenges led to frustration and decreased satisfaction with the mentioned e-health applications, prompting HCPs to resort to workarounds to complete their work.

These workaround practices stemmed from the autonomy exercised by HCPs to deliberately circumvent the mandated systems in order to achieve their tasks effectively and efficiently.

The conceptual framework developed from the data explained these workaround practices emerging from design-reality gaps.

The use of Shadow IT and workaround practices introduced unprecedented security risks to clinical information shared in shadow systems, compromising patient privacy and confidentiality. The study findings demonstrated that workarounds significantly amplified patient safety concerns and led to negative outcomes in the referral process and overall health organisations. In general, Shadow IT should not be viewed negatively, but should be viewed as opportunities for revealing the real needs and challenges encountered by HCPs. One could argue that the utilisation of Shadow IT not only exposes design-reality gaps in existing systems but also pinpoints the realities and demands of healthcare professionals within their specific environments. Consequently, Shadow IT provides innovative solutions to address limitations in the existing health information systems, particularly in enhancing healthcare delivery for referral processes.

In conclusion, this research highlights the challenges and complexities in implementing electronic referrals in Southern African public hospitals. Understanding the underlying design-reality gaps and workaround practices can help health organisations develop more contextually relevant e-referral solutions to enhance patient safety and overall healthcare outcomes.

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CHAPTER 1: Introduction

1.1 Introduction

Information systems have been used in both intended and unintended ways which results in positive or negative outcomes for organisational processes. Healthcare organisations increasingly adopt information systems to achieve planned objectives, yet unintended uses often emerge, leading to both positive and negative outcomes. Healthcare providers (HCPs) working at public hospitals are not an exception, as they use health information systems (HIS) in unintended ways and they often resort to workarounds to accomplish their work (Ogundaini and Dela Harpe, 2022; Blijleven et al., 2022). Despite their prevalence and impact, these unintended uses, characterised as workarounds or improvisations, remain under-theorised in healthcare and health informatics research. Current studies lack a comprehensive socio-technical perspective necessary to understand the underlying contextual factors contributing to these practices, particularly in resource-constrained settings. This research addresses this gap by investigating the workaround practices of HCPs and their use of electronic referrals (e-referrals) in facilitating the patient referral process in public hospitals. Addressing this gap is crucial for developing effective strategies and designing health information systems that better accommodate both intended and unintended use, not only in healthcare settings but in diverse organisational contexts.

An interpretive research paradigm is employed to interrogate the phenomenon of interest in multiple case studies, from Namibia and South Africa. Multiple cases from these settings are selected to explore contextual conditions regarding electronic referrals intended and unintended use. An e-referral intervention was introduced in the two settings and the rationale underlying the selection of multiple-case studies is to explain similar and contrasting results on the use and non-use of e-referrals from the two case studies.

This chapter provides an overview of the thesis. A study background is described outlining the necessary context and justification for the research. The research problem, questions and study approach are highlighted to determine the study focus. The chapter concludes by stating the envisaged study contribution and structure of the thesis.

1.2 Study background

Digital health interventions are implemented in public health institutions to streamline processes and improve efficiency in collaboration and communication between involved HCPs. The World Health Organisation defines digital health interventions as mobile and digital technologies used to support any form of health system needs (WHO, 2023). Electronic referrals (e-referrals) are classified as a digital health intervention or a subset of e-health applications used to electronically store patient-related information on computers for purposes of referrals (Liddy et al., 2015). Liddy's definition of electronic referrals is adopted for this study.

Electronic referrals (e-referrals) also play an important role in the automation of patient referral processes. This automation enables information to be transmitted and shared between multiple healthcare providers using digital devices (Bouamrane & Mair, 2014).

Digital health interventions including e-referrals and other health information systems are implemented in health organisations such as hospitals to automate clinical workflows. Clinical workflows including day-to-day referral activities of HCPs are improved and enhanced because of automation (Hysong et al., 2011).

Electronic health applications equally improve efficiency in clinical processes, enhance access to health services; improve and secure storage of health information and better communication amongst HCPs (Kim-Hwang et al., 2010). Additionally, electronic referral solutions offer a more efficient and effective way for HCPs to share and update patient information and offer effective service and care delivery to patients (Heimly, 2009). Electronic referrals are widely adopted in developed countries such as the United States, Finland, Iran, Norway, Denmark, Australia, and the Netherlands (Hysong et al., 2011; Kim-Hwang et al., 2010).

By contrast, developing countries have been relatively slow in their adoption and implementation of e-referral initiatives. There are therefore limited studies documenting the successes and benefits of e-referrals in developing contexts.

Instead, most studies in these settings generally report challenges and unintended consequences brought about by the deployment of health information systems in these settings (Morris et al., 2021; Mutale et al., 2013; Ogundaini et al., 2021). For example, when health information systems are implemented, users may encounter limitations or constraints in workflow ensuing from ineffective system design, inadequate training, or poor implementation of e-health strategies. These constraints can have negative consequences and be beneficial to health organisations (Ogundaini et al., 2021).

Other constraints reported in the literature are linked to pre-implementation matters related to infrastructural challenges or adoption approaches taken to roll out Information systems (IS). For example, lack of internet access or data (Watkins et al., 2018; Ishijima et al., 2015); lack of user involvement (Laumer, Maier, C., & Weitzel, 2017; Mars, & Scott, 2016) in the systems requirements phase and ultimately in the system design.

In other cases, top-down approaches (such as the political influence of the government or senior management) are employed to make adoption decisions without end-user involvement. To overcome some of these limitations, end-users find alternative ways to complete their work.

Literature in developing contexts, consequently, shows this interesting phenomenon where healthcare providers are resorting to workarounds to complete their work. This phenomenon is characterised by use of informal systems or social media platforms such as WhatsApp to work around formal or mandated systems in healthcare organisations (Kapepo et al., 2021; Kauta et al., 2020).

The purpose of this study is thus to investigate the use of electronic referrals (the phenomenon of interest) for facilitating the patient referral process in Southern African public hospitals (the empirical situation). Additionally, the study examines workaround practices to mandated health information systems to understand why they occur and how they affect referral outcomes.

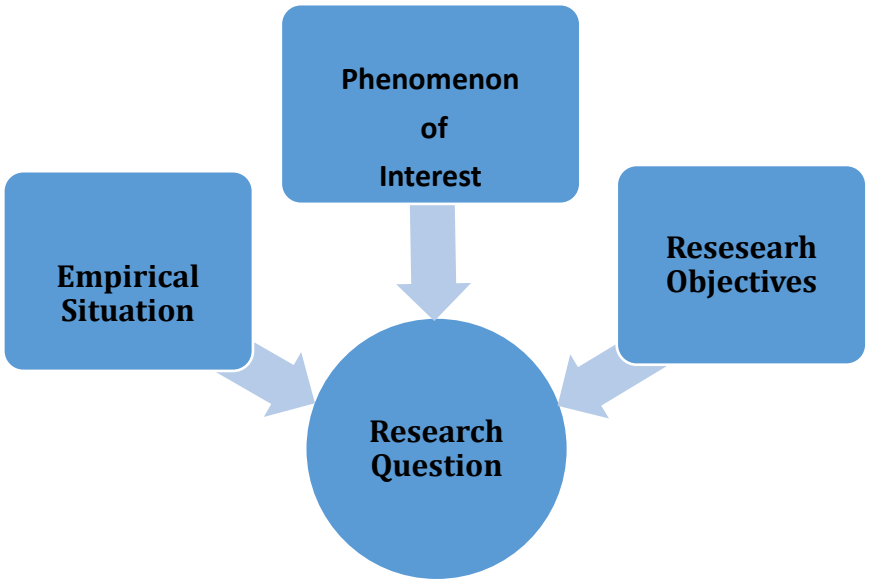


Figure 1.1: Study research question

The research also builds rival explanations for the unintended use of e-referrals in developing contexts. The problem statement, research question and study objectives are discussed in the next section.

1.3 Problem statement

Information systems have been used in intended and unintended ways which can result in positive or negative outcomes in the organisational process. The intended use of an information system refers to its use for the designed and planned objectives (Patterson, 2018). On the other hand, unintended use involves tasks or activities that were not part of the original purpose and design of the system (Blijleven, 2017; Ogundaini et al., 2021).

Organisations adopt information systems to leverage their potential to achieve positive outcomes. Although information systems are beneficial and bring about favourable outcomes for hospitals and other health organisations alike, issues of unintended use and negative consequences have often surfaced in healthcare contexts (Blijleven et al., 2017; Beerepoot, 2021).

In the information systems discipline, this phenomenon is widely observed, and it is characterised as workarounds, feral information technology (Feral IT), Shadow Information Technology (Shadow IT), bricolage or improvisation (Raković et al., 2020; Kopper et al., 2018). Rakoviv et., al (2020), defines shadow IT as the use of third-party software solutions, hardware and services without the approval of the official IT unit within an organisation. He explains that generally this practice often emerges when end-users utilise personal devices or third-party applications to perform work activities to improve efficiency or circumvent perceived limitations in the mandated systems.

While this phenomenon is prevalent in healthcare and health informatics-related disciplines, it is under-theorised. As a result, the existing research in healthcare-related disciplines inadequately explains the unintended use of Health Information Systems and its relationship with socio-technical issues. Moreover, workaround practices are more prevalent in limited resource settings and studies in these contexts lack the socio-technical perspective to work systems and unique contextual factors giving rise to these workarounds (Morris et al., 2021; Williams & Kovarik, 2018). Current studies overlook the socio-technical factors influencing these practices. It is thus important to address this critical gap through the socio-technical lens that examines both the technical and social aspects.

This research contributes to the Information systems and health informatics field by providing a better explanation of the unintended use of health information systems from a socio-technical perspective. Building upon the previous research, this study moves the field forward by problemitising workaround practices and offering a theoretical explanation of their occurrence in public hospitals. The research framework explains the rationales behind HCPs workarounds to HIS. This research can inform practitioners and policymakers on strategies for designing effective HIS systems and taking into consideration the contextual needs of HCPs. This research is thus significant as it offers both theoretical and practical explanations to understand the unintended use of Information Systems in healthcare settings.

This study contends that workarounds should not only be viewed negatively, instead, they can be positive because they present opportunities to engage HCPs and other stakeholders in understanding the risks associated with these practices.

Involving HCPs in finding solutions to their challenges fosters a culture of innovation and continuous process improvement in health organisations.

This research aims to address the following research question:

RQ1: How do healthcare providers (HCPs) use e-referrals to facilitate the patient referral process in Southern African public hospitals?

The research sub-questions focus on pre-implementation issues related to work systems and issues with existing referral approaches. Furthermore, post-implementation issues related to the use and non-use of e-referrals and work practices of healthcare providers are also interrogated.

The secondary questions and research objectives are presented in Table 1.1.

Table 1.1: Mapping the secondary research questions to the research objectives

Secondary research questions	Research Objectives
RQ2: Why do healthcare providers (HCPs) enact workarounds to e-referrals in public hospitals?	Identify causing factors driving the enactment of workaround practices to e-referrals. Examine and explain why healthcare providers enact workarounds to e-referrals
RQ3: How do healthcare providers (HCPs) workaround practices affect referral outcomes?	Explain the influence of workaround practices on the referral process outcomes.

This research aims to achieve several objectives. First, it seeks to identify and describe causing factors driving the enactment of workaround practices to e-referrals in public hospitals. Second, it aims to examine HCPs workaround practices to official HIS and explain rationales behind workaround practices to e-referrals. Third, the research aims to explain the influence of workaround practices on the referral process outcomes such as patient safety.

Patient safety refers to practices aimed at preventing harm to patients during the course of healthcare service deliver (Yang, et al., 2012). In this research, patient safety specifically focuses on practices that protect patient privacy and confidentiality during the transmission of information between healthcare professionals in the electronic referral process. The secondary research questions and objectives therefore incorporate a range of socio-technical concepts to explain the phenomenon of interest.

These social concepts comprise of work practices of healthcare providers namely, medical doctors, and medical specialists and the tools they use for facilitating referral activities. In this study, referral activities are defined as tasks undertaken by healthcare providers to refer patients for advanced health care and management.

The South African Department of Health categorises referrals into upward, downward, lateral or internal (in-patient). Upward referrals are defined as "the process by which healthcare providers at lower levels of the healthcare system seek the assistance of providers, who are better equipped or specially trained, to guide them in managing, or to take over responsibility for a particular episode of a clinical condition in a patient" (South Africa, 2020 p.4). These referrals are initiated to seek an expert opinion regarding the patient or additional health services, care, and management for the patient. On the other hand, downward referrals refer to the process where patients are transferred from higher levels of care, such as tertiary or secondary hospitals, to lower levels of care, such as district hospitals, community health centres, or primary healthcare clinics.

These types of referrals occur when a patient no longer requires specialised care and can be managed by healthcare providers at a lower-level facility, ensuring that resources at higher-level facilities are available for patients who need more intensive or specialised treatment (South Africa, 2020). Inpatient referrals are the process of transferring a patient from one department or specialty service to another within the same healthcare facility treatment (South Africa, 2020; Ministry of Health and Social services (MoHSS) Namibia (2015).

This study examines electronic tools used in facilitating all types of patient referrals (upward, downward, lateral, and internal) in public hospitals.

The focus is to study the official electronic referral applications adopted and used by in the Department of Health in the Western Cape Province and the Ministry of Health and Social Services in Namibia.

1.4 Summary of research methodology

This study employs a multiple case study approach with multiple sources of evidence to investigate the phenomenon of interest. An interpretive philosophical approach is followed to obtain HCPs' understanding of e-referrals use and work practices through semi-structured interviews (Walsham, 2006). Multiple case studies of public hospitals in South Africa and Namibia are selected to compare the use and non-use of e-referrals in the two settings. Observations of HCPs' referral activities on the Vula smartphone application (Vula app) is undertaken to better understand their work practices. Furthermore, a document analysis of e-health strategies, referral policies and protocols is conducted to gain an understanding of the primary functions of a referral system, tools used to support these systems and the overall patient referral process. Thematic analysis using Nvivo is conducted to identify the study themes within the qualitative data.

By employing the above-mentioned research methodology and approaches, this research goes beyond investigating the intended use of information systems but also investigates unintended use of information systems. Unintended use of information systems is examined from a workaround perspective by conceptualising the causal factors behind the enactment of workarounds. The theories underpinning this research are discussed in the next section.

1.5 Summary of theoretical foundation

The underlying logic and supporting empirical evidence from the study are complemented by theories used in the research. An initial conceptual framework (Figure 6.1) is developed to explain the workarounds to e-referrals in public hospitals. Theoretical interpretations of empirical findings are achieved through three theories. The Activity Analysis and Development (ActAD) framework, an enhanced form of Activity Theory, is used as a sensitising lens to gain insights into the patient referral process (Gregor, 2006; Klein & Myers, 1999).

The ActAD framework was utilised as a descriptive theory to describe subjects involved in the patient referral process, their activities and the tools used to facilitate such activities.

Since the researcher is not working in a healthcare setting herself, it was important to use this framework as a sensitising device for sense-making and descriptive purposes (Baskerville, & Myers, 2002).

While the ActAD was useful in the initial data collection and analysis, its concepts offered limited explanatory power. This research therefore further draws concepts from the Process framework for Healthcare Information System Workarounds and Impacts (Yang et al., 2012) and the Systems Engineering Patient Safety (SEIPS 3.0) framework to develop a theoretical understanding of the phenomenon of interest (Carayon et al., 2020).

To gain insights into work systems and workarounds, theoretical perspectives from the Theory of Workarounds (Alter, 2014) and the new Theory of IT innovation, adoption, and adaptation, (Alter, 2018), the design-reality gaps framework (Albertus & Makoza, 2023; Heek, 2006) were considered. The next section discusses the significance of the study.

1.6 Significance and contribution of the study

This research is of contemporary interest as it contributes to current and ongoing debates and discussions on perspectives and theories in Information Systems.

The research perspective recognises both pre-implementation and post-implementation environments in which HCPs use mandated HIS but may also develop workarounds that subvert prescribed health processes or organisational policies.

The conceptualisation of workarounds to electronic referrals in public hospitals is original and important. This conceptualization is significant in foregrounding theoretical perspectives explaining workaround practices concerning socio-technical issues and the use of HIS in low- and middle-income countries. The interpretive perspective surfaces unique contextual factors explaining causal factors behind non-compliant practices of HCPs in limited resource settings.

The study thus makes several contributions. A methodological contribution is made through the development of a work systems snapshot (Table 6.6 and 6.7) using the work system method as a process improvement approach for information systems and healthcare processes (Alter, 2002). A theoretical contribution is also made through the development of propositions in Chapter 8 and a theoretical framework illustrated Figure 8.1. The next section outlines the thesis structure.

1.7 Thesis outline

This section provides an overview of the thesis chapters. The research questions are mapped to the thesis chapters and theoretical frameworks employed in the study as illustrated in Figure 1.2.

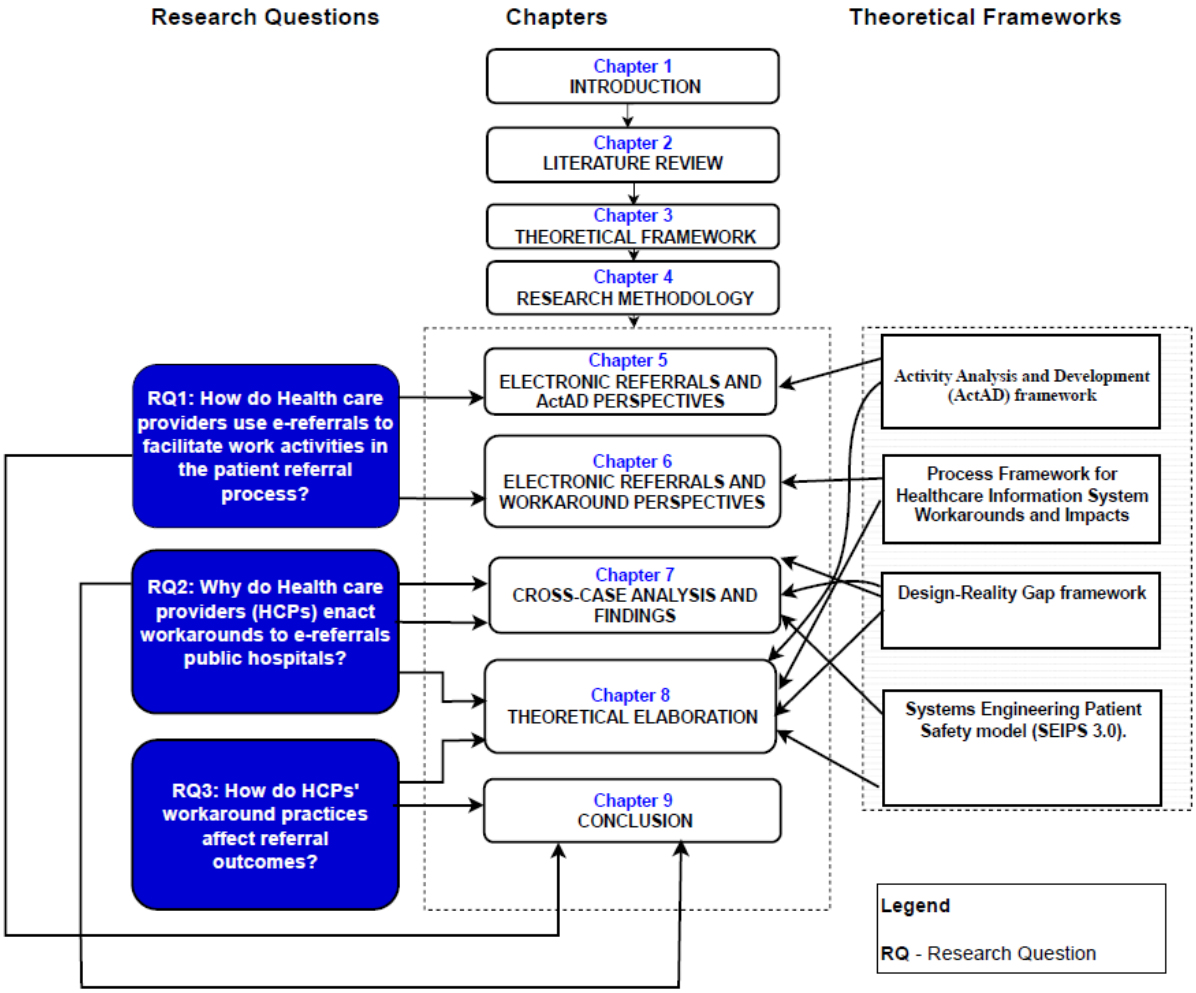


Figure 1.2 :Mapping of research questions to the chapters in the thesis

Chapter 1: Introduced the study by providing a contextual background to the phenomenon of interest. The problem statement, questions and study objectives are presented.

Chapter 2: Provides the basis and foundation of the study by presenting a review of preliminary studies on the intended and unintended use of general e-health, digital health interventions and health information systems (HIS) in low- and middle-income countries (LMIC). Issues related to contextual limitations and benefits associated with e-referrals are discussed in different public hospital settings. Furthermore, the literature on constraints giving rise to unintended use of health information systems is examined.

Chapter 3: The theoretical foundations of the study are presented in this chapter. First by providing an overview of different theoretical perspectives, and then expounding on their relevance to this study. Limitations of these theories are also highlighted.

Chapter 4: This chapter outlines the research approach, methodology and strategies employed for data collection and analysis.

Chapter 5: This chapter reports findings from phase one of the data analysis. The Activity Analysis and Development (ActAD) framework is particularised to the empirical situation to describe evidence from semi-structured interviews. Findings on referral activities of HCPs, their role in public hospitals and the role of tools in facilitating these activities are discussed. Given the limited explanatory power of the ActAD framework, an inductive analytical approach is pursued to achieve other theoretical interpretations of the data.

Chapter 6: This chapter presents a conceptual framework developed (Figure 6.1) from empirical evidence of the study. Findings on misfits between work and e-referrals in public hospitals are discussed. A conceptualisation of workarounds is discussed to explain the causal factors behind the enactment of workaround practices to e-referrals in the patient referral process in Southern African public hospitals.

The process framework for healthcare Information system workarounds and impacts and the Systems Engineering Patient Safety model (SEIPS) model are employed to explain HCPs' workaround practices. The empirical findings in Chapter 6 are linked to Chapter 7.

Chapter 7: A cross-case analysis of multiple-case study evidence is presented to achieve rival explanations of causal factors behind workaround practices. The causal factors behind the enactment of workarounds are interpreted through the design-reality gap framework. Cross-case findings focused on similarities and differences in the two cases are discussed. Chapter 7 presents relationships between workarounds and design reality gaps affecting e-referral outcomes for patients, HCPs and health organisations.

Chapter 8: This chapter provides a theoretical elaboration of empirical findings for this research. The explanation is presented through theoretical proportions demonstrating relationships between workarounds and design-reality gaps. The propositions further provide an explanation that improvisations and workarounds to official information systems are a result of the gaps between the design of the e-referrals applications and contextual realities in which the systems were implemented. Furthermore, a final theoretical framework is presented (Figure 8.1) to illustrate design-reality gaps giving rise to the emergence of workarounds to e-referrals in Southern African public hospitals.

Finally, practical contributions, research implications, recommendations and future research are discussed in **Chapter 9.**

CHAPTER 2: Literature Review

2.1. Introduction

In recent years, researchers have become increasingly interested in investigating the use of Electronic Health Solutions (e-health) and Health Information Systems (HIS) for facilitating communication and collaboration between healthcare providers (HCPs) in different healthcare settings. Moreover, these digital interventions are not only used in intended but also unintended ways which can result in both positive and negative outcomes in the organisational process. Positive outcomes range from efficient and streamlined health processes, better coordination of patient care, a decrease in self-referrals and unnecessary visits to health facilities of high care and improved communication and collaboration between HCPs and specialists. Although digital health interventions have been reported to bring about favourable outcomes for health organisations and hospitals alike, issues of unintended use have surfaced in healthcare contexts. This chapter surveys the literature to outline the constraints and benefits of e-health use in different contexts.

The remainder of this chapter is structured into five sections. Section 2.2 presents a literature review on e-health background and e-referrals use. Literature on the intended use and benefits of e-health and associated challenges are presented in Section 2.3 and Section 2.4, respectively. A contextual background on the use of e-referrals for patient referral processes in public hospitals is discussed in Section 2.5. Section 2.6 discusses related work on the unintended use of e-health and workaround practices emerging from power relations in public hospitals. A chapter summary is presented in Section 2.7.

2.2. Electronic Health (e-health) and Mobile health (m-health)

Electronic Health (e-health) is defined as the use of Information and Communication Technologies (ICT) for health (WHO, 2022).

The goal of e-health is to improve communication and coordination of healthcare and streamline health processes to improve the quality of care. E-health is categorised into different subsets, namely, the use of electronic health records (Katurura & Cilliers, 2018; Luna et al., 2014); m-health (Hoque et al., 2020) and other general ICTs such as health information systems (Heeks, 2006; Walsham, 2020).

In the context of this study, electronic referrals (e-referrals) and mobile health applications (m-health) are used for facilitating a patient referral process, are examined. Electronic referrals (e-referrals) are a subset of e-health that focuses on electronically storing patient referrals and related information on computers or mobile devices. Bouamrane and Mair (2014) further define e-referrals as the electronic transmission of patient data and clinical requests between health service providers.

The main purpose of using e-referral applications is to support the documentation of referrals, particularly by auto-populating patient information from electronic medical records, and to automate the processing (Bouamrane & Mair 2014). Azamar-Alonso et al., 2019, assert that the purpose of e-referrals is to improve waiting times and automate the referral process to standardise the transmission of information and communication between HCPs.

The focus of the recent literature review has been on the use of electronic referrals in the provision of patient referral services, particularly through the use of mobile technologies (m-health). Notably, studies on the use of e-referrals are more prevalent in the global north, with research conducted in countries such as Canada, Denmark, France, New Zealand, the United States, and the United Kingdom (Azamar-Alonso et al, 2019; Montellier et al., 2022). While there is limited research specifically addressing e-referral systems in the global south, a substantial body of literature has been published on the general use of e-health in Sub-Saharan countries over the past decade. Bervell and Al-Samarraie's scoping review (2019) offers an overview of the status of e-health and m-health in the region. Figure 2.1 illustrates various m-health and e-health initiatives in sub-Saharan Africa.

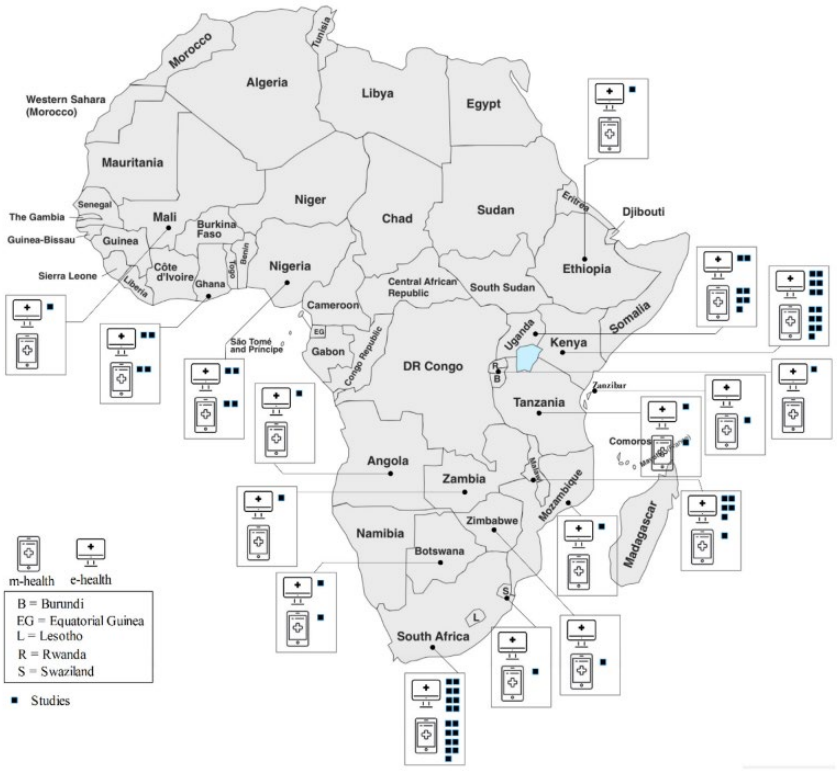


Figure 2.1: Use of m-health and e-health in Sub-Saharan Africa (Bervell & Al-Samarraie, 2019)

A total of 66 papers across 17 countries were reviewed within the Sub-Saharan region (Bervell and Al-Samarraie; 2019, p. 2). Their study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to identify, select, assess, and summarise the findings from the various settings. Their study demonstrated that e-health and m-health were adopted to promote adherence towards healthcare services (e.g. text messaging alerts for antenatal care for pregnant women) to support diagnostic usage in health delivery and patient monitoring and evaluation.

Electronic health interventions were reported to be concentrated in South Africa and rural settings of Kenya as shown in Figure 2.1. It is however noteworthy that no e-health and m-health initiative was recorded in Namibia (Bervell & Al-Samarraie, 2019). Although evidence on the lack of m-health and e-health implementation is presented by Bervell and Al-Samarraie (2019), research efforts have been made to explore and examine the use of health information systems and integration in Namibia (Gerson & Shava, 2020; Mutasa, 2022; Shaanika, 2021).

2.3. Intended use and benefits of e-referrals

Electronic patient referrals (e-referrals) are commonly studied in high-income country contexts. More recently, e-referrals have been popularly used during the COVID pandemic to ensure effective and efficient health service delivery in different hospitals (Dark, et al., 2022; WHO, 2023). The extensive and successful use of e-referrals is reported to be linked to effective and efficient referral processes in health organisations. A study by Kim-Hwang (2010) in the United States made a comparison between e-referrals and paper-based referrals. This study concluded that the use of e-referrals promoted standardised referral processes and potentially improved communication between referring HCPs and clinicians. In another study conducted in Canada, MacGregor et al. (2009) assess the implementation of a paediatric referral system in a hospital. Their study demonstrates the use of the electronic referral system significantly improved communication between the referring professionals and specialists. Implementation of the system resulted in an increase of 6 % in the total referrals processed and a decrease of 2.7% in inappropriate referrals.

Montellier et al. (2022), describe the design and implementation of an electronic referral system to facilitate patient admissions in a French hospital. Their study reported that the system was valuable in improving the coordination of hospital admissions between primary care providers (PCPs) and hospital specialists. The study results also demonstrate the potential of the referral system in facilitating direct patient admissions within a short time frame, and it was reported to be efficient and useful in the first wave of COVID-19 where communication was limited. A study by Azamar-Alonso et al. (2019), conducted a scoping review of electronic referrals in health care. Although beneficial, their review was mainly limited to e-referrals use in the global north.

Naseriasl et al., (2015) provide an overview of electronic referrals or electronic referral solutions used in other developed countries. The successful implementation and use of electronic referral systems in the global north is therefore well-documented in the literature.

The benefits derived from the use of these systems were the improvement of communication and collaboration between HCPs and specialists (Montpellier et al., 2022; Zanaboni & Wootton, 2012), a streamlined referral process and a seamless exchange of information (Gu et al., 2014; Warren et al., 2011), a decrease in unnecessary visits to specialists (Fischer et al. 2010;) and decreased waiting times (Gu et al., 2014; Keely et al., 2013). Literature also reports that electronic referral solutions are used in these countries to provide specialised services to health institutions in remote areas. Most of the services recorded are both synchronous and asynchronous for teleconsultations and are also used to seek a second opinion on health cases.

Despite the documented benefits, limited literature on the use of electronic referrals exists in low- and middle-income countries (LMIC). A few scholars have documented the successful use of e-referrals in medically underserved settings. This study is thus exclusively concerned with reviewing scholarly work published on the use of electronic referrals in resource-constrained settings. Emphasis is particularly on low and middle-income countries (Namibia and South Africa). South Africa was selected as one setting identified with a high number of e-health initiatives and Namibia as a setting with minimal e-health interventions.

In South Africa, some public hospitals are utilising paper-based records in various provinces. However, the National Department of Health (NDoH) has made efforts to digitise patient records in certain public hospitals (Department of Health (DoH) South Africa, 2022). In particular, the National Department of Health has made efforts to implement initiatives such as the Health Patient Registration System (HPRS) where 57,000,000 patients are registered in 3111 public health facilities (Department of Health (DoH) South Africa, 2022, p. 18).

The national digital health strategy and e-health strategies are some of the other initiatives implemented to conduct a review of the progress made in the implementation of digital health applications. For example, there are several routine systems such as the District Health Management Information Systems (DHMIS); mobile health initiatives such as *MomConnect* and Stock Visibility System (SVS) implemented to aid healthcare service delivery (Department of Health (DoH) South Africa, 2015).

Although there is evidence of these great initiatives, the majority of health facilities in South Africa are still utilising paper-based patient records Department of Health (DoH) South Africa, 2022).

In contrast, while patient records in Namibian public hospitals are primarily paper-based, there are various disparate e-health systems used in some tertiary hospitals, such as the District Health Information Systems 2 (DHIS2), Electronic Patient Management System, and Electronic Patient Monitoring System, which are predominantly utilised for administrative purposes and disease management (Khan & Edward, 2012). Additionally, an e-health strategy was recently developed and adopted in 2021 (Ministry of Health and Social Services (MoHSS) Namibia (2021). Although the above-reported initiatives have yielded benefits related to the adoption of e-health initiatives, there are socio-technical factors and unique contextual issues that warrant further exploration. The next section discusses the constraints and challenges associated with e-referrals.

2.4. Constraints and challenges associated with e-referrals.

Despite the reported benefits of e-referrals in the global north, countries in the global south i.e. low and middle-income countries (LMICs) experience constraints and challenges related to the implementation and use of e-health applications in health organisations.

Several researchers (Mayoka et al., 2012; Zailani et al., 2014) outline constraints related to a lack of readiness assessments, inadequate infrastructure, shortage of skills, design-reality gaps and absence of laws and regulations in these settings. Pare et al. (2011) argue that organisational readiness is a key factor for the successful implementation and use of clinical information systems. When readiness assessments are not conducted to determine the fit between health information systems and organisational processes, it can impede the implementation and institutionalisation of e-health initiatives.

A study by Yusif et al., (2020) analyses e-health readiness assessment factors in developing countries. Their study lists readiness factors such as the absence of e-health regulatory policies, limited resources for rural health facilities and ICT infrastructure.

While this particular study was conducted in Ghana, these readiness factors are observed elsewhere in the literature by other studies in similar settings.

For example, in rural Uganda, Mayoka et al. (2012) discuss hindrances to telemedicine adoption, implementation and sustainability. Telemedicine is a subset of e-health, and in their study, they found that factors impeding implementation and thereafter use of telemedicine are lack of policies, knowledge and skills and resistance to change by HCPs in the hospitals. In another study in Malaysia, determinants of e-health are explored (Zailani et al, 2014). Even though this study looked at determinants of telemedicine, the findings are similar to those of Mayoka (2012) and Yusif et al. (2020). Zailani et al. (2014) agrees that factors such as government policies, top management support, perception of usefulness and computer self-efficiency have a positive impact on telemedicine acceptance in public hospitals, and these were lacking in Malaysia.

In Tanzania, a study by Ishijima et al., (2015) discusses and highlights inadequate computer skills and unsatisfactory infrastructure for information and communication technology, as some of the challenges impeding the implementation of e-health initiatives. Even though some of the above studies focus on the adoption of e-health initiatives, the outlined challenges apply to the other e-health initiatives (such as e-referrals) in developing contexts. Several studies, for example, underscore constraints linked to e-referrals that are embedded as part of existing Health Information Systems or Electronic Medical Records (EMR)/Electronic Health Records (EHR).

In Zambia, for example, an electronic referral system was deployed as the first instance of a complete EMR system (Darcy et al., 2010). This is advantageous because obstacles faced by full EMR systems can be easily addressed in a smaller system. Webster (2011) agrees with this finding, as his study argues that implementing highly centralised systems and rolling them out downward to users (clinicians and patients) does not work. Other e-health projects in Zambia include the Electronic Immunisation Registry, which tracks children’s immunisations (Uwera et al., 2024).

Uwera's study is one of several studies aimed at identifying additional digital health interventions to support and enhance the health information system for the immunisation program.

Literature, therefore, outlines that constraints to the implementation of e-health initiatives are due to a lack of readiness, and inadequate infrastructural and economic barriers in these countries. Additionally, most of these studies also reported general challenges linked to a lack of skills and training on e-health and a lack of system integration for specific health systems implemented in the public sector. The next section discusses the contextual background for the study.

2.5. Contextual background

2.5.1. The South African healthcare system and e-health status

The South African healthcare system consists of the public sector, the private sector, and the African traditional medicine sector. The majority of the population (90%) is served by the public health system which is administered by the National Department of Health, provincial health departments, and municipal health departments (Western Cape Department of Health South Africa, 2020).

Healthcare services are rendered by different healthcare facilities, namely, district, regional, tertiary, central and specialised hospitals. Healthcare facilities at primary healthcare levels include health centres and clinics. In the Western Cape Province (Figure 2.2), a population of approximately 6 million is serviced by both private and public health facilities.

Existing gaps in access and service delivery should be addressed by a National Health Insurance System (Weimann et al., 2014).

Figure 2.2: South Africa, Western Cape Province Map (Western Cape Government, 2022)

There are three tertiary hospitals, forty-two districts, five regional hospitals and twenty-two clinics in the Western Cape Province as shown in Table 2.1. Healthcare services are also provided through mobile services to vulnerable groups and displaced populations in displaced (WHO, 2022).

Table 2.1: Health facilities in the Western Cape Province (Adapted from Western Cape Department of Health South Africa (2020)

Health facilities in the Western Cape Province, South Africa	
Type of Health facility	**Total number**
TB hospitals	6
Reproductive Health Facilities	5
Psychiatric Hospitals	6
Midwife Obstetrics Units	10
Clinics	22
District hospitals	42
Regional Hospitals	5
Mobile services	30
Tertiary Hospitals	3

South Africa is reported to be one of the countries which popularly use mobile health technologies across various income and educational levels (Bervell & Al-Samarraie, 2019). This can be supported by 162 mobile cellular subscriptions per 100 inhabitants in 2020 (ITU, 2022). Access to the internet and mobile cellular subscriptions can be good measures for ICT development. In the South African case, access to these services promotes the use of e-health and m-health. Other initiatives are for example the implementation of the e-health strategy and national digital health strategy can strengthen digital health governance structures driving the adoption of e-health interventions.

The sources above report that the use of electronic health interventions is shown to be concentrated in South Africa when compared to Namibia (ITU, 2022; Bervell & Al-Samarraie, 2019). E-Health has also been used in other fields such as telepathology (Biagio et al., 2013) and orthopaedics (Klingberg et al., 2018; Morkel et al., 2019).

This study focuses on the use of Vula as an e-referral application in the Western Cape province. The next section provides background to the Vula application and its use in public hospitals in South Africa.

2.5.1.1. Vula referral application

Several studies have documented the use of e-health applications in the South African public healthcare sector. E-health studies were found to be popular and focused on maternal health. For example, the *Momconnect* project aims to deliver information to pregnant women (Peter et al., 2016). Other studies focused on the use of mobile phones as a monitoring device for Anti-Retroviral Treatment adherence to HIV patients (Evans et al., 2013).

Other mobile health applications used for electronic referrals include the Vula mobile application. Vula mobile is an application implemented as an intervention to link healthcare workers with specialist care (Vulamobile, 2023). The intervention was adopted in some public hospitals in South Africa as a response to challenges experienced by rural healthcare workers to provide access to specialist advice and means of efficient referrals (Morkel et al., 2019).

Several scholars have examined the use of Vula for referral services in the South African setting. For example, Klingberg et al. (2018), examine the usability of the Vula mobile application for remote consultation and referrals of burn injuries. The study reported that although clinicians found the application to be fit for the purpose of their work and it was easy to use, there was low uptake because users were using WhatsApp as an alternative mode of communication for clinical decision support.

Vula has also been studied as a general referral application with the potential to improve access to healthcare information and services in low-resourced settings (Watkins et al., 2018).

Literature recently shows the prominent use of the Vula mobile application in the South African public sector. There has been a sharp uptake of this application, and it has been adopted and mandated as the official referral application for the Department of Health in Western Cape Province (Western Cape Government, 2022).

The Vula mobile application is designed to facilitate patient referrals between healthcare workers and specialists. The benefits of the Vula mobile application are associated with increased coordination of care and effective communication between HCPs (Morkel et al., 2019; Steyn et al., 2022). Vula is used by different specialities in public hospitals. The dermatology units in Hospitals A and B were among the first to introduce e-referrals via Vula and it has offered numerous benefits. For example, Vula brings about educational benefits and an efficient patient flow between hospitals (Blom et al., 2018). Additionally, the Vula application is reported to be fit for capturing and storing and transferring sensitive patient information (Ogundaini et al., 2021).

Despite these benefits and opportunities offered by Vula, there were unintended consequences which are reported in the literature. For example, Ogundaini et al. (2021) highlight the notifications on the application which are disruptive and the contextual factors that may contradict the usability of technology features. Other researchers highlighted limitations related to the lack of comparison of electronic referrals with traditional referral methods (Morkel et al., 2019). Though some studies were limited to district hospitals Gloster et al. (2021), and some were conducted to compare mHealth in Nigeria vs Vula in tertiary public hospitals in South Africa (Ogundaini et al., 2021).

The Vula application was also introduced in Namibia to some medical practitioners but there was a low uptake of it. Given the highlighted gaps, this study therefore, sought to explore further the use of Vula as an e-referral application deployed in some Namibian and South African public hospitals.

Firstly, the study examines traditional referral methods vs Vula referrals. Secondly, the study examines the use and non-use of Vula in two different settings to determine contextual factors giving rise to intended and unintended use.

2.5.2. Healthcare system and e-health status in Namibia

Namibia is also located in Southern Africa and is one of the member states of the South African Development Community (SADC) (Mbuende, 2014). The country consists of 14 regions consisting of 706 health facilities servicing a population of approximately 2.5 million (Namibia, 2022; Namibia Statistics Agency, 2022). Figure 2.3 shows the number of public health facilities in Namibia per region.

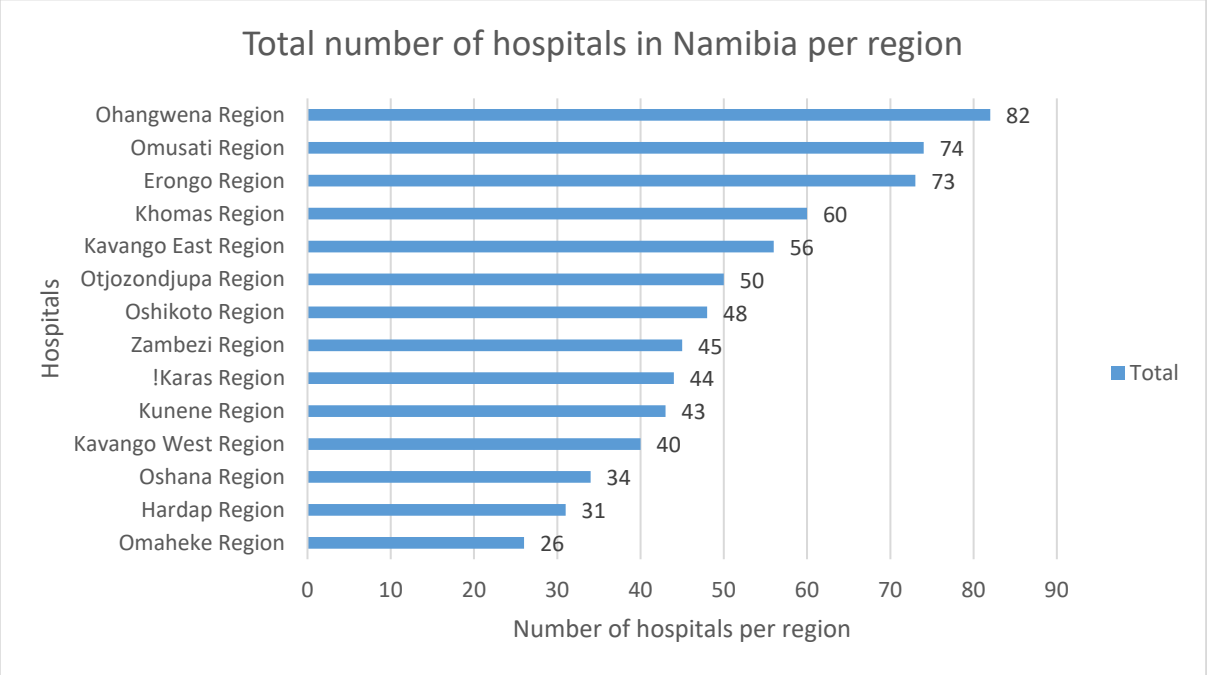


Figure 2.3: Total number of hospitals in Namibia per region (adapted from MoHSS, 2020)

Although the number of hospitals is relatively high compared to similar settings, Namibia's sparse population poses challenges to health facility access, with services concentrated in urban areas, leaving remote regions underserved. For example, approximately 54% of the population in remote areas receives health services from clinics and 15.1% at health centres (Namibia, 2022). The public health system, and the referral system, face challenges related to incomplete and inefficient referral services (Meguid et al., (1999), and self-referrals (Low et al., 2001).

There have been efforts to adopt and implement health interventions to overcome these challenges. For example, USAID conducted an assessment in 2012 on existing e-health systems implemented in the Namibian healthcare system (Khan & Edwards, 2012). At that time over 60 e-health systems were supporting different health programmes. Some systems include the District Health Information System (DHIS2) used as an administrative system for electronically capturing patient health information, the Electronic Patient Management System (ePMS) is used for storing patient information, and the Pharmacy Management Information System (PMIS) is mainly used for the management of medications (Khan & Edwards, 2012).

Other initiatives were the implementation of the "Integrated Health Care Information Management System (IHCIMS) which was designed for patient records and to dispense information. While the system was developed to automate and integrate patient health information, it was implemented at Windhoek Central Hospital (MOHSS, 2020). This project was embarked upon in 2011, and it was ultimately unsuccessful (MoHSS, 2022). There is limited research examining the failure of IHCIMS in Namibia.

Other challenges impeding the implementation of e-health interventions in Namibia are reported to be linked to a lack of infrastructural support, fragmented and disparate e-health systems due to un-interoperable standards (Angula & Dlodlo, 2018; Shaanika, 2021), data management and a skills shortage (Khan & Edwards, 2012).

Notwithstanding the reported challenges, progress has been made over the past decade in implementing recommendations from the USAID report (Khan & Edwards, 2012), where the first e-health strategy was implemented in 2021 (Ministry of Health and Social Services (MoHSS) Namibia (2021).

Additionally, important structural changes to the ministry have been made to lead and implement this strategy. For example, to strengthen the ICT initiatives, an e-health steering committee, as well as the HIS technical committees, have been set up to lead these e-health efforts. According to the e-health strategy, "only 8 of the 61 systems reported in 2012 are owned by the MoHSS, although 11 of these were still operational" almost a decade later (Ministry of Health and Social Services (MoHSS), 2021, p. 11). Mutasa and Iyamu (2021), also report issues related to HIS integration.

The MoHSS highlights challenges related to lack of IT skills (Ministry of Health and Social Services, 2020). Other persisting challenges for the public health sector continue to be the lack of network coverage, limited access to IT equipment and data, and privacy issues (Kapepo et al., 2021; Shaanika & Nehemia, 2019).

Despite the above-mentioned challenges, the International Telecommunication Union (ITU) indicators show that 41% of individuals in Namibia were using the Internet in 2020 although there were 115 mobile cellular subscriptions per 100 inhabitants in 2021 (ITU, 2022). While these indicators are good measures for ICT development in a country and access to technological services, the healthcare sector is currently not fully leveraging access to mobile technologies for healthcare services. The adoption of m-health initiatives in the healthcare sector remains low (Bervell & Al-Samarraie, 2019). With the implementation of the e-health strategy in 2021 and the above indicators, The MOHSS has the potential to harness the use of mobile technologies to improve access to healthcare information and improve e-referral services.

The Namibian healthcare system is made up of the private (17.8%) and public health (82.2%) sectors (Ministry of Health and Social Services (MoHSS) Namibia (2021). Private hospitals serve the private sector, while government-owned healthcare facilities serve the public sector (MOHSS, 2020). Except in cases where a patient is insured by health insurance, most hospitals in both the public and private sectors require patients to pay out of pocket.

The national government, through the Ministry of Health and Social Services (MOHSS), provides healthcare services to the public health sector in the 14 regions. Khomas Region is located in Windhoek the capital city of Namibia. The region consists of a national referral hospital, an intermediate hospital, 3 health centres and 8 clinics as shown in Table 2.2 (MOHSS, 2020).

This study was conducted in two public hospitals located in the Khomas Region shown in Figure 2.4.

Figure 2.4: Map of Namibia showing 14 regions (Source: Namibia Statistics Agency,2022)

Healthcare services are rendered by these healthcare facilities. In cases where a healthcare provider (at one level of healthcare delivery) cannot manage a clinical condition, a referral is initiated to seek care or services at health facilities at higher levels of care (e.g., a patient is referred from a health centre to a district hospital). This is defined as "a referral process in which a health care worker/provider at one level of health care service delivery, having inadequate resources (pharmaceuticals, equipment, or technical skills) to manage a clinical condition, seeks assistance from a different resourced facility at the same or higher level to manage the client's condition", Ministry of Health and Social Services (MoHSS) Namibia (2015, p. 8).

Table 2.2: Health facilities in the Khomas region, Namibia (MOHSS, 2020)

Health facilities in the Khomas Region, Namibia	
Type of Health facility	**Total number**
Tertiary hospitals	2
Health centres	3
Clinics	8

The goal of the referral system is therefore to initiate patient referrals and to ensure timely access to comprehensive healthcare services and a continuum of care. Additionally, clinicians ensure that they are managed promptly to comprehensively provide healthcare services and a continuum of care to patients. This goal has been met with challenges in the referral system. Previous reports have documented challenges related to no clear linkages between health facilities.

Limited studies have explored the use of electronic referrals in Namibia. Of interest is a study by Shaanika (2021), which highlights the challenges of data sharing during patients' mobility.

The study refers to patient referrals and outlines numerous factors to consider before the realisation of electronic health records.

The study suggests that if electronic health records are to be implemented, data management policies and standards need to be implemented to allow the adoption of electronic referrals. Furthermore, it points to crucial infrastructure that needs to be set up for health facilities such as internet services and the development of integration architecture to manage heterogeneous data (Shaanika, 2021; Shaanika & Nehemia, 2019). Given this gap in the literature, this study, therefore, explores e-referrals non-use in a Namibian context as a first step to understanding contextual challenges.

While the above literature provides an overview of e-health implementation, use, and limitations in both high-income and low- and middle-income countries, there is a need for future studies to explore emerging technologies that could address the current limitations of e-referral and e-health systems. This research limited to multiple cases in the Western Cape, in South Africa and Khomas region in Namibia. These settings are selected to explore contextual conditions around the use of electronic referrals. The next section discusses literature on workarounds and related work.

2.6. Related work

The intended and unintended use of Information systems has been studied in Information systems and healthcare literature. Unintended use of existing mandated systems is conceptualised as workarounds in literature (Davison et al., 2019; Malaurent & Karanasios, 2020). There is a growing body of literature on workarounds. The notion of workarounds is widely studied by information systems scholars and various definitions exist. Workarounds are conceptualised as conscious adaptations of work activities that are not expected or specified to be changed in a certain manner (Laumer et al., 2017).

Workarounds are further conceptualised to be deviations or subversions from intended work processes to overcome obstacles, constraints or limitations perceived by system users to achieve their work. Workarounds can be defined as "a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system to overcome, bypass, or minimise the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving the desired level of efficiency, effectiveness, or other organisational or personal goals" (Alter, 2014, p. 1044). Alter's definition is adopted in this study to investigate the unintended use of e-referrals.

2.6.1. Workarounds

Workarounds in the information systems literature are characterised as some form of resistance to the usage of the system due to a lack of system functionalities (de Vargas Pinto et al., 2018; Reiz & Gewald, 2016); deviation due to technology misfits (Mörike; 2024; Davison et al., 2021; Ejnefjäll & Ågerfalk, 2019; Strong & Volkoff, 2010).

The concept of workarounds substantially intersects with other notions related to Bricolage/improvisation (Davison et al., 2019; Malaurent & Karanasios, 2020), non-compliance (Haag & Eckhardt, 2017; Roder et al., 2016), and Shadow Information Technologies (Azad & King, 2012; Haag & Eckhardt, 2017; Silic & Back, 2014).

Although the above scholars characterise workarounds differently, most scholars agree that workarounds result from inadequacies in information systems related to their functionality, usability, management, or organisational culture. De Vargas Pinto et al. (2018) argue that the extent to which users engage with implemented information systems is influenced by their satisfaction and the level of support provided.

Dissatisfied with the system, either specific functions or features, users often find alternative ways (to those mandated by the IT department) to complete their work (Laumer et al., 2017). These alternative ways are at times viewed as resistance or non-compliance to prescribed processes or policies.

A study by Reiz (2016) examined the use of a health information system for healthcare delivery in German hospitals. The study found that physicians resisted using the mandated HIS because they found it unusable and therefore found alternative ways of using paper-based methods and voice recorders to capture patient information. This kind of resistance was reported to be linked to the usability of the system and related to a lack of skills and training for physicians. Several scholars report similar resistance practices related to workarounds in Germany. Other forms of resistance are motivated by a lack of necessary attributes of system functionality. Some scholars explain the lack of functionality results in misfits between processes, systems, and the actual work of system users.

Misfits are reported in the literature to be linked to functionality, data, usability, role, control, and organisational culture (Ejnefjäll and Ågerfalk, 2019; Wiesche et al., 2024). Ejnefjäll and Ågerfalk (2019) in a review of workaround literature, classify misfits into two domains, namely, deficiencies and impositions. Deficiencies are described as misfits arising from lacking features of the system required by users to complete tasks. Impositions are described as misfits arising from the system's characteristics.

A study conducted in the Netherlands by Blijelven (2019) explores workarounds resulting from deficiencies in Electronic Health Records (EHR). For example, data entry options were missing to enter medication measures (e.g. 3.75 mg. rather than the available options 2.5 mg. or 5 mg.).

The study reports that while some misfits could be intentionally designed to enforce hospital policies on restricting the type of information to be entered into the system, some were linked to unfriendly user functionalities, and therefore perceived as misfits (Blijleven et al., 2019).

Similarly, Ogundaini et al. (2022), in South Africa, report unintended consequences of a mobile application (Vula) use because of both deficiencies and impositions of the software application. While the mobile application is reported to be fit for purpose in the hospitals in which it was implemented, the study established misfits between the work activities of clinicians, their local realities, and the mobile application. The study, for example, reports impositions related to the features of the application where notifications sent to clinicians interfere with face-to-face consultations with patients. This points to a system functionality requiring design attention to ensure it fits with the work realities of clinicians.

In another study, in China, Davison et.al. (2019) explore misfits related to the use of an enterprise system in a warehouse that deals with inbound international shipments and distribution of goods in China. Davison et. al. (2019) further report that misfits were a result of both deficiencies and impositions in the enterprise system. The system lacked the functionalities required by employees to complete their work tasks.

For instance, the enterprise system failed to support necessary tasks related to sorting, picking management, handling oversized items, and checking delivery details for distribution purposes. To overcome impositions and deficiencies in the enterprise system, users resorted to using Microsoft Excel software to complete the work. Although the use of Excel was an alternative solution to work around the system, the employees did not comply with corporate expectations regarding the use of the mandated system (Davison et. al., 2019).

Other studies use the term Shadow Information Technology (SIT) to describe the use of feral systems to those required or mandated by the IT department in a specific organisation (Klotz et al., 2019; Kopperet.al., 2020). The following section discusses the notion of Shadow Information Technology (SIT).

2.6.2. Shadow Information Technology (SIT)

Perspectives on SIT conceptualise workarounds as shadow IT (SIT) or feral practices. Zimmermann et al. (2014, p. 1) define Shadow IT as "applications, spreadsheet and database solutions, cloud services, mobile devices, hardware, support structures, or a combination thereof" which are not controlled by an IT business unit. Feral practices or feral information systems are any technological artefacts which end users deploy instead of using mandated systems by the IT department (Haag & Eckhardt, 2017; Roder et al., 2016).

Furstenau et al. (2017) define SIT as autonomous software systems or extensions to existing systems enacted by users where the IT department neither develops nor controls these systems. It is, therefore, important to explore the unintended use of e-health applications (e.g. Shadow IT) and why users resort to these alternative systems.

The literature outlines that users resort to the use of Shadow IT for several reasons. Klotz et al. (2019) present three categories of SIT-causing factors, namely, motivators, missing barriers, and enablers. SIT motivators are related to shortcomings of mandated systems, a lack of business-IT alignment, limited or inefficient IT support, employee motivation/impact orientation and peer behaviour (Klotz et al., 2019).

Several scholars present limitations and shortcomings of existing systems and users deploying Shadow IT (Ogundaini and Dela Harpe, 2022; Blijleven et al., 2022). Some studies highlight some system functionalities for mandated systems in organisations that are perceived to be complex and therefore inflexible for users to complete their work. For example, the shortcomings related to the system functionality of corporate enterprise systems are widely documented in the literature where the deployment of SIT is recorded (Strong & Volkoff, 2010; Davison et al., 2021; Zimmermann et al., 2017).

Furthermore, a lack of business-IT alignment and lack of knowledge and skills leads to unmet needs of system users. For instance, when users are not sufficiently trained or not provided with IT support to use mandated systems, then users find available applications or solutions to complete their work (Silic & Back, 2014; Thatte et al., 2012).

In other studies, the use of SIT is motivated by peer influence in the workplace to communicate and collaborate (Buchwald et al., 2014; Mallmann & Maçada, 2021). Other studies highlight Shadow IT as an opportunity for change management and innovation (White, 2023; De Vargas Pinto & Beerespoot 2023). For example, White (2023), underscores the importance of identifying potential benefits and risks associated with Shadow IT. They argue that this should be achieved through established forums where employees can openly discuss these matters. According to White, fostering such an environment enables employees to highlight and identify workarounds without fear of prejudice, ultimately fostering innovation.

A few studies additionally show deployment of SIT is motivated by missing barriers associated with a lack of support for SIT and insufficient policies (Rentrop & Zimmermann, 2012; Walterbusch et al., 2017). Conversely, other studies report enablers of SIT in organisations linked to users' technical accessibility to applications (software as a service; web services; BYOD) and their ability and competence to use these applications.

These enablers of SIT seem to be prominently documented in developing contexts. For example, users commonly use personal devices (BYOD) to complete work-related tasks.

Dulipovici and Vieru (2016) examine BYOD-enabled workarounds or shadow IT. The study contends that users resort to SIT due to conditions relating to the inability of the organisation to address user needs, organisational conditions related to policies, norms or organismal culture and individual conditions related to satisfaction of using the personal device in personal life and adopting this for work. Although the study has proposed a useful model to study BYOD in relation to workarounds/SIT, there are limited studies examining BYOD and Shadow IT. The enablers and motivators of Shadow IT are summarised in Appendix 4.

The body of literature on workarounds and Shadow IT in developing contexts similarly attributes the enactment of workarounds to constraints or limitations perceived by system users to achieve their work.

In addition, design-reality gaps such as lacking functionalities or capabilities of a system, poorly designed systems or processes, and lack of IT literacy are pushing users to resort to alternative systems or shadow IT to complete their work (Mörike et al., 2024).

Literature reports the proliferation of instant messaging applications to use such as WhatsApp in clinical settings, fuelled by the use of personal devices (BYOD). For example, studies from India (Joshi et al., 2018), Israel (Siegal et al., 2016) Botswana (Williams & Kovarik, 2018), Namibia (Kapepo et al., 2021), South Africa (Chipps et al., 2015; Kauta et al., 2020; Morris et al., 2021) report use of WhatsApp in clinical settings. In India, WhatsApp is used for neurosurgical referral services, and it is also recorded to facilitate the transfer of paediatric patients (Joshi et al., 2018; Neogi & Panda, 2020).

In Israel, WhatsApp is reported to be used to transfer medical information for patient care and consultations between surgeons. Although these surgeons shared patient information (text/pictures/videos) with other members of a WhatsApp group, they were not aware of institutional policy safeguarding the transfer of personal medical information by personal smartphones (Siegal et al., 2016).

In Botswana, WhatsApp is used for care coordination, in particular dermatology consultations. Referring physicians consult with specialists to get immediate feedback including educational material on their patients (Williams & Kovarik, 2018).

Similarly, WhatsApp is used in Namibia, by medical officers to seek a second opinion from dermatologists (Kapepo et al., 2021).

In South Africa, WhatsApp is used to facilitate patient referrals to a regional burn centre for paediatric burn injuries. The use of WhatsApp prevented unnecessary hospital admissions by conducting online consultations before referring patients. Another study by Kauta et al. (2020) describes WhatsApp for orthopaedic referrals. A WhatsApp group (orthopaedic referral group) was created for orthopaedic doctors and the orthopaedic team at Mitchells Plain Hospital to co-manage and discuss orthopaedic conditions.

The study concludes that there was a reduction in delays to care and referrals, as most cases were successfully managed by doctors through co-management and consultations with the orthopaedic team on WhatsApp.

While these studies report the benefits of WhatsApp use, Morris et al. (2021) warn of security risks associated with the application as it is not designed for clinical use. In their study, they assert the need for health institutions to safeguard patient information when using rogue Shadow IT applications such as WhatsApp.

In addition to the ease of use and convenience of WhatsApp, there are legal, regulatory, ethical and security concerns with the use of the application for clinical purposes. Patients' privacy is breached when their data is shared on personal devices and transmitted over a third-party application. Moreover, the limited application of data protection laws, and in some cases the complete absence of laws to regulate the transmission and storage of this sensitive data, exacerbate data security issues.

For example, in the UK the National Health Service advises against the use of instant messaging in clinical exchanges because of security concerns related to third-party servers, security, and laws governing the jurisdiction of data storage. For European Union (EU) member countries, the General Data Protection Regulation (GDPR) is adopted as a blueprint for various data protection acts in the EU. In the United States, the Health Insurance Portability and Accountability Act (HIPAA) safeguards and protects confidential healthcare information.

In South Africa, the POPI (Protection of Personal Information Act) prescribes the protection of personal information (including clinical information) processed by private and public bodies (South Africa, 2022).

Although there are data protection laws in some countries, WhatsApp is non-compliant with these data protection laws. Sharing of sensitive patient information on WhatsApp, therefore, remains a threat to patient safety in different healthcare settings. Given the sensitivity of patient data, privacy and confidentiality, data security must be safeguarded at all costs to achieve patient safety in health organisations.

2.7. Chapter Summary

The existing body of knowledge shows that e-health is widely studied. The benefits and use of e-health electronic referrals are reported to be prominent in high-income countries (Azamar-Alonso et.al., 2019; Montellier et al., 2022). Conversely, literature in

low- and middle-income contexts shows limited studies documenting the successful use and benefits of e-referrals. Most studies in these settings generally report constraints, challenges and unintended consequences brought about by the deployment of health information systems (Bervell & Al-Samarraie, 2019; Morkel et al., 2019; Gloster et al. 2021). Studies in these contexts widely evidenced unintended use of e-health interventions in the form of workarounds or adoption of Shadow Information Technologies.

Despite extensive documentation of unintended use and workarounds associated with e-health interventions, such as the adoption of Shadow Information Technologies in health organisations, there is a notable absence of theoretical insights that explain the causing factors and rationales behind these workaround practices. In particular, there are limited studies offering theoretical frameworks to explain the design-reality gaps that lead to these workarounds, especially within low- and middle-income settings. This study thus aims to address this gap by investigating the phenomenon of workaround practices in Southern African public hospitals, providing a much-needed explanation on the unintended use of HIS and their adaptation in these settings. The next chapter discusses the theoretical frameworks adopted in this study.

CHAPTER 3: Theoretical Framework

3.1 Introduction

The purpose of this chapter is to discuss the theoretical lens employed to analyse the case studies. Theories provide a conceptual framework to guide a researcher's thinking and research process. Additionally, theories are important in providing a systematic statement of rules or principles to be followed to explain a phenomenon of interest (Gregor, 2006). Walsham concurs that theory, particularly in interpretive studies is often necessary to use a theoretical framework which can provide a lens to examine the phenomena of interest and take account of previous knowledge. Thus, it creates a practical theoretical basis to inform the approach of early empirical studies (Walsham, 2006). Theory can be used in distinctive ways for interpretive studies. The theory can be used as an initial guide to design and data collection; as part of an iterative process of data collection and analysis; or as a final product of the research (Walsham, 2006).

In this research, multiple theoretical frameworks were adopted to investigate the phenomenon of interest. The fours theoretical frameworks and the descriptions of the concepts used in the study are outlined in Appendices 20 and 21.

The Activity Analysis and Development (ActAD) framework was selected as a sensitising lens to guide the formulation of the interview guide (Appendix 15 and 16). ActAD was also used in the deductive analysis to gain an understanding of the patient referral process. This framework was also used to develop the question in the initial interview guide (Appendix 15). As part of the research hermeneutic process, an inductive approach to theory was subsequently adopted to explain and develop an understanding of emergent themes related to workarounds. The Process Framework for Healthcare Information System Workarounds and Impacts, and the Systems Engineering Patient Safety (SEIPS 3.0) frameworks, were chosen because they aligned quite well with the emergent themes from phase 2 of data analysis. The rationale for choosing these frameworks was the need to explain the additional concepts related to workaround practices and patient safety within the work system. The concepts from these frameworks were utilised to create new questions and revise the research interview guides (Appendix 16).

This chapter consists of four sections outlining the theoretical foundation of this study. Section 3.2. unpacks the ActAD framework with an emphasis on its origins, concepts, and limitations.

The design-reality gap model is discussed in section 3.3. The Theory of Workarounds is discussed in section 3.4. Other related frameworks are discussed in sections 3.5.

3.2 Activity Theory and the ActAD Framework

Activity theory (AT) has its roots in the work of the Russian philosopher Vygotsky, who undertook a comprehensive study to examine the higher mental functions and human consciousness. The first generation of AT is centred around the work of Vygotsky (1978) whose work is centred around the notion of mediated action. He believed that the higher psychological function in humans, which is consciousness, differs from the pre-conscious psyche of animals, and is constructed through communication and interrelationship between subjects (people) with the objective world. His model further posits that the relationship between subjects and objects is mediated by tools (artefacts). His model of mediated action, therefore, depicts a relationship between subjects, objects, and tools (Appendix 1). Over the years, Vygotsky's model has evolved, and various researchers have adapted it as they apply it to research and practice. The second generation of AT was developed by Leontiev who further developed Vygotsky's work into a framework that places activity at the centre of the analysis (Leontiev, 1978). Leontiev proposed the notion of collective activity, and he made a distinction between activity, action, and operation. The model as shown in Appendix 2 was later adapted to focus on the mediational structure of an activity system (Engeström, 2001).

The third generation of AT was developed by Engeström (2001) and Sannino et al. (2011). They added new elements focusing on examining the activity system at the macro level with a community perspective (Appendix 3). Several theoretical frameworks were developed from Activity theory to examine activities in organisational settings. In their study Mursu et al., (2007), adopted a theoretical framework from Korpela (2000), depicting the work activities of clinicians and their application to information systems development (Korpela, 2000; Mursu et al., 2007). The framework as illustrated in Figure 3.1 places emphasis on collective activity, which is made up of individual human actions.

This study, therefore, examines the referral activities within the Khomas and Western Cape referral systems using AT as a lens.

Firstly, Activity Theory (AT) is used to examine these referral activities and roles by various subjects in the given referral systems.

Secondly, the activity analysis and development framework (ActAD) in Figure 3.1.is used as a lens to provide a theoretical elaboration of e-referrals and other means of work used in facilitating the communication work of HCPs.

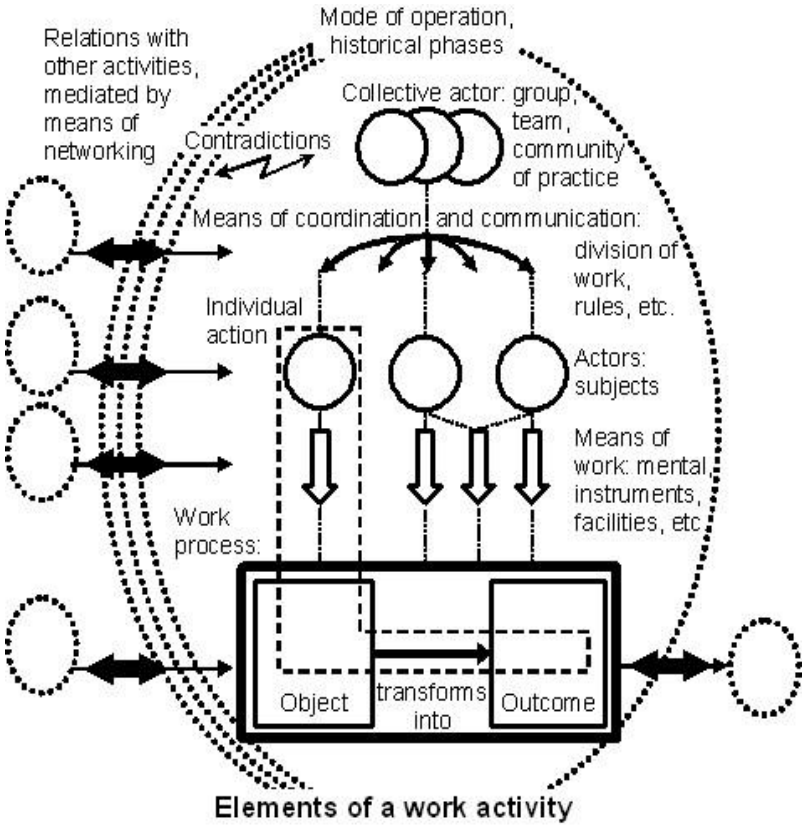


Figure 3.1: Activity analysis and development framework (ActAD)(Source: Mursu et.al., 2007)

The concepts from the ActAD framework are described in Appendix 20. Concepts from this framework are further particularised to the empirical situation to gain an understanding of the referral activities. The particularisation of the theory is described in the Chapter 4 (Section 4.8.1), and how this is applied to phase 1 of the research.

This framework was adopted as sensitising framework to make sense of the referral process and tools facilitating various referral activities.

Particularising the concepts was of importance in breaking down concepts into a systematic structure of looking at the referral system as a collective activity system. A referral system is therefore examined to identify the roles of subjects and tools or means of work used to accomplish their work. In this study, the concept of "collective actor" represents subjects who are a team of healthcare providers (HCPs) consisting of medical officers, supernumerary registrars, nurses, and dermatologists.

Rules and division of work are used to coordinate and guide subjects as they work on a shared object (Korpela, 2000). Rules in this study examine important documentation (presented in Table 5.7) such as referral guidelines, protocols, referral policies and e-health strategies that govern and regulate the work of HCPs in the referral system. Division of work is examined to understand how the roles and responsibilities of various HCPs are structured and how they are supported by e-referrals.

The framework further explains the concept of means of coordination and communication (Korpela, 2000). These refer to tools and other means of work employed to coordinate individual actions of HCPs and direct these actions toward a common goal to achieve a certain outcome.

Examining the referral activities within these activity systems provides insight into how referring healthcare providers (HCPs) utilise electronic applications as a way of mediating collaboration with specialists to accomplish their work. Activity Theory suggests a collective artefact-mediated, and object-oriented activity is the prime unit of analysis (Engeström & Sannino, 2010).

While the concept of collective activity is useful in facilitating understanding of the referral systems, AT is limited to explaining concepts related to activities, subjects, rules and means of coordination and communication.

3.2.1 Application of Activity Analysis and Development (ActAD) framework to study

The Activity Analysis and Development (ActAD) framework, an enhanced form of activity theory, was employed as a sensitising theory to gain insights into elements of a referral process (Gregor, 2006; Klein & Myers, 1999).

The ActAD framework was therefore used as a descriptive theory to describe subjects involved in the referrals process, their activities and the tools used to facilitate such activities.

Since the researcher is not a medical professional, this framework was instrumental in developing a description of concepts related to electronic referrals.

ActAD was therefore applied as a descriptive theory. Descriptive theories are the most basic type of theory that describe or classify specific dimensions or characteristics of individuals, groups, situations, or events by summarising the commonalities found in discrete observations. They state, 'what is,' and they are useful when nothing or very little is known about the phenomenon in question.

ActAD was also used as an initial to design the interview guide and for data collection. In particular, the framework was useful in the design of pilot questions and concepts such as tools; and subjects were further used to survey e-referrals tools used in public hospitals and their function. Other means of coordination and communication, such as traditional referral methods were explored. This framework was applied in phase one of the study as described in Section 4.8.1. While the ActAD framework was valuable as a sensitising tool, it had certain limitations, which are discussed in the following section.

3.2.2 Limitations of the ActAD framework

There are limitations and challenges of Activity Theory. Activity theory is limited in different ways. Several scholars have criticised AT for its abstractness and lack of principles to apply and use in given research settings (Hedestig & Kaptelinin, 2002). Additionally, Activity theory is limited to specific well-bounded activities (Sannino & Engeström, 2018). The theory is thus limited in explaining formations and activities which go beyond the confines of well-bounded activities. The AT is also limited in elaborating additional practices that deviate from formal activities and the use of

alternative tools in mediating these activities. While ActAD was useful in the initial analysis, its concepts offered limited explanatory power for emergent themes.

It was, therefore, necessary to explore additional theoretical lenses that explain workarounds and the use of alternative tools or information systems from mandated ones. This research therefore further employs concepts from the process framework for healthcare Information System workarounds and impacts (Yang et al., 2012) and the Systems Engineering Patient Safety (SEIPS 3.0) framework to develop a theoretical understanding of the phenomenon of interest (Carayon et al., 2020, Carayon et al., 2006; Holden et al., 2013; Holden & Carayon, 2021).

Other theoretical perspectives such as the Theory of Workarounds (Alter, 2014) and the new Theory of IT innovation, adoption, and adaptation (Alter, 2018) were used to gain insights into work systems and IS improvisation. Different theories were therefore used to iteratively analyse the empirical evidence and to provide theoretical elaborations at different phases of the research. Other theoretical perspectives are discussed in the next section.

3.3 Design-reality gap framework

The design-reality gap (DRG) framework is a robust model for explaining multiple cases of HIS success and failure (Hawari and Heeks, 2010). The design-reality framework was coined by Heeks (2006) as an analytical framework for evaluating and predicting the success and failure of health information systems (HIS). In his study, he sought to understand the success and failure of health information systems with a focus on the contingent realities of healthcare institutions in developing contexts. The original model (figure 3.2) consists of seven dimensions namely, information, technology, processes, objectives, and values, staffing and skills, management systems and structures and other resources. The DRG dimensions are described in Appendix 20.

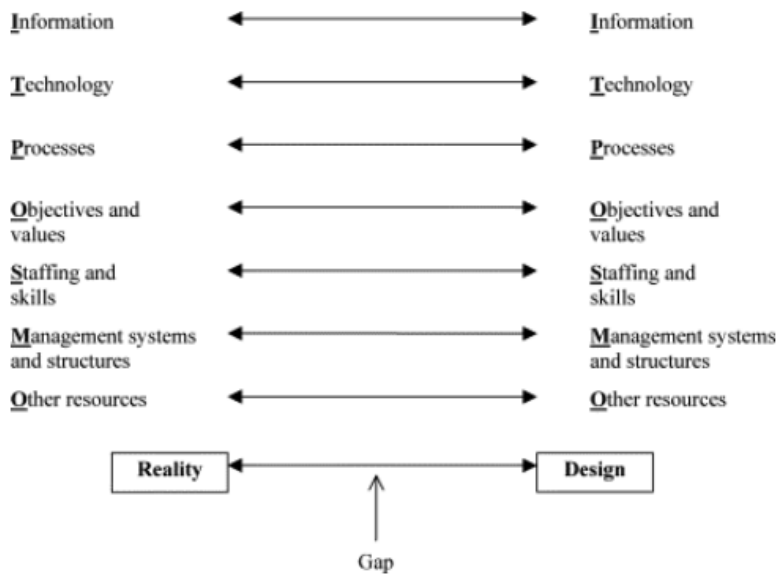


Figure 3.2: Design-reality gap framework (Heeks, 2006)

The design-reality gap framework describes the difference between the "design" or assumptions built into the IT artefact by designers and the reality of the real needs of end-users in the given context (Greenhalgh et al., 2010).

These gaps can emerge when features of the IT artefact do not match the goals and needs of end-users, therefore creating incongruence and mismatch between user expectations and systems delivery.

The DRG framework has been used in many settings, and other scholars have expanded this model with additional constructs. For example, Masiero (2016) included the concept of "other factors" where she explored causal factors for success and failure of information systems. Albertus and Makoza (2023), explored a digital contact tracing mobile application (App) a COVID Alert SA App (CASAA). In their study, they expanded the DRG model with additional constructs on privacy, security, and ethical issues.

This study adopts Albertus and Makoza's (2023) version of the model shown in Figure 6.7 as it includes concepts on privacy; security and ethical issues which are particularly relevant to this study which includes patient health data.

The DRG framework was employed to explain workarounds practices and their relationship to design-reality dimensions. The matrix coding was adopted to map improvisations to seven dimensions of the DRG model. Rationales for improvisations are elaborated in section 7.2 and 7.3. The model is further applied in section 8.2 where theoretical propositions are presented.

The next section describes the theory of workarounds in information systems research.

3.4 Theory of Workarounds in Information Systems Research

The use of Activity Theory (AT) offers a natural starting point to study activities and electronic tools or information systems facilitating or mediating these activities. Even though AT provided a lens to study areas of technology use in activity systems, the Theory of Workarounds provided an additional lens to examine how actors adapt, improvise or bypass one more, or an overall existing official system, to overcome constraints that are perceived to prevent the system or actors from achieving certain goals (Alter, 2014; Alter, 2018).

In Information systems literature, workarounds are typically implemented to circumvent limitations that system users see as impeding their ability to complete tasks (Alter, 2014; Ejnefjäll & Gerfalk, 2019; Kopper & Westner, 2016).

According to these scholars (Raman & Sullivan, 2024; Kobayashi et al., 2005; Laumer et al., 2017; Reiz & Gewald, 2016), these workarounds are typically enacted to resolve constraints that system users see as impeding their ability to complete their work.

Users turn to alternative systems or Shadow Information Technologies (SIT) in situations where there is a design-reality gap, such as when a system lacks functionalities or capabilities (Mörike et al., 2024; Davison et al., 2019) or when systems or processes are poorly designed (Gasser, 1986; Koppel et al., 2015). Users thus resort to alternative systems or Shadow Information Technologies (SIT) to accomplish their work.

These improvisations or practices are therefore viewed to lead to positive benefits, where workarounds can be a source of improvement to the existing design of such systems (Alter, 2014; Safadi & Faraj, 2010).

Conversely, workarounds are viewed to be risky because they lead to medical errors or inefficiencies (Boudreau et al., 2005; Baker et al., 2024) which can immediately impact work activities or they can become institutionalised (Azad & King, 2012; Orlikowski, 1996).

Some scholars have characterised shadow IT (SIT) as improvisations, workarounds or feral practices or systems. Feral practices or feral information systems are "any technological artefact that end users deploy instead of mandated systems by an IT department (Klotz et al., 2019; Lund-Jensen et al., 2016). Shadow IT is also characterised as "workarounds as discussed in Section 2.6.1.

The Bozan & Berger (2018) study concluded that workarounds are largely found to be a direct result of dissatisfaction with IS leading to some form of resistance. Other studies claim workarounds are a result of misfits between work and implemented systems. For example, Davison (2019), argues that when misfits are not addressed, they can persist in coordinated workarounds. Confirmations that these types of gaps between user needs and implemented systems are indeed called misfits (Van Offenbeek et al., 2024; Van Beijsterveld & Van Groenendaal, 2015).

The above shows workarounds are generally and widely studied by Information systems scholars.

The Theory of workarounds is explicitly developed for Information Systems as a discipline, and its focus is on analysing Business Information Technology and business-managed IT.

Additionally, the theory of workarounds builds on well-established reference theories such as loose coupling theory, agency theory and theory of planned behaviour.

While the Theory of workarounds is grounded on well-established reference theories, the Theory has certain limitations. For example, Alter (2014), presents outcomes into local and broader consequences. This only provides a starting point for analysing outcomes and workaround risks (Zimmermann et al., 2016). However, the theory is limited in exploring process outcomes pertinent to healthcare settings.

Furthermore, the theory does not consider governance aspects. For example, Klotz et.al, (2019), report that the theory does not apply to the governance of Business IT and Business managed IT. Their study expands this theory by adding governance steps to include concepts that explain instances of governance (general governance for Shadow IT and Business managed IT and instances of governance for overt Business managed IT). Moreover, the theory of workarounds is restricted to exploring IT consumerisation which can be an enabler for workarounds.

While the theory of workarounds provided a good lens for exploring workaround practices and their causing factors, it was vital to complement it with an additional theoretical framework from healthcare to study the use of IS in health organisations and its effect on organisation processes, workarounds, and patient safety outcomes. Therefore, it was necessary to incorporate theoretical models such as the Systems Engineering Initiative for Patient Safety (SEIPS) and the Process framework for healthcare IS workarounds and impacts to provide explanatory power for the socio-technical aspects of the research phenomenon. These theoretical models in healthcare research are discussed in the next section.

3.5 Theoretical models in healthcare research

While workarounds are generally and widely studied in healthcare contexts, they are under-theorised. A few studies have offered useful models and frameworks to explain workaround behaviour to health information systems in health organisations. For example, Azad and King (2008), studied workarounds as situated practices in a healthcare setting by investigating a medical dispensing system used to support the pre-approval policy for anti-microbial drugs. Their follow-up study, (Azad and King, 2012), developed a framework explaining workaround practices and how workarounds are institutionalised in organisations. Their framework explains workarounds as not temporary, but that workarounds need to be observed by looking at the tension between the task environment and the Information Technology (IT) artifact.

"Institutionalised behaviour to information systems is in response to establishing some 'equilibrium' between the pressures from outside the organisational and the bottom-up pressure of real work activities within the organisation" (Azad and King, 2012 p.359). Their framework, however, takes the view of decoupling and loose coupling practices of actors. The next section discusses the Systems Engineering Initiative for Patient Safety (SEIPS) model.

3.5.1 Systems Engineering Initiative for Patient Safety (SEIPS) model

There are popular theoretical perspectives to study workarounds namely the Systems Engineering Initiative for Patient Safety (SEIPS) model (Holden et al., 2013; Niehaves et al., 2006). SEIPS is a theoretical model rooted in the ergonomics or human factors discipline (Carayon, 2012; Carayon, 2009). This model was originally proposed by Carayon (2006), as a framework to describe factors that contribute to patient safety.

These factors include the environment, organisation, tasks facilitated by technology or tools, people, processes, and outcomes. The contributors to patient safety were categorised into physical, social, and biological factors.

Holden (2013) introduced an extended model of SEIPS 2.0 with a primary focus on work done by various actors (patients, families, and other non-professionals). SEIPS 2.0, incorporates three additional concepts in the original model, namely configuration, engagement, and adaptation. "The concept of configuration highlights the dynamic, hierarchical, and interactive properties of sociotechnical systems, making it possible to depict how health-related performance is shaped at "a moment in time" (Holden et al., 2013 p.2). Engagement conveys that various individuals and teams can perform health-related activities separately and collaboratively. Engaged individuals often include patients, family caregivers, and other non-professionals. Adaptation is introduced as a feedback mechanism that explains how dynamic systems evolve in planned and unplanned ways. (Holden et al., 2013).

SEIPS 3.0 in Figure 3.3 was subsequently developed to further understand or design socio-technical systems, paying more attention to promoting the patient journey as it unfolds over time and space (Carayon et al., 2020).

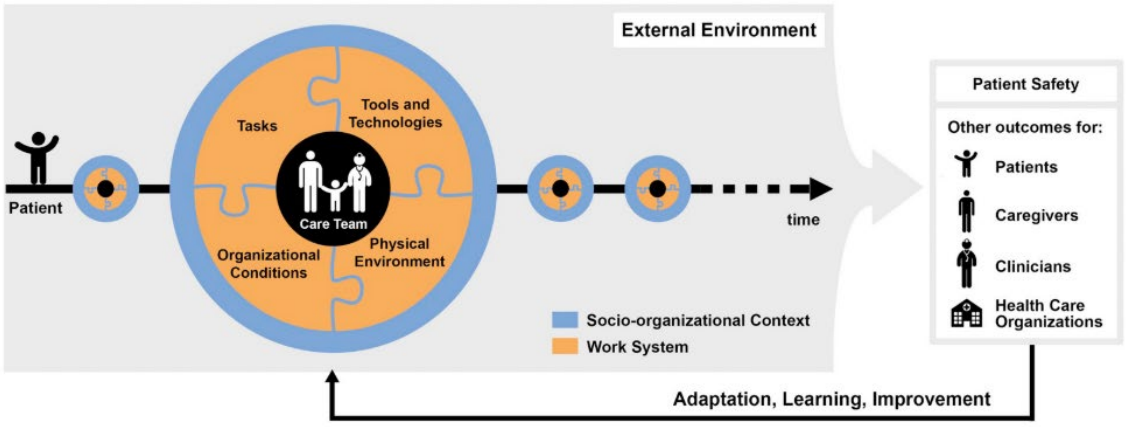


Figure 3.3 : SEIPS 3.0 (Source: Carayon, et al., 2020)

A simplified model (SEIPS 101) in Figure 3.4 is the current version of the model focusing on the most essential SEIPS components (Holden & Carayon, 2021).

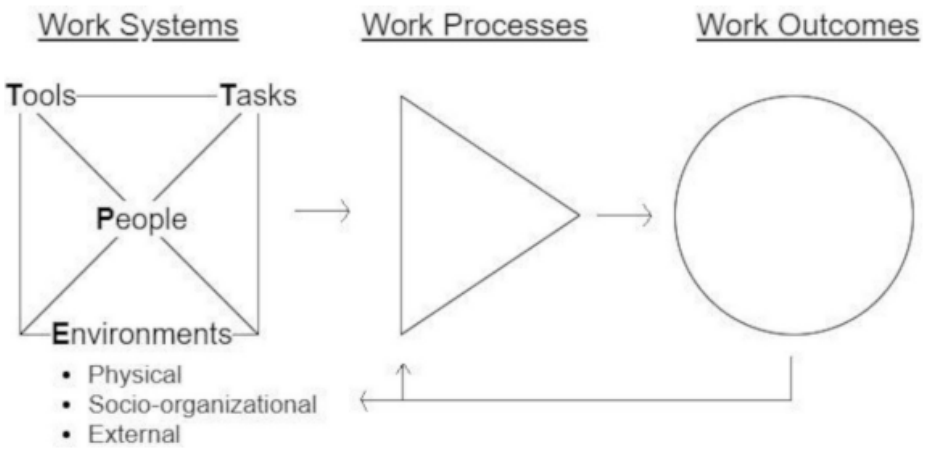


Figure 3.4 : SEIPS 101 (Source, Carayon et., al, 2021)

This study adapted SEIPS 3.0 as a guiding model to explore and explain socio-technical issues in the work systems under study. The concepts from the SEIPS model are described in Appendix 21. Both models consist of three main concepts, namely work system, work process, and outcomes.

The referral systems in the two case studies were examined as work systems. Work processes and a work system are interlinked concepts.

According to Carayon et al. (2021, p. 901), the work system is "composed of interacting structural elements that together produce performance". A triangle is used to symbolise a work system, which is made up of many elements like people, environments, tools, and jobs. The idea of the environment can be divided into two categories: the physical environment and the socio-organisational environment, such as a hospital where medical staff use tools to carry out tasks to complete processes. Additionally, a work system's external environment consists of political, regulatory, legal, economic, cultural, and societal settings. The concept of work processes describes how medical practitioners complete their tasks and how activities flow within the work system. The models' objective is to examine what outcomes result from work processes and activities.

Additionally, the models also examine how work processes and systems affect referral outcomes. Work outcomes can both be positive and negative, and they can affect professionals or other actors such as patients and health organisations (Carayon et al., 2021).

This model also considers the causal feedback loops between work processes, systems, and outcomes, which can be thought of as improvement and adaptation mechanisms (Carayon et al., 2020). Even though the SEIPS 3.0 and SEIPS 101 models described how various elements, such as actors and the socio-technical system, interact as well as the adaptation mechanisms occur, the models have limitations and do not include a concept outlining the causal factors behind adaptations or workaround practices.

3.5.2 Process framework for healthcare IS workarounds and impacts

Due to the model limitations, the above theoretical models were complemented with concepts from another framework. The Process framework for healthcare IS workarounds and impacts is adapted to explain the notion of workarounds (Yang et al., 2012).

The framework (Figure 3.5) integrates two theoretical perspectives on Information Systems by incorporating two streams of workarounds on misfits (Gasser, 1986) and information systems evolution (McGann and Lyytinen, 2008).

Yang uses this framework to illustrate factors that lead to workarounds and interrelates them to strategies used to respond to issues with existing systems (Yang et al., 2012).

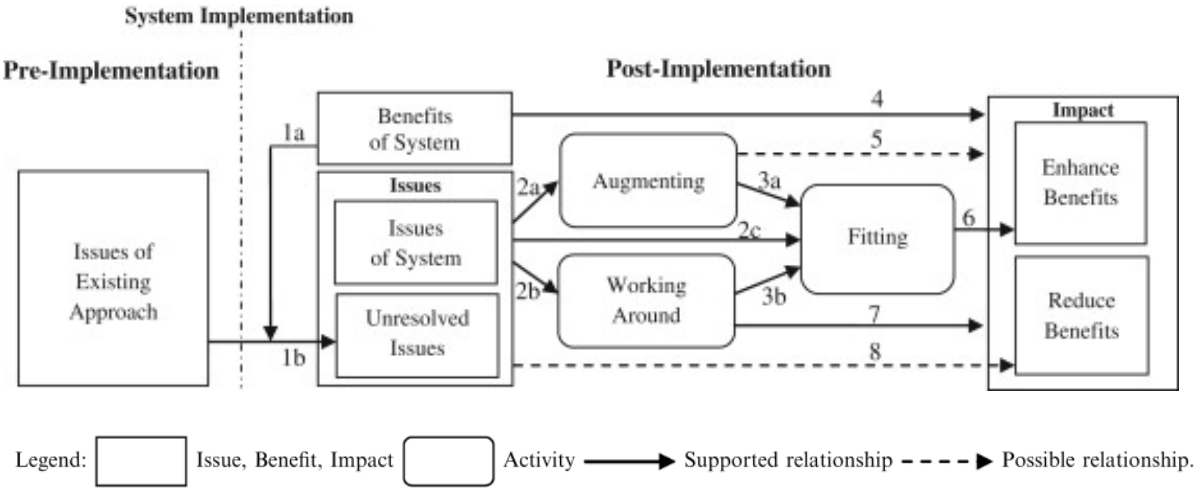


Figure 3.5: Process framework for healthcare IS workarounds and impacts (Source: Yang et al., 2012)

The overall aim of the process framework for healthcare IS workarounds and impacts is to provide a better understanding of the impact of workarounds in organisations. The description of concepts from the Process framework for healthcare IS workarounds and impacts are defined in Appendix 21.

The concepts adapted for this study are pre-implementation and post-implementation with a particular focus on explaining issues with existing e-referral systems. In the inductive analysis phase (Sections 4.10.1.1 and 4.10.1.2), concepts related to the benefits of the system; issues with the system; augmenting; working around; fitting and impact are adapted. In cases where there were overlapping concepts in the above theoretical frameworks the most appropriate concepts were particularised in this study.

For example, the ActAD framework and SEIPS share some concepts, such as subjects, persons, tasks vs. activities, tools vs tools, and work activity vs. work system.

Where there were overlaps, the distinctive concepts were adapted and where necessary additional concepts explaining other socio-technical issues were adapted from SEIPS and the process framework for healthcare IS workarounds model.

3.6 Conclusion

The above theoretical frameworks were applied to this study to offer a theoretical understanding of the phenomenon of interest. This was achieved by firstly building on the ActAD theoretical lens to describe the referral process, in particular tools that facilitate referral activities in this process.

Secondly, the Process Framework for Healthcare Information System Workarounds and Impacts (Yang & Yip, 2012) and the Systems Engineering Patient Safety (SEIPS 3.0) model are integrated. Thirdly, the design-reality gap (DRG) framework was employed as a lens to explain the workarounds practices and their relationship with DRG dimensions.

Finally, the theoretical framework (Figure 8.1) and propositions are theoretically elaborated to explain e-referrals use and design-reality gaps giving rise to workaround practices in public hospitals from developing contexts.

The next chapter discusses the research methodology.

CHAPTER 4: Research Methodology

4.1 Introduction

This chapter outlines the scientific philosophy, the design and the research strategy underpinning this research. It is deemed necessary to choose the most appropriate research methodology to answer the research questions under investigation and achieve the research objectives. Saunders, Lewis & Thornhill (2009), persuade scholars of the need to choose appropriate methodologies throughout the consequential research process to match the type of research they are undertaking. This study adopts interpretive multiple case studies to interrogate the phenomenon of interest.

This chapter consists of seven sections describing the research process. Section 4.2. defines the research process and compares different research philosophical perspectives in the information systems discipline. Sections 4.3 and 4.4 discuss the epistemological foundations of the research and justification of the choice of the research paradigm, respectively. Section 4.5. outlines the research approach adopted. The case study strategy is described in the context of two referral systems in section 4.6. This discussion leads to the justification of the selection of cases and data collection methods used, which is discussed in section 4.7. The data collection, analysis and ethical considerations are discussed in the last three sections of this chapter.

4.2 Research Philosophies in Information Systems

This section outlines the scientific philosophy and research process adopted. The research process is multifaceted, and it is important to map out the trajectory through which the research questions are answered. Saunders explores the research process through what he terms a "research onion" as illustrated in Figure 4.1 (Saunders et, al., 2009). The research onion consists of layers representing different research process elements. The outer layer consists of philosophies of ontology, epistemology, and axiology. The second layer consists of research approaches namely the deductive and inductive approaches. Research strategies can be used with the given approaches shown in layer 3.

The other elements in the research onion are identified as namely, philosophy stances, research approaches, strategies choices, time horizons and data collection techniques. The approaches adopted in this study are highlighted in red (Figure 4.1).

Philosophical assumptions enable a researcher to shape their formulation of the research questions and the approach to take in answering those questions. An interpretive case study is adopted for this study.

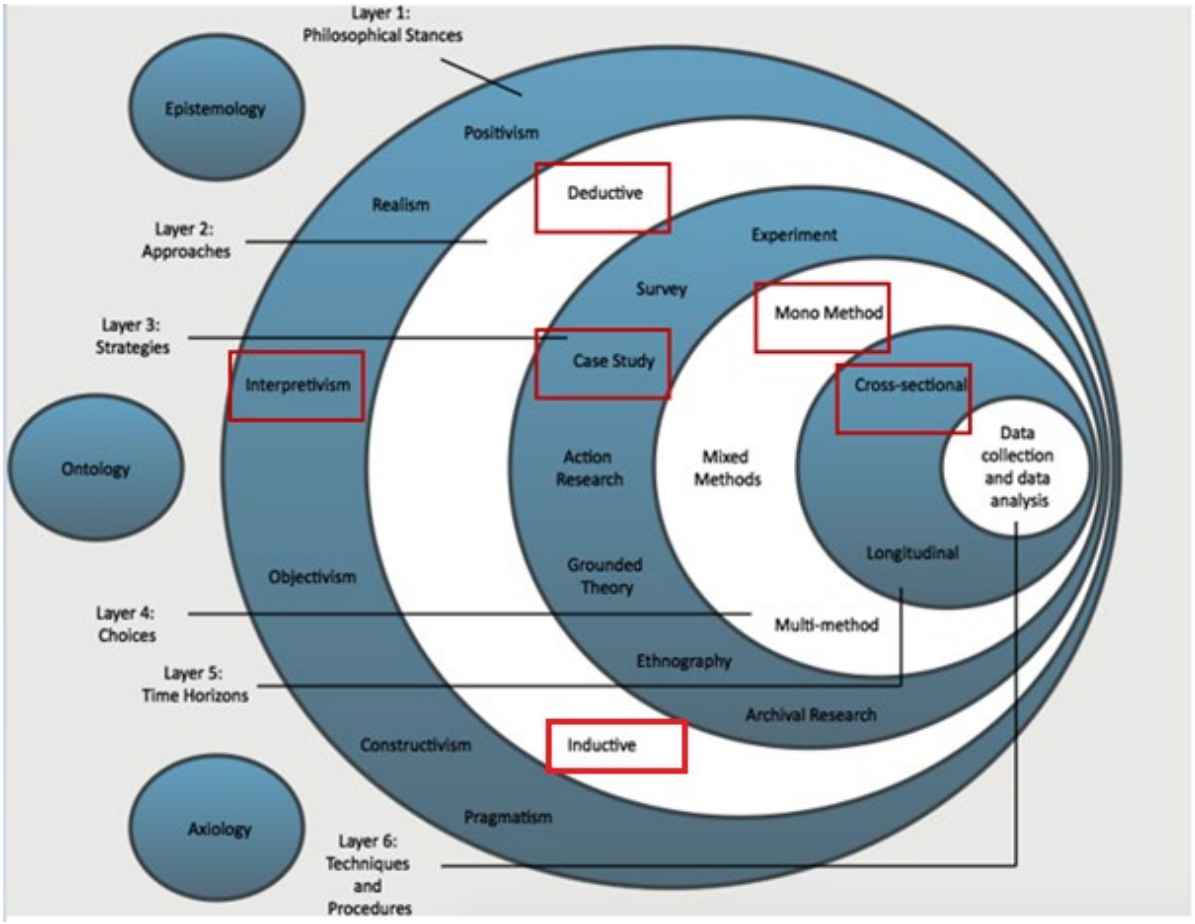


Figure 4.1: The research onion (Adapted from Saunders et al, 2009)

4.3 Ontological and epistemological foundations

There are different research paradigms in the information systems discipline.

This variation requires a thorough understanding of underlying philosophical and epistemological assumptions (underpinning each approach as this ultimately informs the researcher's perspective of the phenomena under investigation), choice of methodologies and strategies to answer the research question.

Philosophical assumptions have been coined differently by numerous scholars. Some scholars refer to them as paradigms (Lincoln, Lynham & Guba, 2011; Mertens, 2010), others call them epistemologies, and ontologies (Licqurish & Seibold, 2011); others call them alternative knowledge claims (Creswell, 2009).

In the context of information systems, Creswell (2009) defines philosophical assumptions as "beliefs about the nature of reality (ontology), what counts as knowledge and how claims are justified (epistemology), the role and values of research (axiology) and the process of research (methodology)". Orlikowski and Baroudi similarly define ontology as beliefs about beliefs and reality. It is crucial to understand the interrelationships between ontology, epistemology, methodology and methods (Orlikowski & Baroudi, 1991). These interrelationships between fundamental beliefs and Information Systems research paradigms are illustrated in Appendix 5 and discussed in the next sections.

4.4 Research paradigms

4.4.1 Positivism

The positivist research perspective has been classified as one of the dominant paradigms in the Information discipline (Klein & Myers 1999; Lee 2004; Walsham 1995; Weber 2004). Ontologically, this perspective assumes an "objective physical and social world that exists independent of humans, and whose nature can be relatively unproblematically apprehended, characterized, and measured" (Orlikowski & Baroudi, 1991). The epistemological position of positivism is objective (Saunders et al., 2009; Baskerville, & Myers, 2002; Gregor, 2006). Positivists aim to discover knowledge about objective reality.

This paradigm's scientific propositions are founded on data and facts. Hence the knowledge is value-free.

The positivist paradigm is unsuitable for this study as it fails to accommodate the divergent perspectives held by multiple actors (clinicians, administrators, and IT personnel) using health information systems.

These varied and sometimes contradictory viewpoints require a paradigm that can explain the social and contextual aspects of these perspectives. Given that these perspectives are rooted in the subjective experiences of stakeholders and may not be easily quantifiable, a positivist paradigm is deemed limiting. Therefore, achieving a comprehensive understanding requires an interpretive or mixed methods approach in research.

4.4.2 Pragmatism

Pragmatism as a research paradigm was coined by philosophers Dewey and Peirce and it has further been developed by Rorty (1989). The ontological position of pragmatism is one of actions and change (Goldkuhl, 2012). The fundamental beliefs of this perspective, therefore, suggest choosing multiple, external views to best achieve answers to research questions. Pragmatism posits that either or both observable phenomena and subjective meanings can contribute to knowledge depending on the research question. The focus of this paradigm is motivated by the idea of integrating different perspectives to help interpret the data. Moreover, pragmatist thinking has been implicitly utilised in numerous studies in Information Systems research. However, the philosophical foundations have not been fully acknowledged in most studies. For example, Baskerville & Myers (2004) contend that pragmatism is the underlying philosophy for action research.

Pragmatism is also deemed a more adequate research paradigm for design research in IS. Goldkuhl (2012) therefore argues that IS scholars should consider pragmatism as a possible paradigm within IS besides existing paradigms. For this study, it is important to understand personal and subjective views of HCPs and their use of e-referrals. Other perspectives are explored in the next sections.

4.4.3 Critical Research

Critical research is one of the emerging philosophical paradigms in the information systems discipline. It has been proposed as an alternative to the more prevalent paradigms of positivism and interpretivism (Wynn & Williams, 2012).

"Critical research is concerned with social issues such as freedom, power, social control, and values with respect to the development, use, and impact of information technology" (Myers & Klein, 2011: p. 17).

Critical research as documented in Information Systems literature outlines three streams associated with the critical social theories of Habermas, Foucault, and Bourdieu as shown in Appendix 5. Critical research is founded on three elements namely, insight, critique, and transformation. Insight is explored and gained by using for example critical hermeneutic and archaeological knowledge. Myers and Klein further explain that the critique element is concerned with the social practices of control and reproduction which goes beyond interpretation but focuses more on power structures behind such interpretations (Myers & Klein, 2011). The other element concerns transformation where suggested improvements to human existence, social arrangement and social theories are studied. The objective of this research is not to change the status quo, but to explain experiences and subjective meanings HCPs attribute to their use of e-referrals in the context of public hospitals. An interpretive paradigm is therefore a suitable paradigm to study the phenomenon of interest. This is discussed in the next section.

4.4.4 Interpretive

The underlying ontological belief of the interpretive paradigm is premised on "reality that is socially constructed" (Orlikowski & Baroudi, 1991). Walsham (2006) refers to this same ontological position as "our knowledge of reality, including the domain of human action, is a social construction by human actors". Epistemological foundations of this paradigm focus on subjective meanings and social phenomena in Information systems research (Burke, 2007).

Niehaves and Stahl, further elaborate that while this paradigm rejects the claims of the positivism paradigm that objective knowledge is achievable, instead the interpretive stance claims that knowledge is assumed to be subjective to the researcher's interpretations and to the context in which a study is undertaken (Niehaves & Stahl, 2006).

The adherents of this perspective, therefore, emphasise the importance of human interpretation and that knowledge can be attained through social discourse (Ivari, 1991).

It was therefore deemed fit to employ the interpretive perspective for this study as it aims to obtain subjective meanings attached to the use of e-referrals and interpretations of how they support and affect the work of HCPs (Orlikowski & Baroudi, 1991; Walsham, 1995; Walsham, 2020).

The seven principles of interpretive research are applied to this study (as presented in Table 4.1) to enrich the understanding of the use and non-use of e-referrals (Klein & Myers, 1999). The first principle of "the hermeneutic circle" is an overarching principle which expands to the other six principles.

The six principles are also interrelated and dependent on each other. It is important to apply these principles when the researcher determines a relevant context to be studied (principle two).

Table 4.1: The seven principles of interpretive research, Source: Klein and Myers (1999).

Principles		**Description**
1	The Fundamental Principle of the Hermeneutic Circle	This principle of human understanding is fundamental to all the other principles. This principle suggests that all human understanding is achieved by repeating between considering the interdependent meaning of parts and the whole that they form.
2	The principle of Contextualization	This principle requires clear reflections on the social and historical background of the research setting to ensure the intended researcher can see how the current situation under investigation emerged.

Principles		Description
3	The Principle of Interaction between the Researchers and the Subjects	This principle requires clear reflections on how the data or research materials were constructed through the interaction between researchers and respondents of the study.
4	The Principle of Abstraction and Generalization	This principle requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.
5	The Principle of Dialogical Reasoning	This principle requires an understanding of potential contradictions between the theoretical preconceptions guiding the research design and actual findings with subsequent cycles of revision.
6	The Principle of Multiple Interpretations	This principle requires an understanding of potential differences in interpretation among the respondents as are typically expressed in multiple narratives or stories of the same sequence of events under study.
7	The principle of Suspicion	This principle requires an understanding of potential "biases" and systematic "distortions" in the narratives collected from the respondents.

Principle three deals with how data is created and sourced through interactions with subjects. The researcher should also take careful consideration in choosing concepts or theories to which to abstract and generalise (principle four) and discern theoretical preconceptions from actual findings (Principle five). Furthermore, the researcher should apply different interpretations with care and capture different narratives of respondents (Principle six); and these narratives should be assessed critically to identify potential bias "(Principle seven)" (Klein & Myers, 1999, p. 78). These principles were adopted in Chapter 9 section 9.4 to reflect on this research.

4.5 Research Approach

Four inferential logic or research approaches can be used to develop research conjectures namely, deduction, induction, abduction and retroduction (Blaikie, 2009; Osei-Bryson & Ngwenyama, 2014).

These research approaches play a pertinent role in determining how contribution to knowledge is achieved. Osei-Bryson and Ngwenyama (2014) describe deduction as an inference of results from a rule to a result. He explains that deduction reasoning derives its conclusions from premises where theories are tested and deduced to reach conclusions.

In phase one of this research, a deductive approach is adopted where concepts from AT are adapted to explain the referral activities of HCPs. In addition, an inductive approach is to be further used to explore and seek an understanding of the use of the informal system and HCPs' workaround practices.

An induction approach involves inferring a general rule from specific observations and cases, helping researchers explain broad social rules from observed irregularities in phenomena or phenomenal behaviour (Osei-Bryson & Ngwenyama, 2014). Thomas explains that the main objective of an inductive research approach is to "allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies" (Thomas, 2006, p. 238). In this research emerging concepts were identified from this inductive approach as outlined in section. 4.10.1.2.

The last two inferential to logic types are abduction and retroduction. According to Osei-Bryson and Ngwenyama (2014), abductive logic to reasoning involves generating the most plausible explanation for an observed phenomenon, while the retroduction logic involves identification of mechanisms or conditions that could explain observed phenomena (Osei-Bryson & Ngwenyama, 2014). This study was limited to the deductive and inductive inferential logics to draw the research conclusions. The research strategy and design are described in the next section.

4.6 Research Strategy and Design

Information Systems research encompasses numerous strategies for conducting research, namely field experiments, case studies, narrative studies, surveys, phenomenological studies, and laboratory experiments (Orlikowski & Baroudi, 1991).

Case studies are one of the many research strategies used in social sciences (Yin, 2013). A case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context and where the boundary between events and the context is not clearly defined (Yin, 2013).

The case study strategy has been widely adopted by various Information Systems scholars (Orlikowski & Baroudi, 1991, Walsham, 1995; Yin, 1999; Yin, 2014). Case studies are usually connected with qualitative research. However, they can have different approaches depending on the assumptions made about how reality is understood and what knowledge is valued. While mixed or quantitative methods can offer valuable statistical insights and perspectives, the qualitative approach is suited for examining the phenomena under study. The qualitative approach is appropriate for examining e-referrals use and workaround practices within the real-life life context of HCPs.

Case studies can take a positivist, critical or interpretive stance depending on the ontological and epistemological assumptions adopted (Orlikowski & Baroudi, 1991). Walsham (1995) expresses the view that a case study strategy is best suited for conducting empirical research with an interpretive perspective. Yin (1999) particularly refers to using case study methods in health services research. He claims that the use of the case study method is suited for health services research since it is driven by developments in managed care systems that link multiple components that produce "mega-systems" of great complexity. These systems are rapidly and continually changing making them challenging to track and understand (Yin, 1999). Yin, therefore, favours a case study method as the most appropriate strategy for health services research, over other empirical methods.

Given the nature of the research question and the interpretive stance adopted for this research, a case study strategy is deemed an appropriate strategy for the study context. Figure 4.2. shows the case study design followed in this study.

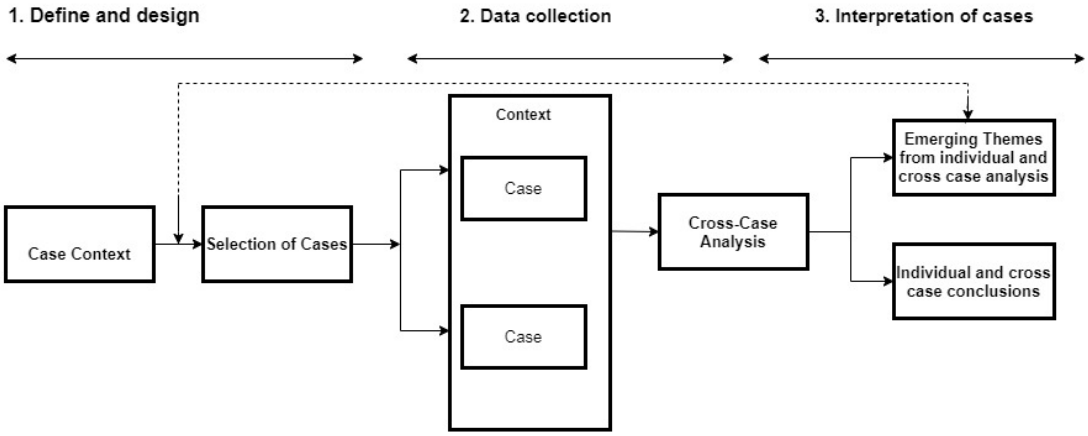


Figure 4.2: Case study design (Source: Author)

The selection of a case or cases is determined by the contextual factors and objectives of the study (Yin, 2013). Yin further advises researchers to make careful consideration when selecting cases. Researchers should choose a suitable criterion to answer the research questions. This study aims to answer the "how" question, hence the selection of a case study as a strategy is a suitable choice.

The chosen strategy takes into consideration the context of health referral systems and issues concerning e-referrals use in the given context. The case study strategy is therefore useful in novel situations of Information systems use, where contextual conditions of events are critical, and the researcher is independent and does not have control over as events unfold. The use of e-referrals is investigated in the real-life context of public hospitals.

Despite the use of case studies in IS research, the case study strategy has been subjected to many criticisms. The main critics are related to a lack of statistical generalisation and non-representativeness. (Flyvbjerg, 2006, p. 799) refutes this misunderstanding and argues against the notion that one cannot generalise from a single case and that case studies cannot contribute to scientific development. Instead, he posits that generalisation from a single case is often possible, and case studies can be pivotal to scientific progress, either supplementing or serving as an alternative to other methods.

He believes that formal generalization is overvalued as a source of scientific development, while "the force of example" is undervalued. It can thus be inferred that case study research, in particular interpretive case studies, are not only important in foregrounding unique contextual findings, but case study findings can illuminate unique contextual findings, and these findings can be generalised to similar settings. Additionally, interpretive studies also underscore the importance of “abstraction and generalisation.” This principle concerns the generalisation of the phenomenon of interest to some theories.

Equally, Mitchell (2000) explains that “an analyst should try to generalise findings to ‘theory’; analogous to the way a scientist generalises from experimental results to theory, note that the scientist does not attempt to select ‘representative’ experiments” (Mitchell, 2000, pp. 174-175). Yin (2013) refers to this generalisation as “literal generalisation”.

Despite the critics, it is important to emphasise that analytic and theoretic generalisation are applied in the chosen cases, in which the generalisation of findings to a theory is the objective of this study (Yin, 2009). This study, therefore, undertakes multiple cases using an interpretive stance.

Multiple cases of referral systems in the Western Cape and Khomas region in Namibia are selected to explore contextual conditions around the use of electronic referrals. A description of the cases is provided in the next section.

4.7 Description and Selection of Cases

This section describes the cases by generating a contextual understanding of the study settings. It commenced with a preliminary literature review and definition of the research context based on the study's motivation. Multiple cases of the Western Cape Department of Health in South Africa and the Ministry of Health and Social Services in Namibia were selected.

The embedded systems in the two cases - the Western Cape Referral System, which consists of hospitals A and B, and the Khomas Referral Systems, which consists of hospitals C and D - are taken into consideration.

The two cases are selected for their distinct characteristics related to e-referrals use in the two settings. E-referrals were only occasionally used, according to the literature, at Khomas region hospitals. However, widespread adoption and usage of e-referrals is observed in the Western Cape referral system.

To explore the similarities and differences between the two settings, the cases were selected. Replication logic and theoretical replication is thus employed in choosing these cases to make contextual comparisons (Yin, 2013). The two cases are expected to yield contrasting results. It is therefore important to investigate whether e-referrals facilitate or constrain the work of HCPs in the two contexts.

The fieldwork involved conducting semi-structured interviews with HCPs in the two settings. Interviews were conducted with HCPs in the Western Cape Province and Khomas region public hospitals. Phase 1 aimed to determine activities, practices and tools used to facilitate these referral activities.

A summary of the fieldwork and interview dates is presented in Table 4.2.

Table 4.2: Summary of fieldwork

Location of fieldwork	**Interview Dates**
Phase 1	
Western Cape Province, Cape Town, South Africa	12th - 24th October 2017
Khomas Region, Windhoek Namibia	7th - 29th November 2017
Phase 2	
Western Cape Province, Cape Town, South Africa	30th May 2020
Khomas Region, Windhoek Namibia	16th July - 16th October 2020

An ActAD framework was used as a lens to guide the design of semi-structured interviews.

In both settings, an arrangement was made to organise a dedicated meeting room where interviews were conducted. Participants took turns to attend interviews and, in cases where the dedicated room was unavailable, HCPs were interviewed in their private offices.

Phase 1 highlighted unique contextual issues experienced in the two settings. Contextual issues related to the use of e-referrals in unintended ways and the proliferation of Shadow Information Technology (SIT) were uncovered. This led to the adjustment of the interview guide to include more questions on these workaround practices.

Follow-up interviews in the two settings were conducted. In this second phase, particular attention was taken to probe participants on their workaround practices. The next section describes the pilot study.

4.7.1 Pilot case study

A pilot case study is undertaken to help the researcher refine the data collection plans with respect to procedures to be followed and content (Yin, 2014).

Similarly, Prescot & Soeken define a pilot study as a "feasibility study that comprises 'small-scale versions of the planned study, trial runs of planned methods, or miniature versions of the anticipated research to answer a methodological question(s) and to guide the development of the research plan." (Prescott and Soeken, 1989, p. 60).

A pilot case can be identified based on the convenience of the site geographically or whether the fieldwork site is congenial or accessible (Yin, 2013). The pilot case can be selected to represent the real case so that all the relevant data collection issues will be encountered and addressed in the pilot case. The main benefit of a pilot is that it provides the researcher with an opportunity to make revisions and adjustments to the main study (Kim, 2011).

A pilot study was therefore conducted to refine the instrument and determine the type of e-referrals used in the public health sector.

Careful consideration was taken when selecting pilot case participants to ensure they were similar to the real case study participants to be studied in this research.

The scope of the pilot inquiry included conceptualising the referral process and different types of health information systems (HIS) used for patient referrals in the public health sector. Initial interviews (Appendix 15) were therefore conducted with two medical officers at Hospital A, which provided insights into the referral process and types of HIS used to facilitate this process. This phase allowed better positioning of theoretical concepts that aided further design of the interview guide (Appendix 16).

The research instrument was modified to improve the structure of the questions because some questions were repeated. Additional questions were then added based on relevant theories and input from participants. For example, new questions were modified in Section A namely, part 1, question 6, part 4; questions 4.1. – 4.7 were added to capture the socio-technical factors related to workaround practices. Additionally, more questions for IT personnel in section B of the interview guide were added (Questions, 1.3 to 1.4; 1.10, 1.13 to 1.15) to include questions on Shadow IT and the use of third-party applications. A revised interview guide is included in Appendix 16.

The pilot case also helped in arranging the logistics of the field inquiry. Yin (2013) noted that the work of the pilot case can uncover indicators of relevant questions to ask and the logistics of the field inquiry. These include a description of the logistics such as identifying limitations of recruitment and access to participants. This is very crucial especially in the health care sector, as there might be limited access to medical doctors due to their busy schedules. The pilot phase, therefore, helped with the refinement of the sampling strategy and finding the most effective way to recruit the study participants (Janghorban, Roudsari & Taghipour, 2013). Participants recommended that recruitment is best achieved through the Head of Units and using them as the initial contact to teams in their units. A snowball strategy was therefore employed to recruit study participants. Snowball sampling is a type of technique that often proceeds after a study design, and it occurs when the researcher asks a certain participant to recommend other participants to be included in the study (Creswell, 2009).

4.7.2 Selection of Case Studies

A multi-case design is employed to select the Western Cape Department of Health in South Africa and the Ministry of Health and Social Services in Namibia to investigate the phenomenon of interest. Referral activities and electronic tools facilitating the work of healthcare providers are examined in hospitals A and B located in the Western Cape Province, and in hospitals C and D in the Khomas region. The rationale underlying the selection of multiple-case studies is to explain similar results (literal replication) and to contrast results (theoretical replication) in given settings.

The two cases are expected to yield exemplary outcomes in the use of e-referrals. Evidence collected from cases is often considered more compelling, and the study is therefore regarded as being more robust. For this reason, a multi-case design was employed to achieve a replication logic and theoretical replication in this study (Yin, 2009). According to Creswell (1994) and Yin (2013), literal logic can be used to choose cases that have similar settings and are expected to achieve similar results.

Hospitals A and B in the Western Cape were chosen as tertiary hospitals where an e-referral application was implemented and adopted. Medical officers and specialists at these hospitals utilised this application for over a year, thus justifying the selection of these respondents for this study. In Windhoek's Khomas region, public hospitals C and D were selected, and interviews were conducted with medical officers and senior medical officers who had been introduced to the application and those who had not used it. In addition to HCPs, IT personnel were also interviewed in both cases to gather technical perspectives. The aim of selecting these two settings was therefore to compare the use and non-use of the application and to examine the contextual conditions that led to different usage patterns of e-referrals.

From the Western Cape, Hospitals A and B were chosen as tertiary hospitals where an e-referral application was introduced and adopted. The application was used for over one year in both hospitals by registrars and dermatologists. Hence, the selection of the participants to take part in this study.

In Windhoek, Khomas region, the public hospitals were chosen for this study, and medical officers and senior medical officers were interviewed. Participants who were

introduced to the application, and those not using the application, were interviewed. The purpose of selecting the two settings was to compare the use and non-use of the application and to examine contextual conditions leading to varying use.

Before the beginning of this study, permission was requested from the relevant bodies (the Department of Health (DOH) in South Africa and the Ministry of Health (MOHSS) in Namibia). Both the DOH and MOHSS gave a positive response, and the study was approved to be conducted in the respective settings. Further permission (at provincial, district, and hospital levels) was granted before embarking on the data collection process. Once permission was granted, initial contact was initiated with the heads of units at the respective public hospitals. Data collection methods are explained in the next section.

4.8 Data collection

Before data collection, a data management plan was devised as per university requirements. This included outlined strategies for handling the sensitive data of study participants such specifying how HCPs was stored without identifiable data on these storage drives. All participants' details were therefore anonymised by removing their names and assigning codes (e.g. HCP_1) before storing their data. This ensured their information was treaded confidentially as per data management procedures. This data management plan was part of the ethics clearance for this research.

This study was undertaken in two phases: (1) Exploratory and Context Definition phase and (2) Workaround's perspective as shown in table 4.3. Ethics approval with the relevant institutions was sought before the beginning of this study.

Table 4.3: Research phases mapping to research questions

Research Phase	Description and Research Question
Pilot study	What electronic referrals do healthcare providers use to mediate collaboration with specialists?
Phase 1: ActAD Perspective: Exploratory and Context Definition phase.	How do healthcare providers use e-referrals to facilitate work activities in the patient referral process?
Phase 2: Workarounds Perspective: Multiple Case Study Phase.	Why do Health care providers (HCPs) enact workarounds to e-referrals in public hospitals? How do Health care provider's (HCPs) workaround practices affect referral outcomes?

The phases of this research are discussed in the following sections.

4.8.1 Phase 1: ActAD Perspective: Exploratory and Context Definition

The purpose of this phase was to gain an understanding of the phenomenon of interest within its original context. A preliminary literature review was conducted to improve the position of the work and to gain an understanding of the tools used to facilitate referral activities and work practices of the HCPs. Secondary data was collected from annual health reports, white papers, and policy documents (e-health strategies and guidelines) to examine the background of each setting. Additionally, referral guidelines and protocols were analysed to examine the use of e-referrals to investigate the benefits, constraints and limitations of e-referrals in public hospitals.

The Namibian national referral policy and guidelines were implemented (Ministry of Health and Social Services (MoHSS) Namibia (2013); Ministry of Health and Social Services (MoHSS) Namibia (2015).

An analysis of documents from the Department of Health in South Africa and the Ministry of Health and Social Services in Namibia was reviewed to gain an understanding of what strategies are implemented to provide a roadmap towards implementing e-health in the two settings (Ministry of Health and Social Services (MoHSS) Namibia. 2021; Department of Health (DoH) South Africa, 2019a).

Once the document analysis was completed, the initial primary data was analysed using the Activity Analysis and Development (ActAD) framework. In this phase, the ActAD framework was adopted as a sensitising tool to better understand e-referrals as tools facilitating HCPs referral activities. This framework was crucial in comprehending the overall referral process and the various concepts involved, as described in Section 3.2.1. The findings from this phase are discussed in Chapter 5.

This phase was conducted pre-COVID (2017 - 2019) and it focused on examining types of e-referrals and how they facilitate the work of HCPs. Once benefits and limitations were established, the next phase was conducted from the beginning to mid-2020 (during the COVID pandemic) to investigate workaround practices and these limitations concerning e-referrals. The findings from phase one are reported in Chapter 5.

4.8.2 Phase 2: Workarounds Perspective (Multiple case study phase)

This phase used the outcomes of the pilot study and phase one to achieve a firm basis for the design and analysis of the multiple case data. Semi-structured interviews and observations were used as primary sources of data. Part of the data collection was conducted during the COVID-19 pandemic in the year 2020. A separate ethics application was requested, and an extension of the study was granted as shown in Appendix 13.

This phase focused on investigating the enactment of workarounds to e-referrals in public hospitals. The Process framework for healthcare IS workarounds and impacts framework played a crucial role in this research phase, as it was adopted to analyse HCPs workaround practices observed from the empirical data. Concepts such as benefits of the system; issues with the system; augmenting; working around; fitting and impact were adapted for this study as discussed in section 3.5.2. The findings from this phase are reported are in Chapter 6.

A cross-case analysis is conducted to compare work practices and workarounds to e-referrals used in multiple cases to draw similarities and differences in the two settings.

A work systems method is used to illustrate activities and workaround practices enacted in both case studies. Additionally, the SEIPS 3.0 model, as discussed in section 3.5.1, served as a guiding lens for exploring and analysing the socio-technical issues within the work systems under study. This phase focused on examining the use of e-referrals and their association with referral outcomes. The findings from this phase are presented in Chapter 6. The research instrument and data sources used in phases 1 and 2 of the research are discussed in the next section.

4.9 Data sources and research instrument

Empirical evidence was gathered utilising semi-structured interviews. Semi-structured interviews were conducted with 31 respondents. In the Western Cape Province in hospitals A and B; 2 heads of units (dermatologists), 11 medical officers (including registrars), and 1 IT person were interviewed.

In the Khomas region, in hospitals C and D, 2 heads of units, of which one is a dermatologist, 11 medical officers, and 2 nurses were interviewed. Two IT personnel from the Ministry of Health were also interviewed as illustrated in Table 4.5. Case study participants were recruited using snowball sampling, as it was easier to identify participants through their heads of units. Using this technique proved to be effective in recruiting medical officers in the respective departments, as the researcher was not familiar with the participant's daily schedules. The researcher, therefore, relied on the guidance of the head of the department to identify the potential participants and their availability

All participants in the study were asked for informed consent (Appendix 14) before the interviews. The interviews were recorded with each one lasting between 30 to 40 minutes. Interviews were transcribed verbatim and NVivo software was used to thematically analyse the transcripts. NVivo is a software used for qualitative data analysis. This is classified as computer-assisted qualitative data analysis software; CAQDAS (Friese, 2022). Semi-structured interviews in phase 1 were developed and guided by the study objectives and the concepts from the ActAD framework. Different interview protocols were developed for the selected participants, Head of Units, health care providers (nurses; registrars and medical officers) and IT personnel.

The interview guides were further modified to incorporate emerging concepts from prior phases. Concepts from workaround perspectives were included in the interview guide. Table 4.4 shows the participants interviewed.

Table 4.4: Demographic profile of study participants

	Case Study 1		Case Study 2	
Job title	**Participant**	**Code**	**Participant**	**Code**
Head of unit	Participant 1	H_01	Participant 14	HCP_14
	Participant 10	HCP_10	Participant 18	HCP_18
Medical officers	Participant 2	HCP_02	Participant 15	HCP_15
	Participant 3	HCP_03	Participant 16	HCP_16
	Participant 4	HCP_04	Participant 17	HCP_17
	Participant 5	HCP_05	Participant 19	HCP_19
	Participant 6	HCP_06	Participant 20	HCP_20
	Participant 7	HCP_07	Participant 21	HCP_21
	Participant 8	HCP_08	Participant 22	HCP_22
	Participant 9	HCP_09	Participant 23	HCP_23
	Participant 11	HCP_10	Participant 24	HCP_24
	Participant 12	HCP_12	Participant 26	HCP_26
Nurses	Participant 13	N_13	Participant 28	N_28
			Participant 27	N_27
			Participant 29	N_29
IT Personnel	Participant 31	IT_31	Participant 25	IT_25
			Participant 30	IT_30

In the next phase, careful consideration was taken in interviewing participants to solicit relevant information on e-referrals use and workaround practices.

The interview guides consisted of three sections. The first section of the interview collected the general background and biographical information about the participants. The second section consists of questions aimed at understanding the referral activities of participants, their work and the tools used in facilitating them. Section three aimed at gathering data on the workaround practices of participants. General questions were then included in Section four to further probe and get more information on other areas not covered by previous questions.

The interview guide is included in Appendix 16. Thematic analysis was then conducted to analyse data collected from interviews.

In addition to interviews, several documents (Table 5.7) were reviewed; and observation (on the Vula application) was conducted to study the interactions and actual activities of the participants on the application (Appendix 17). Data analysis techniques used in this research are discussed in the next section.

4.10 Data analysis

The data analysis is an iterative process including data collection, data reduction, data display, drawing conclusions and verifying the data (Miles, Huberman & Saldana, 1999). Yin (2009) describes this process to involve scrutinising the data collected by examining, categorising, and conducting necessary procedures to answer the research questions. This study adopted thematic analysis as a general analytic technique.

Thematic analysis is an approach to data coding for identifying patterns across the data set in relation to the research question (Braun & Clarke, 2014). This approach involves the identification of themes achieved by careful reading and re-reading of the data (Rice & Ezzy, 1999, p. 258). The analysis process followed phases proposed by Braun & Clarke (2014) namely, familiarisation with data, coding, searching for themes, reviewing of themes, defining, and naming themes and finally, writing up the report.

These phases were undertaken in an iterative order to compare data and themes generated. Different phases were revisited to produce an emergent theory (Braun & Clarke, 2014; Corbin & Strauss, 2015).

Careful consideration was taken to follow a hermeneutic inquiry moving from the entire data set to extracts and parts of the data analysed.

4.10.1 Thematic analysis for case study data

It is important to identify an analytic procedure when developing a case study protocol (Yin, 2009). It is equally important to choose an approach to analysing research data. These approaches are namely deductive and inductive (Burnard et al., 2008).

A deductive approach begins with an idea or a theoretical framework and uses empirical data to falsify or confirm the framework or idea (Burnard, et al., 2008 p. 429).

On the other hand, the inductive approach uses empirical data to derive the structure of the analysis (Burnard, et al. 2008). This study uses both approaches to analyse empirical data from cases.

4.10.1.1 A deductive approach to data analysis

The study initially employed a deductive approach drawing concepts from the ActAD framework and research questions. This phase followed a code to theory process (Figure 4.3) where concepts from theory were used to develop initial codes. A coding manual shown in (Appendix 18) was developed priori based on applicable concepts (Crabtree, 2023; Crabtree & Miller, 1999). The concepts used from this framework are described in Appendix 20. A code to theory model for qualitative inquiry was followed during the coding process as shown in Figure 4.3.

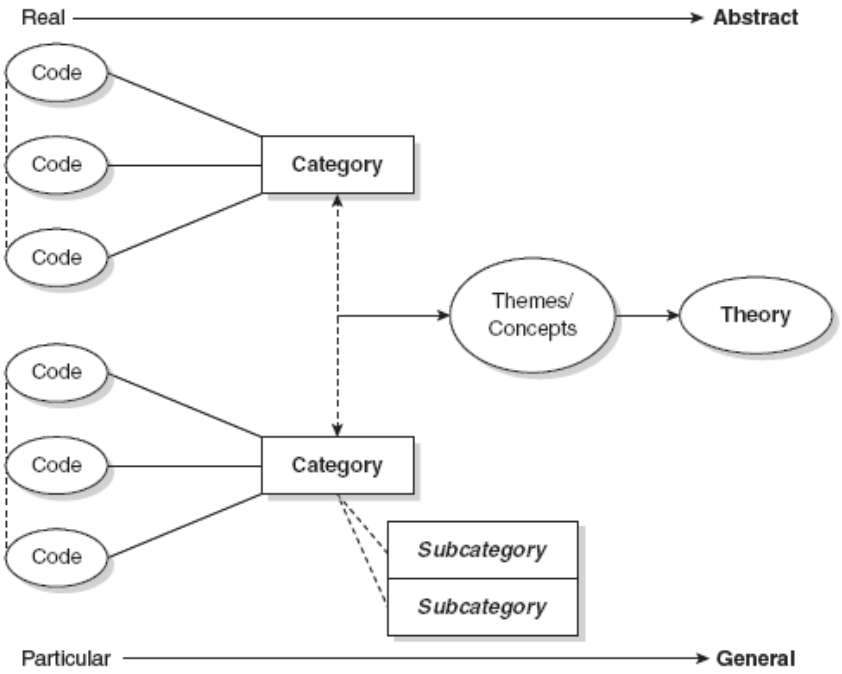


Figure 4.3: Coding process (adapted from Saldana, 2013)

The initial codes were generated during the preliminary stage based on the theoretical concepts. The coding manual was initially developed, and it consisted of seven broad codes (Appendix 18). These codes were reviewed with the entire data set to combine or remove codes. The coding template was then applied to the data, and additional coding was undertaken. As the review was carried out, some codes were redefined and renamed to come up with clear themes describing the data as illustrated in Figure 4.4. These codes were then tested to determine their applicability and reliability (Boyatzis, 1998). Triangulation was used by looking multiple data sources to cross-check and validate the initial codes. A document analysis of e-health strategies, referral policies and annual reports was also carried out to validate the codes. For example, a new code label, "Emerging Findings" was created to capture emerging data not represented by other codes. The label contradictions were replaced with "limitations" as the data suggested there were general limitations experienced with the use of existing referral methods and e-referral applications. The "Means of Work" code was combined with the code "Means of Coordination and Collaboration."

A new code label "Rules" was added as there are findings related to referral guidelines, procedures and informal rules observed from the use of e-referrals.

It is important to note that an iterative process was followed in applying the template, summarising the data, identifying themes, connecting codes, and corroborating and legitimating the coded themes. The iterative loop allowed the codes to be labelled differently and to connect them to the raw data.

As the analysis was carried out, memoranda and annotations were created and attached to the data to highlight and summarise important information and record emerging themes. New themes were generated across the data set. The themes were corroborated and legitimised by scrutinising the labels and descriptions. Additionally, it was necessary to verify the names and descriptions with relevant documents from the Western Cape government and the Namibian Ministry of Health and Social Services (MOHSS).

For example, the types of referrals and description of the referral process were checked in the Western Cape Department of Health annual report of 2020 and description of the referral process and related activities were verified in the National policies and eHealth strategies for South Africa and Namibia (Western Cape Department of Health South Africa (2020); Ministry of Health and Social Services (MoHSS) Namibia, 2021; Ministry of Health and Social Services (MoHSS) Namibia, 2013; Department of Health (DoH) South Africa, 2019a). This phase of the thematic analysis generated the codes depicted in Figure 4.4.

Name	Files	References
Actors_Subjects	11	21
Emerging Findings	9	20
Limitations	31	199
Means of coordination a	29	387
Referrals Activities	27	234
Rules	30	168

Figure 4.4: Initial codes

4.10.1.2 An inductive approach to data analysis

The codes from the previous stage did not provide sufficient new insights from the data. A further analysis was therefore conducted using an inductive approach to further explore emergent data. The emergent data and themes are further presented in section 5.2. Through the inductive approach analysis, two salient dimensions related to workaround practices; and shadow Information technologies emerged. Further coding was conducted to explore, categorise, and group code labels into relevant themes. The SEIPS model (outlined in Section 3.5.1) and the Process framework for healthcare information systems and impacts (outlined Sections 3.5.2) were employed in this iteration of data analysis for further themes development. These reviewed themes are presented in section 6.2. and final themes are discussed in section 7.2. In this section, a cross-case analysis was conducted to examine similarities and differences between the two referral work systems.

A comparison of themes is carried out to improve understanding of these similarities and differences. For example, a comparison of e-referral tools used in case 1 is compared to case 2. Workaround practices of HCPs are also compared using matrix charts (using NVIVO) and tables. Additionally, the design-reality gaps as they emerged from the empirical data were mapped to improvisation types (Section 7.3) using matrix coding. Matrix displays are useful aids in visualising data and assisting the processes of reflecton, verification, and conclusion drawing.

To achieve internal validity, a comparison of the empirical data from case one and case two was conducted where theoretical propositions were developed. Using matrix coding, rival explanations were arrived at to explain the types of improvisation and design-reality gaps as discussed in Section 7.3. Research propositions were thus formulated and presented in section 8.2 to provide an explanation of the phenomenon of interest. The results from the cross-case analysis are described in detail in chapters 6 and 7.

4.11 Ethical considerations

Ethical approval was sought from the University of Cape Town to conduct this research.

The first level of permission was sought from the Faculty of Commerce (Appendix 7) and the Faculty of Health Sciences (Appendix 8) since the study involves human subjects in health organisations.

The second ethical approval was applied from relevant bodies to obtain ethics clearance to conduct this study in the respective settings. Approval was granted by the Western Cape Government (Department of Health, South Africa, 2020) (Appendices 9 and 10) and the Ministry of Health in Namibia (Appendices 11 and 12). Once ethics clearance was obtained, additional permission to conduct the research in selected units of the respective hospital was sought from the hospital management (Appendix 12). Permission was granted, and the letter was shown to the participants before they signed the informed consent (Appendix 14). Henning, Van Rensburg & Smit (2004) emphasise the importance of seeking consent from study respondents. They explain that respondents need to give informed consent to participate in the study, meaning they must be fully informed about the research objectives, their roles, and any consequences.

4.12 Conclusion

This chapter outlined the scientific philosophy, the design and the research strategy underpinning this research. The research process onion was used to compare different philosophical perspectives.

The interpretive paradigm was chosen as a philosophical perspective for this study. A case study strategy is employed as a chosen strategy to examine the two referral systems of the Western Cape and Khomas regions in South Africa and Namibia, respectively. The rationale underlying the selection of multiple-case studies is to explain similar results (literal replication) and to contrast results (theoretical replication) from the two case studies. Semi-structured interviews, document analysis and observation are triangulated to gather empirical evidence for the research. To analyse the data, thematic analysis using NVIVO is conducted to develop the research themes. A deductive and inductive approach to data analysis is followed to arrive at different explanations of the research data.

CHAPTER 5: Electronic referrals (e-referrals) and ACTAD perspectives

5.1 Introduction

This chapter presents the findings of phase one of the data analysis. In phase one (Section 4.8.1) of the research, a deductive analysis is conducted from an ActAD perspective to describe healthcare providers' (HCP) referral activities and tools used to facilitate these activities. The findings on electronic referrals use, and how they facilitate HCPs' referral activities, are discussed in this chapter. Concepts and themes are identified from the empirical data gathered using thematic analysis.

The findings in phase one were interpreted through the lens of the ActAD framework (outlined in section 3.2.1). This framework proved invaluable in developing an understanding of the referral process, the specific activities involved, and the tools used to facilitate the work of the HCPs. This chapter thus reports empirical findings related to the work of HCPs and the activities they undertook in the referral systems are reported. Following the identification of the activities, the means of coordination and communication that support these activities were explored in the four hospitals chosen for this study. The hospitals are given the initials A, B, C, and D to maintain confidentiality. Hospitals A and B are situated in the Department of Western Cape, South Africa (Case study 1), whereas hospitals C and D are situated in the Khomas region, Namibia (Case study 2), Ministry of Health and Social Services.

The goal of this chapter is to address the following question:

How do healthcare providers use e-referrals to facilitate their work activities?

In the sections that follow, the initial codes and categories obtained from the data are presented. The next section discusses the codes related to the activities of HCPs in the referral system as well as the numerous roles they play.

The tools and means of coordination for these activities and collaboration between subjects are discussed in the following section. In the final section, formal rules (policies, guidelines, and procedures) and informal rules (social norms) that regulate referrals, such as societal conventions and policies, are discussed. The codes based on the framework concepts as outlined in section 3.2.1 (application of ActAD to the study) are discussed in the next sections.

5.2 Reviewed codes and categories

This section presents the initial codes identified from the deductive coding process as explained in Section 4.10.1.1. The codes-to-theory approach for qualitative inquiry was adopted for thematic analysis. In phase 1, a deductive approach using an ActAD framework was followed in the initial analysis. A coding manual in Appendix 18 was developed and particularised to the ActAD framework.

After the initial categories were developed, codes were added as labels attached to specific segments of data. According to Saldana (2013, p. 8), "Codes are essence-capturing and essential elements of the research story that, when clustered together according to similarity and regularity (a pattern), they actively facilitate the development of categories and thus an analysis of their connections". The reviewed codes were later grouped and summarised into categories as shown in Table 5.1.

Table 5.1: Reviewed codes and categories in the data

Categories	Codes
1. Referral activities of subjects	1.1. Inpatient referral activities 1.2. Outpatient referral activities 1.2.1. Bookings 1.2.2. Downward referrals 1.2.3. Horizontal referrals 1.2.4. Inter-sectoral referrals 1.2.5. Vertical referrals 1.2.6. e-consultations
2. Subjects	2.1. Groups of actors 2.2. Individual actors 2.3. Roles
3. Means of coordination and collaboration	3.1. Traditional methods 3.2. Paper-based referrals 3.3. Telephonic (Bookings) 3.4. Electronic methods 3.4.1. Vula mobile app 3.4.2. WhatsApp mobile app
4. Rules	4.1. Referral guidelines for e-health 4.2. National referral Policies guiding e-referrals use 4.3. Ethics, privacy, and confidentiality of electronic information
5. Constraints	5.1. Constraints with existing referral methods

5.2.1 Referral activities of subjects

Referral activities are tasks undertaken by HCPs to refer patients for advanced health care and management, either within the same health facility (hospital) or to a different high-level health facility. Inpatient referrals are received from units within the same hospital. On the other hand, outpatient referrals are referrals received from other health facilities for advanced health care and management. The codes that emerged from the ActAD analysis were identified and are shown in Table 5.1. Referral activities consist of two codes, namely, Inpatient and Outpatient activities as shown in Figure 5.1. At the tertiary hospital level, referrals are also classified as outpatient or inpatient referrals.

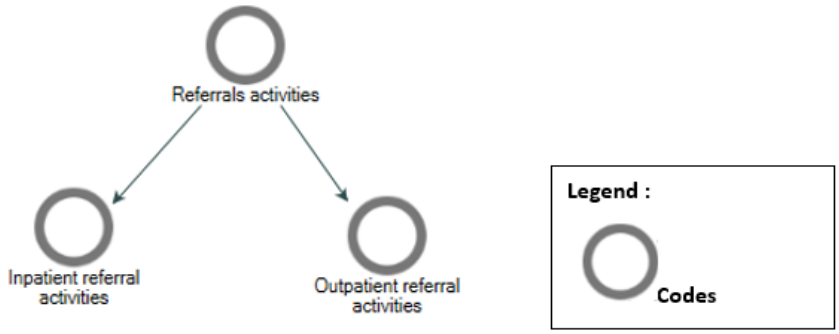


Figure 5.1: Codes of referral activities

The "Outpatient referrals" code is further broken down into sub-codes and categories as illustrated in Figure 5.2. Referrals were received from units within the same hospital.

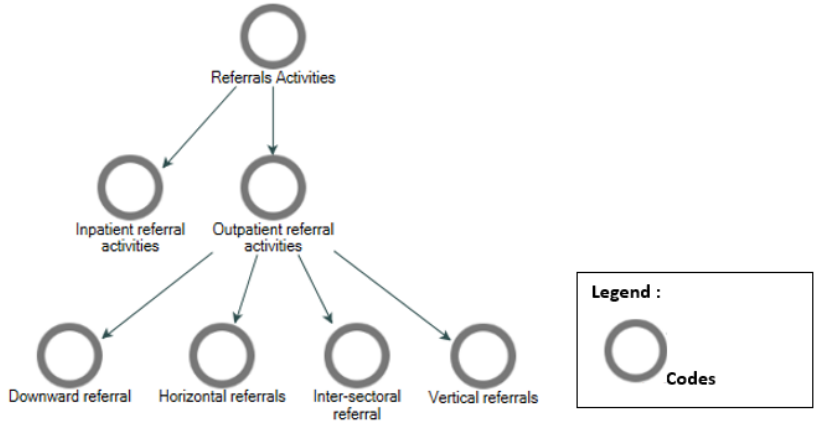


Figure 5.2: Codes, sub-codes, and categories on referral activities

The referral process refers to pathways in which health professionals and institutions communicate and transfer patients between health facilities at different levels of care (Department of Health South Africa, 2021). Findings from this study reveal different types of outpatient services rendered to patients. These are defined in the context of a holistic referral process in public hospitals. Outpatient referrals occur when a patient is referred to another health facility to receive specialist outpatient service or for further management. These are made up of bi-directional (horizontal, vertical, downward) and inter-sectoral referrals.

The healthcare systems in Namibia and South Africa both consist of different types of hospitals supporting healthcare service delivery including referral services.

The study findings show that HCPs undertake different types of outpatient referrals, as illustrated in Figure 5.3.

Figure 5.3: Types of referrals in public hospitals (Source, Author)

Patients can be initially treated at community services before being forwarded to primary healthcare clinics and community healthcare centres. District or regional hospitals are usually the primary points of referral received from PHC facilities. The main referral sources from PHC institutions are often district or regional hospitals.

Referrals can therefore go both ways, from district hospitals to regional, tertiary, speciality, and central hospitals, from low levels of treatment to higher levels of care. According to the Department of Health (DoH) South Africa (2019b), bidirectional referrals can move in a vertical, horizontal, or downward order.

In some cases, patients self-refer (self-referrals) to higher-level facilities without a referral letter from medical practitioners. Vertical referrals occur when patients are sent to higher-level facilities for specialty and continuity of care (Department of Health (DoH) South Africa, 2019b).

Patients can also be sent to another healthcare facility that offers the same services (horizontal referrals; code 1.2.3) and level of care, either in the same district or a different district, to ensure continuity of care. Patients who entered a certain level of care without a referral, require a lower level of care after the initial assessment, or who need continuity of care, follow-up and rehabilitation are referred down (code 1.2.2) to the appropriate level of care. Some referrals are also received from the private sector (inter-sectoral).

Findings reveal that HCPs undertook their referral work as documented in the referral policies and procedures from the Department of Health (code 4). In South Africa, dermatologists in Hospital A, and Hospital B reported that they received referrals from clinics, health centres and day hospitals in the Western Cape.

"We get a referral from the various local clinics and day hospitals" [HCP_8].

Similarly, in the Namibian referral system, HCPs reported that district hospitals received patients from primary health care levels (clinics and health centres). These patients were later referred to regional and then tertiary hospitals:

> "*So, the hospital [hospital A] is the intermediate hospital (received referrals from the regions) and tertiary hospital. The classification is done based on the type of care rendered by the hospital." [HCP_20]*

Downward referrals (code 1.2.2) are sent from higher levels of care to primary healthcare facilities, and these usually occur in the form of written feedback.

> *"Often you do write back. Yes, normally we do write back. If we're going to take over the patient full-time, then not always. Or, for example, if we're admitting the patient, we won't always write back but then we will write a discharge note back afterwards." [HCP_7]*

For inpatient referrals, respondents reported inpatient referrals occurred when they referred patients to departments within the same hospital or a different discipline.

> *"One of the ways is inpatient referrals, meaning that if a patient that's been admitted into the hospital or another ward. The doctor in that discipline refers to us as specialists in the same hospital." [HCP_8]*

From all the types of referrals, HCPs report they conducted numerous tasks and activities (code 1) to complete their work. These tasks required the support of tools to aid in facilitating their work. Findings confirm that both traditional methods (including manual tools (code 3.1) and electronic tools (code 3.2) are in use to support the work of HCPs. These are discussed in the next sections.

5.2.2 Tools, means of coordination and collaboration for activities

The means of work, coordination and communication between different subjects are facilitated by both traditional and electronic tools. Activities and tools are shown in Table 5.2 and described in the next sections. Findings from both referral systems (South Africa and Namibia), reveal that health facilities are required to keep a referral register for the health facility records and in addition to complete referral forms for individual cases.

Table 5.2: Sub- Themes of Tools and referral activities

Activity	Activity description	Method / Tools
Bookings	Administrative bookings of patient referrals	Telephone, Referral letter/note (traditional)
Triage	To prioritise patients with medical emergencies	Vula Mobile® App (electronic)
Education	Sharing knowledge on educational content	WhatsApp® messenger, Vula Mobile® App (electronic)
e-consultation	Facilitate diagnosis of patients using information transmission (i.e., Pictures, patient history) Seek second opinion	WhatsApp® messenger, Vula Mobile® App (electronic)

5.2.2.1 Traditional referral methods

In the referral form, details of the referring clinician, patient particulars, and clinical notes (including instructions for the receiving clinicians) are documented.

These forms are also used to book services at tertiary hospitals for further management of patients. Study results confirm that these forms are part of the referral guidelines and procedures of the National Department of Health in South Africa or the Ministry of Health and Social Services in Namibia (Department of Health (DoH) South Africa, 2019b; Ministry of Health and Social Services (MoHSS) Namibia, 2013).

The booking system is yet another traditional referral method. An administrator from the referral hospital calls a receiving hospital to make a booking for a consultation with the necessary specialists. Both hospitals under study still make use of a manual booking system, and no electronic tool was reported to facilitate bookings.

In addition to the bookings and referral forms and registers, referral notes or letters are also completed by doctors. Findings reveal referral letters (referral notes) are used by doctors to document the patient history and send this to specialists.

A referral letter is later presented to the receiving hospital to provide the required assessment and further management details. The referral letter is also used at the receiving hospital for booking specialised services at higher levels of care.

"You know what, for example, when the doctor from the region will refer patient to, central hospital, in this case to dermatology, they make a booking, with central booking office" [HCP_16].

"Okay, so we have got more than one referral system, so number one, we have got the standard referral system where GPs refer with a letter via the bookings department, okay, so they phone to book for an appointment for a patient and they get a date." [HCP_1]

Respondents confirm traditional referral methods such as paper-based referrals and telephonic bookings are used in all hospitals (A, B, C and D). Results show a total of 20 respondents use paper-based referrals (e.g., referral notes) and 21 out of 31 respondents use a telephone for referral purposes as illustrated in Figure 5.4.

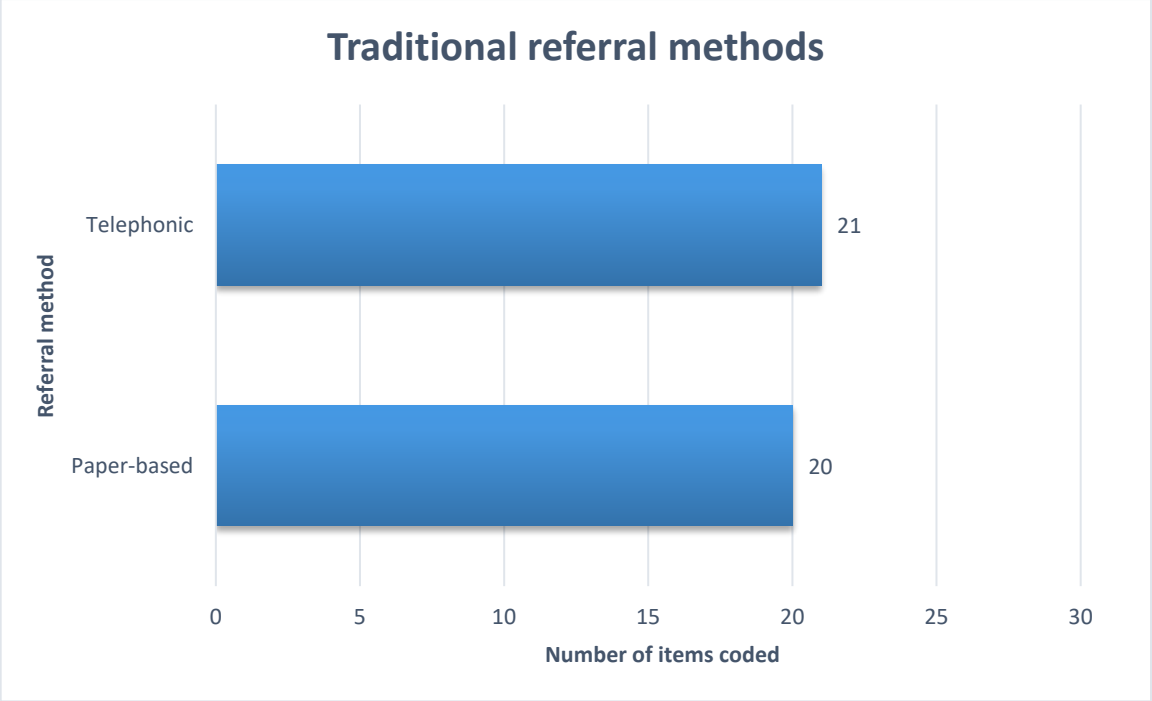


Figure 5.4: Number of participants using traditional referral methods

Although these traditional methods were commonly used, there are numerous constraints (TH5) experienced with existing traditional referral methods.

HCPs confirmed that self-referrals were evident and problematic in all the respective public hospitals. For example, patients are bypassing primary health care levels (self-referrals) to access health services at high levels of care leading to underutilisation and overutilisation of services at primary public hospitals.

> *"Currently we receive unnecessary patients rocking up in the department, this is a nuisance, but more like "self-referrals. These are wrong referral that could have been sorted out at PHC facilities." [HCP_20]*

> *"The Current referral system is not working perfectly. There are hick-ups, especially during COVID-19 – There are a lot of self-referrals. You have to sit with these self-referrals then you have to sort it, you start from scratch. Especially with regional referrals are challenging e.g., if a patient does not have a CT scan, you expect them to have Lab results from a CT scan. They take up Bed space as they wait for a booking for a CT scan. They can overstay even more than a week when you were supposed to use the space for emergencies." [HCP_18]*

Workflow issues were reported to be caused by missing or incomplete information in patient history. This was attributed to the lack of integration of HIS used in the public health system. Moreover, there is no evidence of appropriate functioning of the referral system and feedback among health care providers.

The study results revealed electronic referral methods in addition to traditional referral methods. The electronic referral methods are covered in the next section.

5.2.2.2 Electronic referral methods

Implementation and use of electronic referrals are intended to overcome constraints experienced with traditional methods. For example, electronic referrals can streamline the referral pathways between HCPs. Findings reveal that HCPs are using the Vula mobile application in Hospitals A, B and C. In Hospitals C and D, the District health information system (DHIS2) is implemented as an official health information system.

Apart from the mandated health information systems, an emerging finding from phase one of the study shows that social media platforms such as WhatsApp and Telegram were used alongside the mandated e-health applications (Vula, DHIS2). Findings show that WhatsApp messenger is used in all the hospitals as shown in Figure 5.5.

Respondents	3.1.1. Vula	3.1.2. District Health Informaion Systems 2 (DHIS2)	3.3.1. WhatsApp
Hospital = A (2)	Yes	No	Yes
Hospital = B (1)	Yes	No	Yes
Hospital = D (14)	Yes	Yes	Yes
Hospital = C (3)	Yes	Yes	Yes

Figure 5.5: Electronic platforms used in public hospitals as extracted from NVIVO

At the time of this study, eleven out of thirty-one HCPs reported that they actively used Vula for patient referrals. Respondents also confirmed using WhatsApp® messenger (26 out of 31) for clinical purposes and official communication as shown in Figure 5.6.

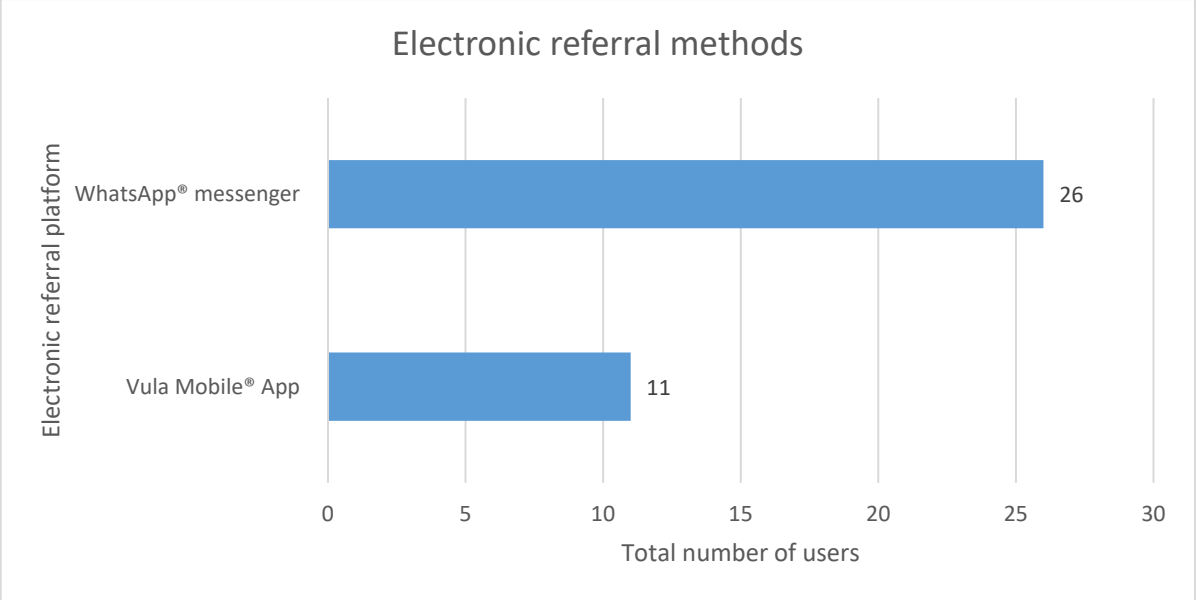


Figure 5.6: Number of participants using electronic platforms

Elaboration on the use of these two electronic applications and their role in facilitating referral activities is reported in the next sections.

5.2.2.2.1 Vula Mobile® App

Vula mobile is an application implemented as an intervention to link healthcare workers with specialist care (Vulamobile, 2023). The intervention was adopted in some public hospitals in South Africa as a response to challenges experienced by rural healthcare workers to provide access to specialist advice and means for efficient referrals (Morkel, 2019).

Vula is adopted by and used by different specialties in public hospitals. The dermatology units in Hospital A and B were amongst the first to introduce e-referrals via Vula. The benefits of using Vula were reported in the given hospitals. For example, Vula brings about educational benefits and an efficient patient flow between hospitals (Morkel, 2019). On the other hand, HCPs in Hospital C were familiar with the referral application but adopted alternative applications for referrals. The Department of Health in the Western Cape Province, and the Ministry of Health and Social Services (MoHSS) in Namibia, are chosen as contexts in different referral systems to achieve generalisability (empirical data to theory). Table 5.3 provides a summary of the benefits and challenges associated with Vula as reported from semi-structured interviews.

Table 5.3: Summary of benefits of the Vula mobile application

Vula Mobile® App Benefits	**Description**	**Empirical Evidence**
Accessibility	Vula provides access to clinical information (Including the medical history) in a single platform.	*"So usually, especially for dermatology, we like to see the skin condition. So, we ask for a picture, and they usually phone you and send it via WhatsApp, or they send the picture to you via the Vula app, and then also a clinical history with that." [HCP_9]*
Mobility and efficiency	The ability for HCPs to communicate and send each other information at anytime, anywhere.	*"So, I mean Vula does afford them that mobility, um, um, mobility, whereas they don't have to be confined in a specific location." [HCP_10]*
Vula Mobile® App Benefits	**Description**	**Empirical Evidence**
Immediate response (instant)	The ability to access information on Vula when needed.	*"So, a doctor cannot make an assessment just by old school telephone call, so at least both of these platforms including Vula, or anything that one could share images with and reply in real-time is good." [HCP_3]*
Improve communication between subjects	Communication is improved by using the application to send patient information.	*"The Vula referral app, that one combines, I guess what they did, it's like the history. So, sending the history and also um, sending the pictures all on one platform." [HCP_3]*
Electronic consultations and second opinion	Using the application to provide an expert opinion from specialists to medical officers or registrars (medical doctors).	*"Sometimes it's things that don't …, that can be managed in primary care. So, then you are giving them advice that a primary care physician should be able to institute. So, I don't necessarily have to see this patient. Mild eczema. I don't know that I'd call myself an expert, but you are now getting a specialist opinion for something that you didn't have a specialist opinion on before." [HCP_11]*

Findings show that Vula is used to facilitate patient referrals for specialist care and management, education, and triage management. Furthermore, the Vula platform is also used to share photos and patient information to support clinical decisions. Findings reveal that some HCPs found the application effective in providing instantaneous access to clinical information and patient medical history. Additionally, Vula facilitates better access to specialists for a second opinion and remote consultations.

HCPs reported that the primary benefit of Vula is the secure storage of patient information, and the generation of referral reports thereafter. Referral information collected on the electronic platform is used for the management of clinical information and analysis of referral trends. HCPs explain that access to this information in the form of reports provides insights on several referrals-initiated referral response times (efficiency) and outcomes. It was also reported that for HCPs using the application, it improved communication and encouraged medical officers to consult and seek a second opinion from specialists.

Despite the reported benefits of Vula, the study findings also highlighted drawbacks and limitations related to users' unwillingness to utilise the application, the features of the user interface's restricted functionality, and data security concerns.

The motivations for Vula's unexpected use and whether the application supported the work of HCPs are further examined in Chapters 6, 7 and 8 to better understand these limitations.

After conducting a thorough analysis of the HCP's practices enacted to overcome encountered limitations, it was found that Vula does not adequately support their work as intended. Consequently, HCPs resorted to employing alternative methods to address the constraints and limitations they faced. These limitations are summarized in table 5.4.

Table 5.4: Summary of constraints and limitations of the Vula mobile application

Constraints and limitations	Description	Empirical Evidence
Reluctance to use	Medical doctors' reluctance to use the Vula application.	*"I don't always find Vula that helpful, to be honest with you. Because I find that they write the note, but I find a phone call easier first of all because the note can just get sat on. I mean, they can send a message; it's not always picked up, that sort of thing. People only respond hours later." [HCP_7]*
Limitations of technical functionalities –	Technical functionalities in the user interface of the application limit the work of HCPs.	*"Some people use that a lot because those fields are not … I don't know how to put them. They, they're very tick, tick, tick, tick. It's kind of difficult to use a tick form, you know when you … Sometimes you can't put it in the tick. So, they will need to use the comment field to ask us to fill in." [HCP_12]*
Bring your own device (BYOD) and Data issues	Bring your Own Device (BYOD) - Using personal phones for professional work without support from IT and compensation for data usage.	*"I think people also maybe don't like the app because it uses your own data. You know, for us, we're on Wi-Fi so it's fine. But if you're outside, now you're having to log on and put in all this patient's information." [HCP_2]*

Findings confirm amongst others, technical issues such as software incompatibility, inadequate training on existing information systems, and lack of buy-in from users and management lead to users finding alternative platforms such as WhatsApp to complete their work.

5.2.2.2.2 WhatsApp® messenger

Another electronic referral method used by HCPs is WhatsApp messenger. WhatsApp is a messaging application that provides fast, simple, and secure messaging and calling features accessible on smartphones running Android, iOS, and Windows operating systems (WhatsApp, 2022).

Findings show that twenty-six (26 out of 31) HCPs were using WhatsApp for consultation purposes and to share clinical information as shown in Figure 5.6. Additionally, numerous benefits as reported by HCPs are summarised in Table 5.5.

Medical officers opted to use WhatsApp because it is conveniently accessible, and the majority of colleagues are using the same platform for personal use.

> *"Why WhatsApp is important because then we can't exclude people just because they don't have an app. So, how do they refer to people in the periphery? They use WhatsApp!" [HCP_3].*

HCPs acknowledged that utilising WhatsApp enhanced their communication and collaboration within their community of practice. For example, HCPs shared patient information with colleagues, facilitating convenient access and seamless collaboration on referral cases. Moreover, given that WhatsApp was installed on personal devices, it enabled mobility as HCPs could communicate and send information at anytime and anywhere.

The other benefit highlighted by HCPs was the instantaneous nature of WhatsApp. The information was not confined to the professional environment, and they did not have to access it on a separate device. They reported that this feature enabled them to efficiently respond to referrals and seek second opinions from senior consultants and specialists. This direct communication with specialists flattened the hierarchy, as medical officers were not compelled to follow referral protocols and pathways.

Table 5.5: Benefits of WhatsApp

WhatsApp® messenger: Benefits	**Description**	**Empirical Evidence**
Accessibility	WhatsApp provides access to information on personal devices	*"WhatsApp is really quick and it's frequently accessible and used by colleagues ." [HCP_6]*
Mobility and efficiency	The ability for HCPs to communicate and send each other information at anytime, anywhere.	"To supplement verbal referrals, you will request for colleagues to send a message on WhatsApp. It's quicker to send a photo than it's very visual. So, we often get photos sent." [HCP_2]
Immediate response/Instantaneous	The ability to access information on WhatsApp on personal devices.	"*They would send you a picture, then you look, you assess, first they discuss with you still, what the problem is, what is it that the patient has, or the history about the patient, then they send you a picture, then they write a brief note also when they send the picture. Yes, then you look at the picture, then you assess them, you respond over the WhatsApp." [N_13]*
Improve communication within the community of practice.	Communication is improved by using the application to send patient information.	*"WhatsApp is actually becoming quite popular, especially with the onset of Covid-19. When patients have respiratory cases, all respiratory cases, are now potentially Covid cases. The first doctor that sees the patient has to take the history, make an assessment and then they can just post it on WhatsApp on a group that has the internal medicine specialist on it to review the case." [N_28]*

WhatsApp® messenger: Benefits	Description	Empirical Evidence
Encourages medical officer to seek second opinion from senior consultants and specialists (Flattens hierarchy).	Medical officers have direct access to specialists where they seek second opinions. There is no need to follow referral pathways and protocols	*"So, now generally they have a WhatsApp group and in that WhatsApp group they report the different notifiable diseases, the cases they have got or confirmed or suspected and so forth.* *With that now you also wonder, we have referrals protocols and guidelines that you are supposed to use to report data but again you are using WhatsApp to record such data." [IT_30]*

Furthermore, WhatsApp was adopted as an alternative platform due to the frustrations experienced with unresolved constraints with the Vula application. For example, some HCPs reported that they could not access. Newer versions of the Vula software are due to incompatible operating software on the devices. Other HCPs found WhatsApp more easily accessible, and they incorporated its use into their everyday practice because of its convenience and user-friendly interface. It is remarkable to note that all medical officers who participated in the study utilised WhatsApp for professional purposes.

The majority of doctors participate in WhatsApp groups (Figure 5.5). Depending on the communities of practice, the group composition varies. For example, medical officers created WhatsApp groups to consult and discuss clinical cases with colleagues. Some medical officers utilised WhatsApp as a one-on-one consultation tool to ask their co-workers, who were typically more senior, for a second opinion. For example, HCP_7 did not adopt Vula but found WhatsApp more useful and effective.

> *"WhatsApp has been fantastic. It means I can give much better advice immediately. I know what I'm dealing with, simply because of the photo" [HCP_7].*

One-on-one consultations on the WhatsApp platform were initiated by referring providers in remote health facilities or lower levels of care seeking specialist opinions.

Specialists also consulted amongst themselves, by seeking senior consultants' advice on special cases.

In instances where WhatsApp was used for specialist care consultations, referring providers sent pictures for evaluation to specialists. A photographed picture for an example of a skin "lesion" is sent to the specialist, and a follow-up text through the chat is then initiated to discuss further the case.

> *"They would send you a picture, then you look, you assess, first they discuss with you still, what the problem is, what is it that the patient has, or the history about the patient, then they send you a picture, then they write a brief note also when they send the picture. Yes, then you look at the picture, then you assess them, you respond over the WhatsApp." [N_13]*

It is noteworthy to mention that medical officers and registrars subscribed to "undocumented rules" (social norms) for sharing clinical information on WhatsApp groups (further explained in Section 5.2.3).

Findings also show that there are multiple WhatsApp groups utilised by different cohorts of HCPs and that they served different purposes. For example, medical officers belonged to a group exclusively for junior doctors used for educational purposes. In this group, junior doctors share educational resources to assist in the diagnosis of cases.

Senior consultants, "Dermatologists," on the other hand also belonged to their exclusive WhatsApp groups. Some respondents do however indicate that shared groups exist where both medical registrars and senior consultants were participants.

> *"So as far as I know we have our group, WhatsApp group, and then there is also another, uh, group. So, it seems like there is some group that also our consultants are on as well." [HCP_6]*

WhatsApp was predominantly used as an alternative platform to facilitate the work of HCPs. Even though commonly used, there were constraints and challenges associated with its use as shown in Table 5.6.

Table 5.6: WhatsApp messenger constraints

WhatsApp® messenger: constraints	**Description**	**Empirical Evidence**
Data security issues	Confidential patient information is shared on social platforms compromising patients' privacy.	*"WhatsApp referral because it's more encrypted and fewer patient details are sent across and it's set up so that you don't save the photos on your phone, but it's saved within the application. So, the issues of patients' confidentiality are improved." [HCP_2].*
Poor quality of pictures	The camera specifications on personal mobile phones are not designed to take clinical pictures.	"*They usually send pictures as well, via WhatsApp, it is also quite difficult because you don't always get good pictures. when you have to see the patient in person." [HCP_9]*
Frequent interruption	Consultations with patients are interrupted by messages and calls through the WhatsApp platform.	*"The challenges are the fact that it's now another method of people to get hold of you. So, you're being paged inside the hospital and outside the hospital. People are sending you WhatsApp and now you also have Vula." [HCP_11]*

The findings also confirm that multiple uses of communication platforms lead to the interruption of referral workflows. Some reported that it was time-consuming to attend to referrals from different platforms. Other constraints reported are linked to the poor quality of pictures sent by referring providers. HCPs reported that this limited their ability to diagnose or to make decisions which led them to either ask the referring provider to retake pictures or send the patient to visit the health facility for a face-to-face consultation.

Findings also show that there is a serious breach of data security policies where confidential information of patients is shared on social platforms. Patient medical history, CT (computed tomography) scans and other pictures are shared on WhatsApp Messenger and this information is usually stored on personal devices. This compromises the confidentiality of this information, and it poses serious security risks.

Some respondents lack understanding of the security risks caused by sharing patient information on WhatsApp, stating that end-to-end encryption is a measure to prevent security threats to information. This misunderstanding is observed in the following participants' response.

> *"We use WhatsApp for referrals because it's more encrypted and fewer patient details are sent across and it's set up so that you don't save the photos on your phone, but it's saved within the application. So, the issues of patients' confidentiality are improved. "[HCP_2]*

Moreover, the inability to ensure HCPs seek consent from patients before they take pictures is of concern. This is caused partly by a lack of standardised procedures in hospitals for taking and sharing images of patients. Taking pictures without the patient's consent is breaching patient confidentiality because sharing these pictures, for example on WhatsApp, remains the doctor's responsibility to safeguard the confidentiality of such information. Furthermore, storing such information on personal devices poses other security threats.

Given that no official smart devices (including mobile phones) are supplied to doctors, they used their devices (Bring your Device) and installed the required software.

Using personal phones poses a security risk, as information shared on these devices is not controlled by the IT department.

Other respondents also highlighted that using their own devices required them to buy and use their data to connect to the internet. Most of them reported that there was no internet connection in their respective hospitals. In some cases, the available Wi-Fi connection in the respective hospitals was not stable. Due to this, they either ran out of data and could not contact applications such as Vula or WhatsApp.

It is commendable to note that some HCPs were aware of the security risks associated with publicly sharing patient information on WhatsApp. Some reported that they deleted the messages on their devices after sending messages to their colleagues.

"So, you see… So, so, so. So, so with WhatsApp or with Vula now, which has now been only for a year probably running, that's more or less we try and avoid that and say, look don't send me pictures with WhatsApp because the pictures are in my, my, um, photo album forever." [HCP_10]

"So, if your kid plays with your phone, he can tamper with the pictures … How many times did you get pictures that you didn't expect from your friends? "[HCP_14].

The above findings emerged from the deductive analysis phase (Phase 1) and new concepts related to workarounds emerged from these findings. These results were further interpreted and are further discussed in Chapters 6, 7 and 8, where workarounds and theoretical insights are elaborated.

The rules governing the referral activities conducted by HCPs and their practices are described in the next section.

5.2.3 Referral activities, tools, and rules

Rules relate to formal or informal ways of how subjects engage in their work. Informal rules are unwritten rules influencing technology "use behaviours' of subjects. Formal rules conversely refer to written guidelines, procedures or policies guiding certain actions. These include predetermined documentation and mediating instruments, or "social infrastructure" needed within the activity. In this study, forms of mediating instruments such as strategies, policies, standard operating procedures, and tools were examined to get a better understanding of how they regulate referral activities and govern the referral process.

To examine the role of rules as related to referral activities, results from semi-structured interviews are corroborated with findings from document analysis (documents listed in Table 5.7).

Table 5.7: List of documents analysed

Source	Title of document	Pages	Codes	References
Khan & Edward (2012)	Assessment of national health Information systems in Namibia	130	7	30
Ministry of Health and Social Services (MoHSS) Namibia. (2020)	Ministry of Health and Social Services Annual Report 2019 -2020	129	18	38
Ministry of Health and Social Services (MoHSS) Namibia. (2015)	Namibia guidelines for implementing national referral policy	43	4	98
Ministry of Health and Social Services (MoHSS) Namibia. (2013)	National referral policy	13	3	35
Ministry of Health and Social Services (MoHSS) Namibia. (2021)	National eHealth Strategy 2021-2025	105	2	9
Department of Health (DoH) South Africa (2019a)	National Digital Health Strategy for South Africa 2019 – 2024	36	5	74
Department of Health (DoH) South Africa (2019b)	Referral policy for South Africa Health Services 2019 - 2024	40	12	165
Western Cape Department of Health South Africa (2020)	South Africa Annual Report 2019-2020	273	14	150
Department of Health (DoH) South Africa (2015)	South Africa mHealth Strategy	15	5	10
Department of Health (DoH) South Africa (2012)	South Africa eHealth Strategy	36	6	314

These documents were identified based on the responses of participants and guided by the research questions. The selected documents were imported into NVivo and analysed in the context of health information systems and related electronic tools used in the selected public hospitals.

For example, in the two referral systems, other systems such as District Health Information (DHIS2) were mentioned, but not used for patient referrals. The documents were then analysed using appropriate keywords related to the phenomenon under study.

A text query search was conducted for all the selected documents of which a word count of keywords was undertaken. A summary of the word count and frequencies for keywords is shown in Appendix 19.

The researcher further analysed the references mentioning e-health or electronic referrals or Information and communication technology (ICT) in the selected documents. The findings indicate there are existing e-health strategies and policies, general guidelines and strategies for implementation and use of tools for patient referrals. Both policy documents confirm a booking system is used as a traditional method for securing appointments for patients from lower levels of healthcare.

Challenges in both referral systems were linked to patients self-referring to hospitals, inconsistent and lack of feedback amongst health care providers at all levels, and poor linkages between different facilities (public, private and community, home-based care). The other challenge identified is the lack of approved referral policies which normally lead to sub-optimal functioning of the referral systems. Keywords related to downward, Inter-sectoral; vertical, inpatient and outpatient referrals were found in the referral policies. These types of referrals are described in the referral policies and guidelines. The keywords related to procedures, guidelines and protocols were used to analyse the data from the documents and they were linked to the interview responses describing rules regulating referral activities.

The findings from the document analysis confirm that policy documents clearly outline referral pathways and procedures which should be followed when referring patients between levels of care (Ministry of Health and Social Services (MoHSS) Namibia, 2013; Department of Health (DoH) South Africa, 2019b).

The findings also reveal that the implementation of e-health and mobile health strategies are well documented in case study one (Western Cape referral system).

However, in case study two (Khomas referral system), the e-health strategy was announced into effect after the results of this study were compiled (Ministry of Health and Social Services (MoHSS) Namibia (2021). The study findings were analysed in retrospect to the e-health strategy. The policy documents confirm that there are standards and guidelines governing referral systems in both cases (Ministry of Health and Social Services (MoHSS) Namibia. 2013; Department of Health (DoH) South Africa, 2019b). The keywords used for queries in NVivo are presented in Table 5.8.

Table 5.8 : Keywords and associated themes

Keyword	Associated themes
Downward referrals; Inter-sectoral referrals; Outpatient referrals; Vertical referrals; Inpatient	Referral activities Subjects Limitations / Challenges
Booking(s)	Referral activities Subjects
e-health or electronic referral (s); Health information system or Information system (s); Information and Communication Technology (gies); Internet	Means of coordination and collaboration Subjects
Procedures; Guidelines; Protocols	Rules Subjects

Some respondents altogether admitted to a lack of awareness of written policies from institutions of authority.

> *"No, I am not aware of referral guidelines. I am not aware of any, to be honest. I must still go to the Ministry and ask them" [HCP_14].*

In addition to the written rules, findings also revealed that there are informal rules related to the behavioural use of e-referrals. Social norms are informal rules of behaviour dictating what is acceptable in a certain context (Mackie et al., 2015; Chung & Rimal, 2016).

At the time of the study, it was observed (on the Vula platform) that some medical officers were using the Vula application as expected by their seniors but did not entirely experience its effectiveness in completing their work.

Even though the perceived expectation from senior consultants or line managers was for all HCPs to use the Vula application, not all HCPs used it.

> *"The app is simply used and, not always, but is used as a referral, that's it "[HCP_7].*

Observations from the interview responses and the Vula interface reveal that some HCPs signed up for an account, but they were inactive on the application.

Other social norms observed were informal understandings among HCPs leading to the enactment of these alternative systems to accomplish their work. This was particularly observed with junior medical officers and their peers. Findings reveal that some HCPs resorted to using alternative informal systems because peers were using the same systems.

> *"I think all of us are using WhatsApp. Even those that are on the Vula app. So, that means everybody would be using WhatsApp baseline. And that's, that's how the system was before the intro of Vula." [HCP_3]*

The major finding from the ActAD perspective reveals that formal information systems including Vula are not used as intended. HCPs' use behaviour for information systems is not conforming to the approved or expectations of their seniors' descriptive norms which involve "what system users do and not what is approved or expected from their seniors" (Schultz et.al., 2007). While the ActAD framework provided a useful starting point for understanding the initial findings in phase one of the research, it proved insufficient for explaining the emerging phenomenon of workarounds. For further elaboration, the Process Framework for Healthcare Information System Workarounds and Impacts was employed in phase two (Section 4.8.2) of the research. This necessary to explore further this emerging phenomenon to understand why HCPs were enacting workarounds to the mandated and formal HIS. The "why" part of the research is further explored in Chapter 6. Conclusive remarks are discussed in the next section.

5.3 Conclusion

This chapter aimed to explain how healthcare providers use e-referrals to facilitate their work activities. The referral methods facilitating activities of Health Care Providers (HCPs) were reported. The findings from the two case studies were presented from the ActAD (Activity Analysis and Development) perspective.

Traditional referral methods such as paper-based referrals (referral notes and registers) and telephonic bookings are used in all hospitals. These presented challenges related to missing referral notes leading to workflow issues caused by incomplete information.

At the time of the study, the Vula application was introduced through word of mouth to some HCPs in case study two (Khomas referral system in Namibia), but the uptake was low. Recently, additional efforts have been made to introduce the application to the Ministry of Health and some health facilities in Namibia (Vulamobile, 2023). In South Africa, at the time of this study, the intervention was well adopted (even though with some challenges) in some public hospitals in case study one (Western Cape referral system in South Africa). Benefits related to mobility, efficiency, and improvement in communication between HCPs were reported. Despite the reported benefits, the intervention was not used as intended to facilitate the work and activities of HCPs. HCPs resorted to unofficial platforms such as WhatsApp to accomplish their work. WhatsApp generally yielded positive outcomes to the referral process and did not result only in negative effects. For instance, HCPs found WhatsApp to be more efficient, as it enhanced communication and facilitated direct collaboration with specialists for seeking second opinions.

While HCPs reported benefits linked to using traditional methods, the reliance on paper-based referrals and telephonic bookings could hamper efficiency and can lead to data loss which can result in ineffective care rendered to patients. Additionally, the adoption life cycle normally consists of early adopters or early majority whose behaviour could be perceived as resistance or unintended use digital tools such as Vula. Future directions and practical implications for healthcare providers, policy makers and health organisations are elaborated in sections 7.3.7, 8.4 and 9.3.3.

It is thus important to examine the practices behind the unintended use of such tools to devise targeted implementation strategies and address barriers or constraints to technology adoption among healthcare providers (HCPs).

The ActAD lens was employed as a sensitising framework to examine the referral activities and tools used to facilitate the work of subjects. Due to the limited explanatory power of the ActAD theoretical framework, it was necessary to explore other theories offering alternative explanations of the workaround phenomenon. The next chapter discusses study findings from the workaround perspective.

CHAPTER 6: Electronic referrals and Workaround perspectives

6.1 Introduction

Health Information Systems (HIS) and e-referrals in public health hospitals are currently not used as intended, and healthcare providers (HCPs) are increasingly resorting to alternative workarounds and shadow information technologies (Shadow IT) to accomplish their work. This chapter presents findings from phase two of the data analysis as outlined in Section 4.8.2. HCP's workaround practices in relation to e-referrals use from the two case studies are discussed.

Substantial evidence is found showing misfits between work and the use of referral applications in public hospitals under study. Case study findings further show that the workaround practices are a result of the gap between the design of the e-health applications and the contextual realities in which these systems were implemented. The design-reality gap framework was therefore adopted to gain an in-depth understanding of assumptions built into the e-health applications and real requirements of HCPs in the study settings.

The goal of this chapter is to address the following questions:

Why do Health Care Providers (HCPs) enact workarounds to health information systems in public hospitals?

To answer these questions, a case description strategy is employed to present the contextual findings and to report individual cases under investigation. The first section discusses improvisation types as they manifest in the form of workarounds. The next section discusses contextual findings from Case study one (the Western Cape Department of Health) focusing on hospitals A and B as embedded sub-units of the study.

A workaround snapshot of the referral activities, tools facilitating such activities and workaround practices are presented. The next section discusses findings related to improvisation types namely fitting, augmenting and workarounds to the Vula application.

Design-reality gaps (DRG) giving rise to workaround practices are also presented in the context of their effect on patients, HCPs, and health institutions.

The second section reports findings from case study two from the Ministry of Health and Social Services (MoHSS) focusing on hospitals C and D in the Khomas referral system in Namibia. Unique findings related to Shadow IT and the national health information system (DHIS2) are presented from hospitals C and D. Lastly, the relationships in the data related to improvisations from individual cases are discussed. In the next section, improvisation types and manifestation of workarounds practices are discussed as evidenced by the empirical data.

6.2 Improvisation types: manifestation of workarounds practices

Shadow IT is defined as the use of autonomous software systems or extensions to existing systems by end-users where the IT department neither develops nor controls these systems (Furstenau et al., 2017). Workarounds are a form of Shadow Information Technologies (Shadow IT) as they are forms of extensions or improvisations to existing systems. Workarounds are defined as a "goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system to overcome, bypass, or minimise the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving the desired level of efficiency, effectiveness, or other organisational or personal goals" (Alter, 2014).

A conceptual model (in Figure 6.1) was adapted from the Process Framework for Healthcare Information System Workarounds and Impacts in the deductive phase of the study (Yang, et al., 2012).

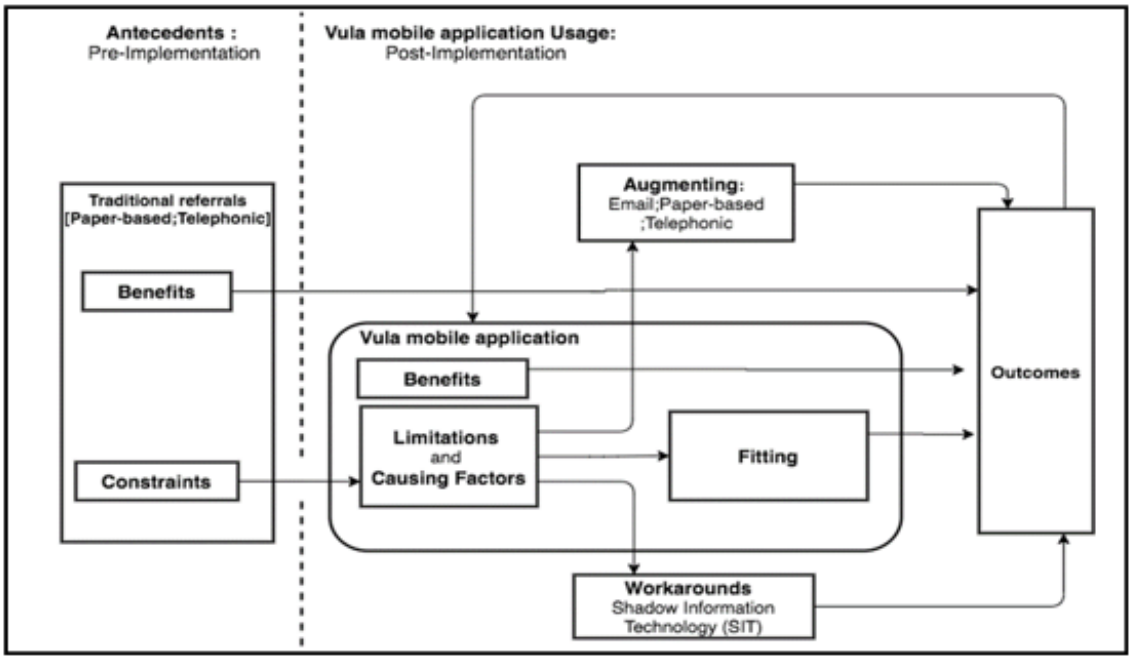


Figure 6.1: Conceptual model of workarounds to e-referrals (Adapted from Yang et al., 2012)

The concepts in the model and workaround practices are further explained in individual cases in the next sections. In case study 1, the snapshot of the work system, referrals activities and types of workarounds observed from the empirical data is discussed in the next section.

6.2.1. Case Study 1: Western Cape Referral System (WCRS)

In the Western Cape referral system, data was collected through semi-structured interviews, observations, and document analysis. The interviews were conducted with the head of units, medical officers and IT personnel involved with the Vula application. To triangulate the study results, a document analysis of e-health strategies, referral policies and annual reports was also carried out. Observation of real data on the Vula application was granted (with an observer account and limited access rights) to evaluate referral information. Findings from hospitals A and B are reported through the lens of workarounds and the design-reality framework. The design-reality gaps observed from the data and their relation to patients, HCPs and health organisations are discussed.

Furthermore, emerging findings as they relate to improvisations, in particular workarounds are discussed in the next sections.

6.2.1.1 Improvisation types

In the Western Cape Referral system, the Vula Mobile® App is implemented at hospitals A and B in the dermatology departments. This referral process involves both inpatient and outpatient activities conducted by HCPs as described in Table 6.1.

Table 6.1 : Work system snapshot of the Western Cape Referral System

<table>
<tr><th colspan="3">Work system snapshot of the Western Cape Referral system</th></tr>
<tr><td>Customers</td><td colspan="2">Services</td></tr>
<tr><td>Patients</td><td colspan="2">Patient referral information is received from lower levels of the healthcare system.</td></tr>
<tr><th colspan="3">Work Practices (Processes & Activities)</th></tr>
<tr><td colspan="3">• The referral process involves HCPs communicating and transferring patients between health facilities at different levels of care.
• Referral activities are made of inpatient and outpatient referrals.
• Inpatient referrals are received from units within the same hospital using traditional or electronic methods.
• Outpatient referrals are received from other health facilities (district / regional hospitals) through traditional or electronic methods.
• Outpatient referral activities range from bookings with the central office at a tertiary hospital. Inter-sectoral, horizontal, downward, and vertical referrals.
• Medical doctors or nurses in district hospitals send referral letters/notes to the medical officers or specialists in tertiary hospitals.
• Medical doctors or nurses in district hospitals book patients
• Outpatient referrals occur when a patient is referred (through the Vula application or referral notes) to another health facility to receive specialist outpatient care or further management.
• HCPs use different types of referral methods such as referral letters, telephone Vula mobile application and WhatsApp to share and transfer patient information with specialists.
• Electronic referral methods are used to overcome constraints experienced with traditional referral methods (referral letters; telephone).</td></tr>
<tr><th colspan="3">Workaround related practices</th></tr>
<tr><td colspan="3">Medical officers enact workarounds to the Vula mobile application using WhatsApp.
All HCPs share patient information using traditional referral methods email, referral letters and telephone</td></tr>
<tr><th>Participants</th><th>Information</th><th>Technologies/Tools</th></tr>
<tr><td>Medical officers
Nurses
Specialists (Dermatologists)
IT personnel
Medical doctors</td><td>Patient biographical information.
Patient medical history (patient medication, allergies, problem, procedure lists).
Patient medical imaging (x-rays, MRI magnetic resonance imaging).
Referral policies, procedures and guidelines governing referral systems.
Referral protocols.</td><td>Vula Mobile® App
WhatsApp® messenger
Health Information Systems
Email
Telephones
Referral register
Referral notes</td></tr>
</table>

Vula is used to transmit patient referral information between HCPs from primary, secondary, and then at tertiary healthcare level. The objective of Vula is to streamline the referral process. Vula is adopted in different specialities such as dermatology, orthopaedics, and cardiology in the public hospitals under study. The intervention is part of the hospital's standard operating procedures for facilitating referrals in the respective departments. At the time of this study, Vula was adopted only in some public hospitals in South Africa.

The app was adopted as a response to challenges experienced by rural healthcare workers to provide access to specialist advice and means of efficient referrals (Morkel, 2019).

In addition, the application was also implemented as an intervention to link healthcare workers with specialist care (Vulamobile, 2024).

The dermatology units in Hospitals A and B were among the first to introduce e-referrals via Vula and it has offered numerous benefits. For example, Vula brings about educational benefits and an efficient patient flow between hospitals (Blom, Laflamme & Alvesson, 2018; Morkel, 2019). Furthermore, the application automates referral activities and overcomes numerous constraints such as illegible handwriting, and data loss, which are often associated with paper-based referrals.

At the time of this study, the application was not yet mandated by the Western Cape Department of Health but deployed in some of the departments including the dermatology department's understudy. The specific activities and functions supported by Vula were elaborated in Chapter 5, Section 5.2.2.2.1.

Findings from interviews show that the Vula application is used by 69% of HCPs in the dermatology unit in Hospital A and 29% in Hospital B (Figure 6.2). Despite good uptake of the application in these hospitals, the empirical evidence from the data shows misfits between HCPs' work and Vula.

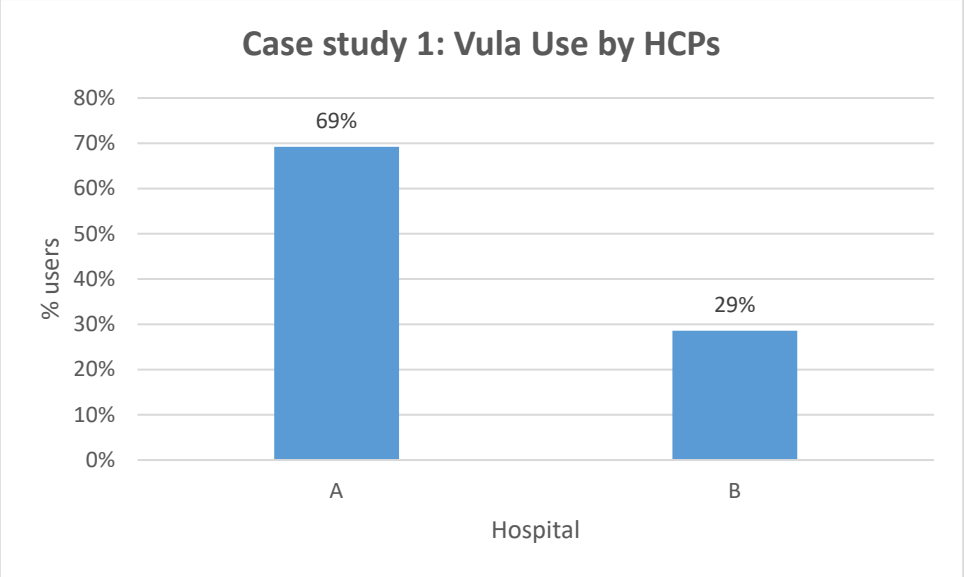


Figure 6.2: HCPs use of Vula in hospital A and B

The study findings also reveal that there were limitations with the design of Vula that resulted in HCPs increasingly resorting to fitting augmenting existing applications and using WhatsApp as a Shadow IT to accomplish their work. Findings from the text search show some of the most frequently used terms are Vula and WhatsApp as shown in Figure 6.3.

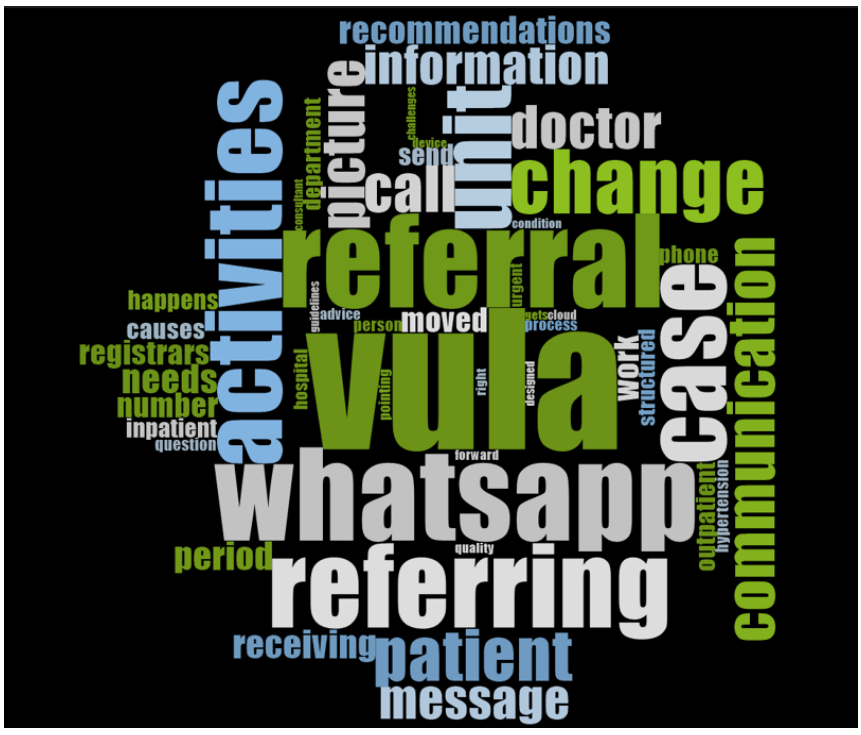


Figure 6.3 : Word cloud of workarounds related terms in case study 1

This emerging finding on workarounds prompted a further analysis of the primary data to explore additional and alternative explanations for this phenomenon. An inductive analysis of the data was therefore conducted to generate codes and to identify concepts deducted from the data. These concepts were compared to concepts from theories in literature and were then used as a guide to extract associated concepts to draw an understanding of the emerging phenomenon. The concepts from the Process framework for healthcare IS workarounds and impacts were adapted to explain workarounds (Yang et al., 2012).

The codes related to fitting, augmenting and workarounds were then generated and grouped under the "improvisation types" theme as shown in Figure 6.4. The study findings are presented in themes consisting of code references from text files, which serve to illustrate instances of data, and the relationships between concepts from the chosen theoretical frameworks employed in the research (Crabtree, 2023; Williams & Moser, 2019).

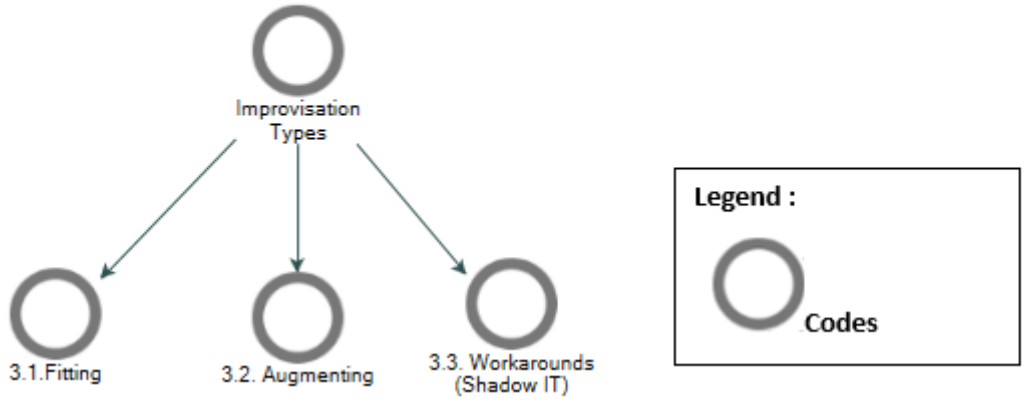


Figure 6.4: Codes related to improvisation types

A total of 254 references (as shown in Table 6.2.) was coded to various improvisation types (fitting, augmenting and workarounds).

Table 6.2 : Number of code references of improvisations in Case Study 1

Improvisation Type	Hospital A	Hospital B
Fitting	37	15
Augmenting	82	31
Workarounds (Shadow IT)	70	19

The improvisation types are discussed in the following sections.

6.2.1.2 Fitting and adaptions to the Vula application

Findings show that for hospitals A and B, the number of coding references for fitting were 37 and 15, respectively. Fitting is defined as an activity or task of changing the structure of work or computing to accommodate technical misfits (Yang et al., 2012). In this study, it was observed that HCPs were using the Vula but there were limitations with the design and functionality of the user interface of the application.

HCPs reported that because some user requirements were not considered while designing the application's user interface, it was hampering their ability to do their work.

For instance, respondents said they had trouble navigating the user interface, filling out some text forms, and choosing radio options.

> *"It's kind of difficult to use a tick form, you know when you … Sometimes you can't put it in the tick. So, they will need to use the comment field to ask us to fill in." [HCP_12]*

Other HCPs found the radio buttons restricting, as they do not allow them to populate additional information required for diagnosis (Appendix 17). Others reported that the limited functionality of the user interface resulted in incomplete patient information transmitted between HCPs. Consequently, HCPs could not complete referral tasks and thus made conscious adaptions by fitting the application interface (such as text fields) with additional information to make it work and complete the referral process.

Fitting for example involved HCPs using the text field to describe the patient diagnosis, even though such text fields were not designed for that purpose.

Hence, some users suggested changes in the design of the user interface, for example, to change some fields and make them mandatory to enforce data entry. This specialist explains specific fields in the system should be made compulsory because HCPs are not populating the fields with the required information.

> *"There were some mandatory fields I thought that we've decided on. But I still feel like sometimes some doctors are not filling in all the information that we would require." [HCP_11]*

Although HCPs adapted the user interface of the Vula application, they did not report any misdiagnosis of patients due to missing or incomplete information. Instead, they adapted the user interface to add the missing information or used the traditional methods to include the missing data. While some findings were related to the users subverting the required fields on Vula, other findings were related to design gaps in the application functionality.

These design limitations caused verification issues with the HPCSA (Health Professional Council of South Africa) registration number for account sign-up. By design, Vula lacks a setting that validates the HPCSA number which is used to identify the role of the HCPs (whether a nurse, or doctor) and the source of the health facility initiating the referral (to verify the province).

The design of the application accepted the registration of the HCPs without verifying the HPCSA which acts as a unique identifier (ID) for practising HCPs and their associated health facility.

Lack of verification therefore leads to HCPs bypassing the "drainage" areas stipulated in the referral guidelines and protocols. Drainage areas refer to the referral and support zones for service delivery between district, regional and supra-regional levels of care (Department of Health (DoH) South Africa, 2022).

HCPs at lower levels of care (primary to secondary and secondary to tertiary) can refer patients only to specified health facilities at higher levels of care as discussed in section 5.2.3.

The exceptions to these guidelines are that direct referrals can occur only when the referring doctors have directly liaised (by telephone) with the doctor requested to treat the patient. At the time of this study, Vula did not support the stipulated referral guidelines. Though the application facilitated referrals linked to certain health facilities, it was not able to detect referrals originating from health facilities outside the drainage areas. Furthermore, the design of the system did not take into consideration the roles of HCPs and referral protocols outlining referral pathways between hospitals.

> *"So now when you see the app you can see where the doctor is because they have to register where they are from. Now sometimes it so happens that the day they registered they were in the Western Cape. I mean they can register from anywhere they want. They can always put themselves as if they are in the Western Cape and they are able to initiate referrals." [HCP_12]*

Given the lack of verification functionality, there were inappropriate referrals that led to discrepancies in the referral process and eventually in the referral reports generated from Vula.

Given that several referral guidelines and protocols were not inscribed in the design of the application, there are design-reality gaps between Vula and the realities of the HCPs in public hospitals. The next section presents findings on augmenting as a second type of improvisation.

6.2.1.3 Augmenting the Vula application

Augmenting refers to undertaking additional work to make up for a misfit between an IT artefact and user needs (Yang et al., 2012). The IT artefact cannot accommodate all the functionality, and other systems are used to take up the slack.

The study results show that augmenting was performed through the use of other traditional referral methods (referral notes, email, and telephone) to complement electronic referrals as shown in Figure 6.5.

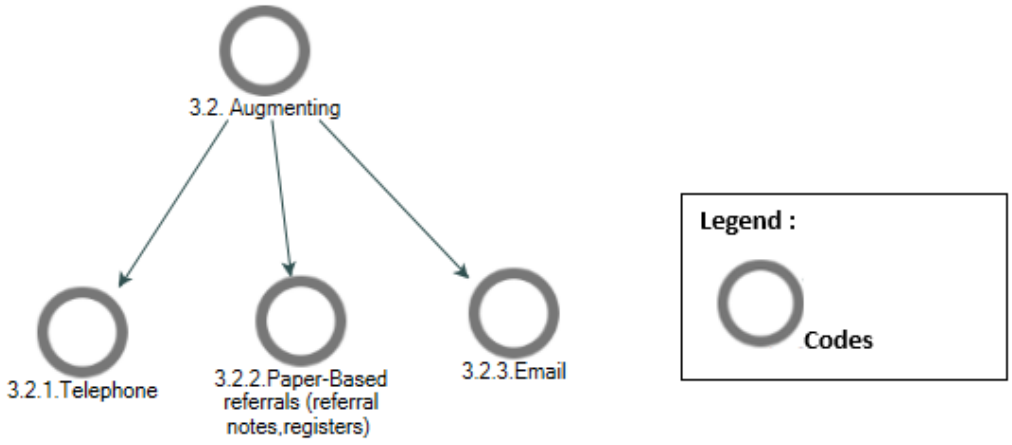


Figure 6.5: Categories and sub-categories on the augmenting code

As shown in Table 6.2, augmenting was mostly observed at Hospital A, with a total of 82 references. Thirty-one (31) references were categorised under this theme in Hospital B. Although Vula was profoundly utilised in Case Study 1, HCPs were also complementing Vula with paper-based methods such as emails and sending SMS (short message service) on their mobile phones.

For example, notes are still recorded in the referral registers for record keeping of the department. In other cases, an SMS is sent to the doctors on their mobile phones when they are unreachable on Vula. The contact details (such as mobile numbers and emails) of HCPs are therefore kept with the central switchboard to promote better inter-organisational communication.

> *"No. So we're not working off the app here. The app is used as a referral basis. But once you're discharged, I make a copy and it goes in his folder, and the other copy goes with him. It will go back to his provider." [HCP_7]*

> *"Through switchboard. They either send you, if it's in-house, or they send you the extension number. So, your phone has now become your bleep. So, they send you an SMS with the extension in-house." [HCP_11]*

In addition to paper-based referrals, emails were also used to complement the Vula application. Findings also confirmed that in resource-constrained contexts, there is a lack of access to other formal information systems mandated by governing institutions to handle referrals in public hospitals. In such cases, traditional methods such as email proved to be more effective compared to electronic systems.

> *"Like people in the other African countries, where there are no official electronic systems, they would send us an email for advice. Some countries don't have dermatologists in the entire country. So, they would send us an email with a picture of the lesion ...Or whatever it is ... And then we would give some sort of advice ... You try and give as best ... But it's quite tricky as well because you haven't consulted with the patient in person examined ... So, there is a chance of being wrong. But I mean they're desperate." [HCP_4]*

HCPs also reported that they were augmenting the Vula application by using telephones to follow up on referral messages sent on Vula. Amongst the many causal factors related to augmenting, the use of telephones was reported to be a more efficient method for communicating urgent referrals.

> *"We use, we have a ward mobile phone in case you got an urgent patient referral. So, if the person is not on Vula, we just call via our ward mobile phone." [HCP_6]*

In other cases where patient information was incompletely captured on Vula, mobile phones and telephones in the wards were used to follow up on e-referrals by acquiring additional information on the patient history.

Causal factors for augmenting e-referrals were related to improved efficiency and ensuring an effective and complete referral workflow.

Using these alternative methods to accomplish the tasks has in a way addressed some misfits and improved the overall efficiency of completing tasks. Moreover, HCPs reported that telephonic booking for referrals was quicker as there was division of labour where the administrator or a nurse handled the bookings for referrals leading to time savings, and medical doctors focused more on patient consultations.

> *"It's saving them time, so if the secretary calls, they don't have to fill in an app or give us all the information, because you can't make a judgement if you don't have all the information, so usually we then just discuss everything, um, telephonically, yes." [N_13]*

Users also received short message services (SMSes) which are similar to "bleepers." They reported bleepers were used hand in hand with Vula. For example, when messages were not attended to, a reminder SMS was sent to a doctor to respond to the messages on the application.

> *"The bleep device used to look like a small bleeper. You know it was fashionable in the eighties. You know in the hospital you just do the four digits. So, they send you the four digits as an SMS effectively. So, before the bleep used to just show you the four digits. But now it's an SMS with the four digits. "[HCP_11]*

Using bleepers therefore improved communication, as doctors were more responsive to messages compared to Vula.

Most HCPs also confirmed that they also used WhatsApp alongside Vula and telephones. The next section presents findings on workarounds as the third improvisation type.

6.2.1.4 Workarounds – (Shadow IT)

Workarounds are defined as "a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system to overcome, bypass, or minimise the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organisational or personal goals." (Alter, 2014, p. 10144). Alter's definition of workarounds is adopted in this study.

Workaround practices in the form of Shadow IT were observed from the data. The unique contextual findings from case study one reveal that workarounds were mainly enacted by medical officers who covertly resisted Vula.

The coding references observed in the data show 70 references for Hospital A and 19 references for Hospital B as shown in Table 6.2. The workarounds code was later renamed to Shadow IT and sub-codes related to Telegram and WhatsApp were created (Figure 6.6).

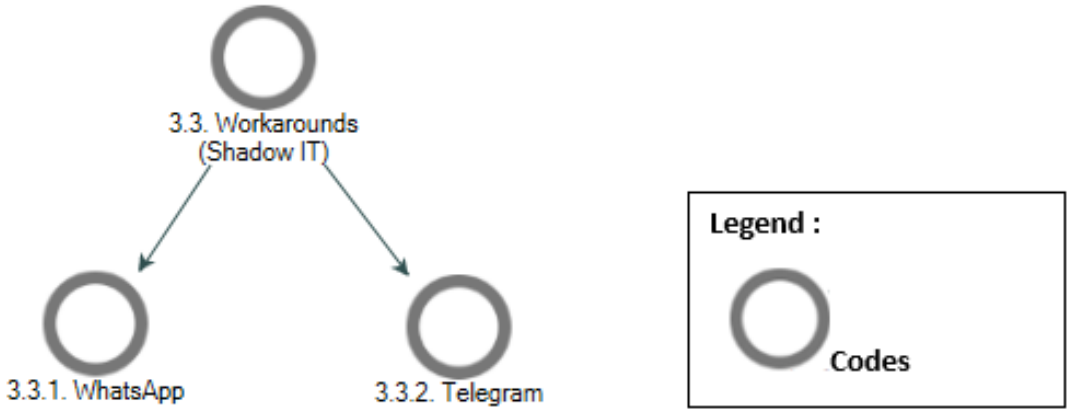


Figure 6.6: Sub-codes of workarounds in Case Study 1

Some medical officers reported certain referral tasks were not adequately supported by Vula. For example, the user interface design did not include field options for the description of medical conditions. As a result, HCPs addressed these misfits by enacting workarounds such as entering the data in other available text fields to include additional information. Workarounds involve HCPs intentionally adapting and using the Vula application in unintended ways. In contrast, augmenting involves undertaking additional work or using tools or methods such as the use of emails, and telephone to transmit information to make up for the misfits.

In case study one, workarounds were observed as described above. In more serious cases, medical officers avoided the use of Vula altogether and resorted to WhatsApp and Telegram as a third-party platform to communicate and share patient information.

Shadow IT is a form of workarounds characterised by the use of WhatsApp messenger and Telegram for consultations and seeking a second opinion from specialists.

Telegram was minimally used for sharing resources (e.g., digital books) between HCPs. The causal factors for using telegram as one of the third-party applications are described in Table 6.2.

> *"You know at the moment we're all onto Telegram because Telegram you can share books … It's like WhatsApp but you can share books." [HCP_2]*

HCPs were also enacting workarounds in a form of Shadow IT as there was lack of buy-in for Vula. Henceforth, the users opted for conveniently available software applications to complete work activities. Findings from case study one thus indicates that workarounds are enacted by users for several reasons. Amongst others, technical issues such as software incompatibility, inadequate training on existing information systems, lack of buy-in from users and poor management systems and structures lead to users enacting workarounds as described in Table 6.3.

Table 6.3 : Causal factors for workaround practice

Technology related Issues	**Empirical evidence**
Software incompatibility: the incompatible operating system on personal devices.	"I'm not using Vula. Because, because I use a Windows phone." [HCP_3]
Design issues: Some text fields on the user interface do not control the input of clinical information hence time-consuming to populate content.	"But the other thing that I think, so there were some mandatory fields I thought that we've decided on. But I still feel like sometimes some doctors aren't putting in all the information that we would require." [HCP_11] "The developer must change the sound. That, that notification sound. It's loud and it's intrusive. "[Laughs] [HCP_12].
Poor picture quality: affecting diagnosis process due to unstandardised device specifications.	"You know, ideally, we'd like certain, we'd like to see, and the lesions have to be visible. Like, what … the skin problem must be visible. And sometimes it's blurry and it's not standardised because people, not everybody's good at taking pictures." [HCP_3]
Lack of internet connectivity: Use private data bundles and personal devices (BYOD).	"I think people also maybe don't like the app because it uses your own data. You know, for us, we're on Wi-Fi so it's fine. But if you're outside, now you're having to log on and put in all this patient's information." [HCP_2]
Organisational Related Issues	**Empirical evidence**
Inadequate training: Users perceive that the introduction training is not sufficient, and follow-up training should be offered for newer versions of the system.	"No, they introduced the Vula app, and they did have a bit of a training programme, to show us how it worked. But that is not sufficient […] because you don't just say wow, we have found this new exciting tool, and this is how you use it. I'm going to train you how to use it. But then you don't assess if one has access to the information." [HCP_3]
Lack of buy-in from users and management: User's resistance to e-referrals use; Lack of buy-in from Hospital management.	"I think if you have got if you have got buy-in from the Department of Health, it became something that was provincial, and it would be much easier to implement it in all the Departments. And um, also then the registrars could see it as their job, you know? At the moment, some of them don't see it as part of their job." [HCP_1].

Organisation related issues	Empirical evidence
Non-compliance: HCPs evading registration linked to their institution, which interferes with referral protocols for drainage areas.	"So now when you see the Vula app you can actually see where the doctor is because they have to register where they are from. Now sometimes it so happens that the day they registered they were in the Western Cape. I mean they can register from anywhere they want. They can always put themselves as if they are in their registered drainage area and hospital." [HCP_12] I think all of us are using WhatsApp. Even those that are on the Vula app. So, that means everybody would be using WhatsApp baseline. And that's, that's how the system was before the intro of Vula." [HCP_3]
Workflow/Activity-related Issues	**Empirical evidence**
Misuse and unintended use of e-referrals: The e-referral application is misused to bypass referral drainage areas which affect workflow.	"Yes. A lot of our referrals are not actually tertiary appropriate. You would not ask a cardiologist about how you manage hypertension. They would never bleep him. But now you've got e-referral system that allows you bleep doctors at any level." [HCP_11]
Interruption of patient consultations: The use of e-referrals by HCP interferes with their patient consultation.	"I'm in a consult with a patient. If I'm on call, it's acceptable if I answer my phone and I can do it. If I start responding to SMSs, the patient thinks that I could be responding to my friend, I'm disinterested. It doesn't look professional. So sometimes it's a lot easier for me to say, sorry, I'm on call, I have to take this call, or I have to make a call." [HCP_7]

These factors were grouped into different categories namely technology, organisational and some workflow-related reasons. The causal factors for workaround practices suggest design-reality gaps. These gaps were therefore examined through the design-reality gap framework.

The relationship between fitting, augmenting, shadow IT and design-reality dimensions are discussed in the next section.

6.2.1.5 Improvisations and Design-reality gaps

This section provides an elaboration of causal factors for improvisations enacted by HCPs in case study one. Study findings present improvisations characterised by augmenting, fitting, and shadow IT as discussed in the earlier sections.

These practices suggest gaps between the design of Vula and the local realities of end-users in the public hospitals under study.

This study draws on the above concepts of the design-reality gap framework to understand the causal factors of HCPs for enacting workaround practices. Furthermore, the notion of contingency is relevant in this study, as fit or congruence looks at the mismatch and match between systems design and systems delivery. The purpose of drawing from the DRG model is to explore alternative concepts that explain the rationales behind HIS adaption and also how HIS are adapted to avoid mismatches (Arakpogun et al., 2020; Albertus & Makoza, 2023).

In this study, the extended DRG framework was employed to explain workaround practices through the lens of the original DRG dimensions and, in addition, through the extended dimensions of privacy, security, and ethical issues.

The extended dimensions are particularly relevant to this study because they include patient health data. The extended DRG framework is illustrated in Figure 6.7.

Actuality		Design	Constructs
Information	⟷	Information	Original constructs
Technology	⟷	Technology	
Processes	⟷	Processes	
Objectives and values	⟷	Objectives and values	
Staffing and skills	⟷	Staffing and skills	
Management systems and structures	⟷	Management systems and structures	
Other resources	⟷	Other resources	
Privacy and security	⟷	Privacy and security	Extended constructs
Ethical issues	⟷	Ethical issues	

Figure 6.7: Extended design-reality gap model (Source: Albertus and Makoza; 2023)

This study draws on the above concepts of the DRG framework to understand HCPs' causal factors for enacting workaround practices. Furthermore, the notion of contingency is relevant in this study, as fit or congruence looks at the mismatch and match between systems design and systems delivery. The aim is to look at ways to adapt HIS to avoid mismatches. Furthermore, the dimensions are applied to illustrate the design-reality gaps between technology, people, and organisations (Arakpogun et al., 2020; Albertus & Makoza, 2023). The DRG framework was employed to explain workarounds practices and their relationship to design-reality dimensions.

The dimensions of the DRG framework are further described in Table 6.4.

Table 6.4 : Dimensions of the DRG framework

Dimension	Description
Objectives and values	Relates to the objectives and valued rules of an Information system. This dimension also includes factors such as culture and politics affecting the use of Information systems.
Information	Information and knowledge add value to people and organisations (Albertus et al., 2023; Gómez & Heeks 2016; Heeks; 2006).
Processes	Activities of users and other actors to achieve the goals of an information system.
Technology	IT artefacts including hardware; software and networks supporting the use of Information systems.
Management systems and structures	Represents information systems and structures guiding and supporting the strategic decisions of an organisation.
Staffing and Skills	Both quantitative and qualitative aspects of competencies.
Other resources	Other resources related to time and money.
Privacy and Security	Measures put in place to safeguard the privacy and security of user information transmitted on the electronic application.
Ethical Issues	Ethical issues related to the use of the electronic application and transmission of user information.

The Design-reality gap framework describes the difference between the "design" or assumptions built into the IT artefact by designers and the reality of the real needs of end-users in the given context (Mörike et al., 2024; Greenhalgh et al., 2010). These gaps can emerge when features of the IT artifact are not matching the goals and needs of end-users, thereby creating incongruence and mismatch between user expectations and systems delivery.

Findings show that different improvisation types were enacted due to design-reality gaps experienced with the Vula application. In case study one, there was a total of 109 references coded to design-reality dimensions, and gaps giving rise to improvisations namely fitting, augmenting, and workarounds as shown in Figure 6.8.

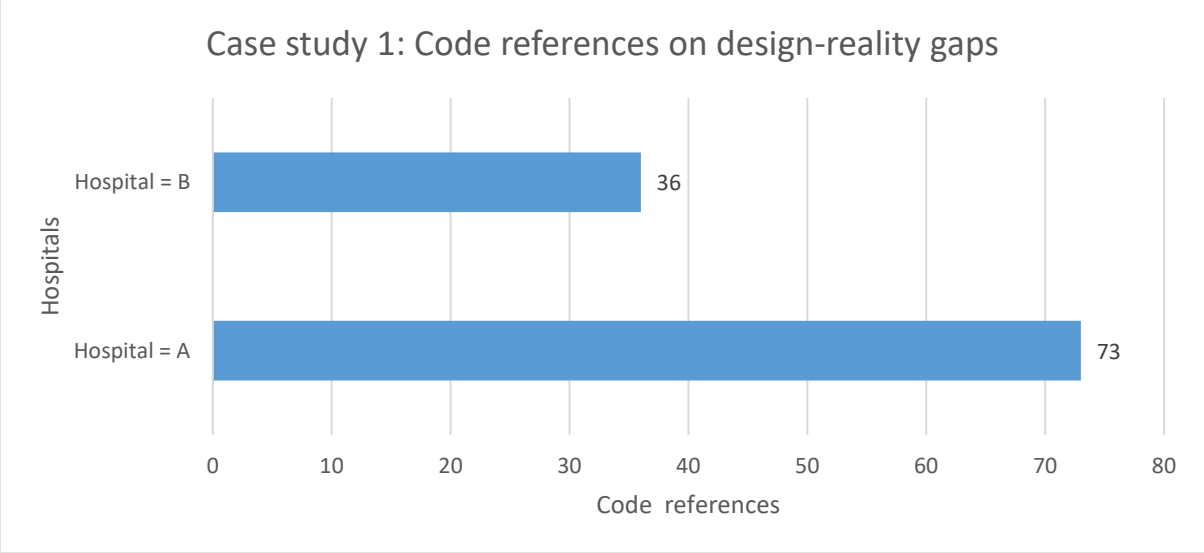


Figure 6.8: Case study 1: Coding references on design-reality gaps

The relationships between improvisation types and causal factors were later interpreted through the lens of the DRG framework. This was achieved through mapping the improvisations to DRG dimensions using matrix coding. This therefore sought to answer the "why" part of the research question.

Why do Health care providers (HCPs) enact workarounds to health information systems?

The objective of the Vula app is to facilitate interactions between health workers and specialists which involve exchanging patient information and history for referral purposes.

Despite the clear objectives of streamlining the referral process, the application was not utilised to its full capacity in case study one as there were design-reality gaps related to poor management systems and structures, lack of end-user involvement, inadequacies of the application to support activities of HCPs and lack of policy and guidelines awareness. These design-reality gaps are shown in Table 6.5.

Table 6.5 : Case study 1: Code references on improvisation types and relationship mapping to DRG dimensions.

Design-reality gap	Description	Improvisation type			DRG -Dimension
		Fitting	Augmenting	Workarounds (Shadow IT)	
CS1_DRG1: Poor management systems and structures.	Poor plans for rolling out and implementing e-health strategies to strengthen healthcare service delivery. poorly executed implementation plans (Vula application).	14	22	23	Management systems and structures. Technology..
CS1_DRG2: Vula Inadequacies and shortcomings.	Inadequacies of the Vula application. User interface restricting work of HCPs. Software incompatibility with user devices.	15	18	5	Technology. Process Information.
CS1_DRG3: Lack of HCPs (end-user) involvement.	Lack of user involvement in the selection process of the e-health application and roll-out planning. No follow-up training on the new versions of the Vula application. Some HCPs were reluctant to adopt the Vula application.	16	14	2	Staffing and skills. Technology. Objectives and values.

Design-reality gap	Description	Improvisation type			DRG -Dimension
		Fitting	Augmenting	Workarounds (Shadow IT)	
CS1_DRG4: Technological Issues	Lack of internet access.	24	25	0	Staffing and skills. Other resources. Information Technology. Management systems and structures. Privacy and security. Ethical Issues.
	Use of personal devices (BYOD) and personal data to transmit information.	5	4	0	
	Slow responsiveness of IT on implementing user requirements.	0	0	2	
	Lack of integration with official systems.	0	0	0	
	Lack of IT policies to manage risks of shadow IT.	0	0	6	Technology. Other resources.
CS1_DRG5: Lack of policy awareness	HCPs lack of awareness of referral policies.	2	10	1	Information Process. Management systems and structures. Staffing and skills. Privacy and security. Ethical Issues.

6.2.1.5.1 Poor management systems and structures (CS1_DRG1)

The management systems and structures are concerned with Information systems and structures guiding and supporting the strategic decisions of an organisation. The empirical evidence shows that the units in hospitals A and B are managed by a senior specialist (dermatologist or senior medical officer) who holds the role of head of department or unit. The head of the unit took on a supervisory role of overseeing e-referrals conducted by medical officers.

The supervisors are responsible for managing e-referral messages and ensuring that the tasks are completed by medical officers as per standard operating procedures. This is achieved through sending reminders to medical officers to respond to referral messages on Vula, and to change settings and roles on the application to ensure the doctor on call is assigned the correct role.

A top-down implementation approach was taken to introduce Vula in hospitals A and B. Employing this approach brought about covert resistance from HCPs to fully adopt Vula as a mandatory software application for patient referrals. Due to this poor management approach in rolling out Vula, there was no buy-in from some HCPs.

> *"Introducing Vula and conducting initial training is not sufficient enough for me to use the application. There needs to be some sort of needs analysis. [Laughs]. Because you don't, you don't just say wow, we have found this new exciting tool, this is how you use it. I'm going to train you how to use it. But then you don't assess my needs and access to Vula." [HCP_3]*

As a result, some HCPs were fitting the application to meet their needs and ultimately referral goals. For example, some HCPs registered for an account on Vula, but they were neither initiating nor actively using the application for referrals. Others were not adhering to rules of changing roles on the application after their work shift until reminded by the supervisor or until referral messages were channelled to them for processing.

Moreover, the end-users highlighted that the top-down approach was not ideal, because management and developers took long to update versions of the Vula software to accommodate some of these user requirements. At the time of this study, there was therefore a mismatch between management actions and the needs of HCPs.

6.2.1.5.2 Vula inadequacies and shortcomings (CS1_DRG2)

The design expectation of Vula was to build-in a notification feature which alerts HCPs of incoming referral messages. The notification sound is designed to send reminders to HCPs on call or off duty.

In reality, at the time of the study, the HCPs reported that this notification sound was intrusive. The HCPs were therefore opting to use WhatsApp as an alternative platform to share patient information.

> *"The developer must change the sound. That, that notification sound. It's loud and it's intrusive." [Laughs] [HCP_12].*

Furthermore, the design of the user interface and some features such as radio buttons and text fields made it difficult to capture clinical information as described in Table 6.2.

At the time of this study, the Vula application was available only on the Android operating system. Some HCPs reported that their personal devices were incompatible with Android and could not afford to buy new personal devices to install the application. This user requirement was later accommodated by the developer as newer versions were also released for the iPhone operating system- IOS (Vula, 2022).

The software incompatibility and technical settings on the user interface of Vula resulted in usability issues and insufficient service delivery. HCPs were consequently resorting to using WhatsApp to seek second opinions, fitting the application to populate information on the user interface for completing referral tasks and augmenting Vula with the use of telephones to follow up on abandoned or unanswered referral messages. These findings demonstrate that there are misfits between the design of Vula and the actual needs of the HCPs.

It can therefore be interpreted that there was a rush from management to speed up the uptake of Vula without end-user involvement in the process of rolling out Vula, and that this undermined the user needs.

6.2.1.5.3 Lack of end-user involvement (CS1_DRG3)

The design expectation is the delivery of a timely and effective exchange of inpatient and outpatient referrals by HCPs in public health facilities. The service provider for Vula indicated that the training of HCPs was undertaken upon the implementation of the application in respective public hospitals. The training aimed to equip staff members with skills on how to navigate and use features of Vula.

"HCPs were trained on the application prior to the app being rolled out." [IT_31]

While the initial training was conducted, there were new HCPs who joined the department long after the initial training, and there was no follow-up training conducted for these users. In addition, newer versions of the software were released, and no further training was conducted to demonstrate which user needs and requirements were incorporated in the new version. These resulted in lack of buy-in from end-users, particularly in hospital A.

Although to a certain extent the objectives of the mobile application matched the process realities, findings show more gaps related to inadequate staffing and skills. Consequently, HCPs resorted to fitting, augmenting and use of WhatsApp as Shadow IT to accomplish their work. There was therefore a gap between the conceived design and the capabilities of Vula in supporting the work of HCPs.

Some HCPs found the mobile application difficult to use, and there was no sufficient training provided to equip them with skills for operating the application. For example, there was a gap between end-users' knowledge and requirements of the application design. HCPs found there were features they recommended to management and the developer to be modified, and they were not incorporated in the design of the application at the time of this study.

"The other thing that I think, so there were some mandatory fields example text fields, I thought that we've decided on with the developer, but this was not included in the new version of the App." [HCP_11].

In reality, the above findings show that there was no involvement of HCPs to provide input on the selection process and roll-out planning of Vula. HCPs thus indicated that the user interface of the application was inadequate and had shortcomings that needed to be addressed. Furthermore, HCPs reported that follow-up training was required to engage in a participative process of discovering user needs and requirements. The training will further capacitate and equip both newly appointed HCPs and old users on new features of the application.

6.2.1.5.4 Technological issues (CS1_DRG4)

Although the application was adopted in hospitals A and B, findings indicate hard-soft gaps in its use. Hard-soft gaps "refer to the difference between the actual technology (hard) and the reality of the social context (people culture, politics, etc.) in which the system operates (soft) (Heeks, 2006).

The application requires a relatively stable internet connection. However, this need was not matched or met by the technological infrastructure of hospitals A and B. Findings confirm that both hospitals lacked a stable internet connection, and HCPs were relying on their personal data bundles to access referrals on the application.

> *"I think people also maybe don't like the app because it uses your own data bundles. You know, for some of us, we're on Wi-Fi so it's fine. But if you're outside the hospital, now you're having to log on and put in all this patient's information." [HCP_2]*

Although some HCPs had access to Wi-Fi in some hospitals, the wireless connection was unstable, and they had limited internet connectivity.

> *"We don't have data bundles. So, if you are here at work ... In a Wi-Fi zone, then it's not an issue. But the minute you're outside of the Wi-Fi zone or at the clinic or around the hospital and you don't have data ... then obviously you miss all those referral messages." [HCP_4].*

Moreover, the HCPs were using personal devices (BYOD) for professional tasks. Using personal phones for professional work was expected without IT support and no compensation for the use of personal data bundles. This gap is described in Table 5.4 as one of the constraints limiting the use of the Vula application. This can further be interpreted as a design-reality gap between expected resources to support the functioning of the Vula application. The availability of financial resources to buy data bundles is obviously a serious challenge for many HCPs.

They reported that it is expensive to use personal data bundles to keep the application running. This matter did not receive sufficient attention from management before the application deployment to ensure the infrastructure particularly the internet connection was in place to support the functioning of the application.

In addition, slow responsiveness on IT to implement their user requirements affected the smooth adoption and ultimately use of Vula.

6.2.1.5.5 Absence of IT policies and lack of policy awareness (CS1_DRG5)

Referral guidelines and protocols are designed to guide the HCPs on procedures and protocols of the referral process. The design expectation is that referral guidelines and protocols are inscribed into the design of Vula.

In reality, some referral guidelines such as referral pathways stipulated in the referral policy from the Department of Health were neither inscribed nor incorporated in the design of the application (Department of Health (DoH) South Africa, 2019b). For example, the design expectation is for the application to include a referral pathway including internal controls for restricting inappropriate referrals at tertiary healthcare levels. In reality, users were bypassing Vula and sending inappropriate referrals at any healthcare level. In addition, the lack of inscription of referral rules in the design of the application leads to inappropriate and overload of referrals at higher levels of care.

> *"A lot of our referrals are not actually tertiary appropriate. You would not ask a cardiologist about how you manage hypertension. They would never bleep him. But now you've got e-referral system that allows you bleep doctors at any level." [HCP_11].*

A more interesting finding was related to HCPs' lack of knowledge and awareness of referral guidelines and policies. It is expected that HCPs and other end-users are aware of the guidelines or protocols governing the referral pathways and the overall referrals process.

In reality, the HCPs' lacked awareness of policies, strategies and guidelines related to referrals.

> *"I am not aware of any referral guidelines, except obviously, which, which hospitals refer to which, uh, who falls under your referral area, but as far as actual referral guidelines, I am not aware of any." [HCP_2]*

In cases where HCPs were unaware of the guidelines, they relied on their supervisors (in particular the head of units) to guide them on how to handle inappropriate referrals.

Furthermore, HCPs resorted to the use of shadow IT such as WhatsApp to seek second opinion from their colleagues or from senior specialists. This gap affected the dimensions of information, process, management systems and structures.

Given the prevalent use of WhatsApp for referrals, there was no evidence of IT policies designed to manage the risks of shadow IT. This presented a threat to patient safety, in particular, the transmission of information on social media platforms threatens the privacy and confidentiality of patients.

This gap can therefore be elaborated that due to the absence of clear IT policies, HCPs freely resorted to WhatsApp and Telegram as there was no IT policy to regulate the adoption and use of these third-party applications. It can therefore be interpreted that the absence of these IT policies exacerbated the adoption of third-party applications in Hospitals A and B.

6.2.1.5.6 Other gaps (CS1_DRG6)

There is a mismatch between the objectives and values of Vula and the social context where the application is implemented. For example, it is notable that the head of the unit attributed the lack of acceptance of Vula to the behavioural intention of users. The head of unit attributes Vula resistance to HCPs' fear of trying out new software applications.

> *"Yes, I think they are just afraid of using the app, because it's something new, you know." [HCP_1]*

In actuality, there were valid rationales such as financial constraints and infrastructural challenges for the non-adoption of the application. Some of these limitations were attributed to expensive data bundles and the extra cost of buying new personal devices (for users with incompatible devices).

In cases where users ran out of data, they missed important referral messages. This necessitated them to use traditional referral methods such as telephones and paper-based referrals to transmit patient information.

The references coded under each design-reality gap dimensions are presented in Figure 6.9. There were more gaps observed along the management systems and structures, and technology.

The gaps on the technology, information staffing and skills, and processes dimensions were medium. For the rest of the dimensions, there were less than 10 references, which indicates a low gap on these dimensions. The illustration in Figure 6.9, thus indicates the magnitude of the gaps observed in the empirical data from case study one.

The above findings show the relationships between improvisation types and design-reality dimensions highlighting gaps uncovered from the data. In case study one, workaround practices were enacted by HCPs due to gaps related to poor management systems and structures, lack of HCPs' involvement in the roll-out of Vula and also due inadequacies of Vula to support referral tasks. Additionally, HCPs were enacting workarounds due to the absence of IT policies for regulating the adoption and use of third-party applications in the public hospitals under study.

Design-reality dimension	References coded to dimension	Magnitude of gap
Technology	66	very high
Management systems and structures	59	very high
Information	38	high
Staffing and skills	32	Medium
Processes	25	high
Objectives and values	13	very low
Patient privacy and confidentiality/Ethical issues	10	low
Other resources	1	very low

Figure 6.9 : Case study 1: Code references to Design-reality dimensions

The next section presents findings from Case Study Two, offering an overview of the Khomas referral system, the tools utilised to facilitate HCPs referral, and workaround practices identified from the empirical data.

6.2.2 Case Study 2: Khomas referral system (KRS)

Findings from Hospitals C and D in the Khomas referral system are presented in this section. The work system snapshot of the Khomas referral system is presented in Table 6.6.

Table 6.6 :Work system snapshot of the Khomas Referral System

<table>
<tr><th colspan="3">Work system snapshot of the Khomas Referral System (KRS)</th></tr>
<tr><td>Customers</td><td colspan="2">Services</td></tr>
<tr><td>Patients</td><td colspan="2">Patient referral information is received from lower levels of the healthcare system.</td></tr>
<tr><th colspan="3">Work Practices (Processes & Activities)</th></tr>
<tr><td colspan="3">Nurses or medical doctors in the regional or district hospitals refer patients to Hospital D or C.
Administrators book patients on the patient referral booking register at the tertiary hospital (Hospital C).
Medical officers receive referral letters from nurses/medical doctors in district hospitals.
Inpatient referrals are handled by nurses or medical officers in the respective wards.
Outpatient referrals are received by medical officers through referral letters and referral registers from district hospitals.
Patient information is shared and transmitted through referral letters, telephonic bookings, and referral registers.
Inpatient information is recorded on the District Health Information System (DHIS2) by nurses or medical officers in the wards.
Medical doctors or nurses in district hospitals send referral letters/notes to the medical officers or specialists in tertiary hospitals.
HCPs use different types of referral methods such as referral letters, telephone, and WhatsApp to share and transfer patient information with specialists.
Limited use of electronic referrals.</td></tr>
<tr><th colspan="3">Workaround related practices</th></tr>
<tr><td colspan="3">Medical officers enact workarounds in the form of Shadow IT by using WhatsApp to share patient information.
All HCPs share patient information using traditional referral methods email, referral letters and telephone.</td></tr>
<tr><th>Participants</th><th>Information</th><th>Technologies/Tools</th></tr>
<tr><td>Medical officers
Nurses
Specialists (Dermatologists)
IT personnel
Medical doctors</td><td>Patient biographical information.
Patient medical history (patient medication, allergies, problem, procedure lists).
Patient medical imaging (x-rays, MRI magnetic resonance imaging).
Referral policies, procedures and guidelines governing referral systems.
Referral protocols.</td><td>District Health Information Systems 2 (DHIS2).
WhatsApp® messenger.
Email.
Telephones.
Referral register.
Referral notes.</td></tr>
</table>

Data was collected from the heads of units, medical officers, nurses, and dermatologists in the respective hospitals. Additionally, IT personnel were also interviewed to gain their perspectives on health information systems use, and regulations governing such use. Findings from case two are reported through the lens of workarounds and design-reality framework.

The district health information system (DHIS2) is implemented as the National Health Information system at the Ministry of Health and Social Services (MoHSS) in Namibia (Khan & Edward, 2012; Ministry of Health and Social Services (MoHSS) Namibia, (2021). However, DHIS2 is not utilised for referral purposes but for administrative tasks as explained in section 2.5.2. A work system snapshot was developed to describe and highlight referral activities and tools facilitating these activities as summarised in Table 6.6. At the time of this study, Vula was introduced to some HCPs in the Khomas and Omaheke regions, with minimal use in some public hospitals (Vulamobile, 2022).

Study findings show that most HCPs were not familiar with Vula as it was not mandated by MoHSS as an official system to support HCPs' referral activities.

6.2.2.1 Vula non-use and workaround practices

In the Khomas referral system, the district health information system (DHIS2) was identified as the official information system used to support healthcare services and related activities in Hospitals C and D. Even though DHIS2 contains an inpatient referral module designed to facilitate patient referrals, this module was not used in any of the hospitals, but there was code reference (1) showing some awareness level of DHIS 2 (Ministry of Health and Social Services (MoHSS) Namibia, 2021). IT personnel from the MoHSS confirm the system is instead used for administrative and reporting purposes.

> *"Doctors, when it comes to the DHIS, they only use it for reporting. From there it's the nurses or the Health Information Systems officer that does the records." [IT_30]*

Furthermore, Vula was introduced to HCPs at Hospital C; however, the uptake was not good as the application was not mandated by the MoHSS.

For HCPs who used Vula, they did so through word of mouth. There were 2 code references to Vula use in Hospital C, and 4 references in Hospital D as shown in Figure 6.10.

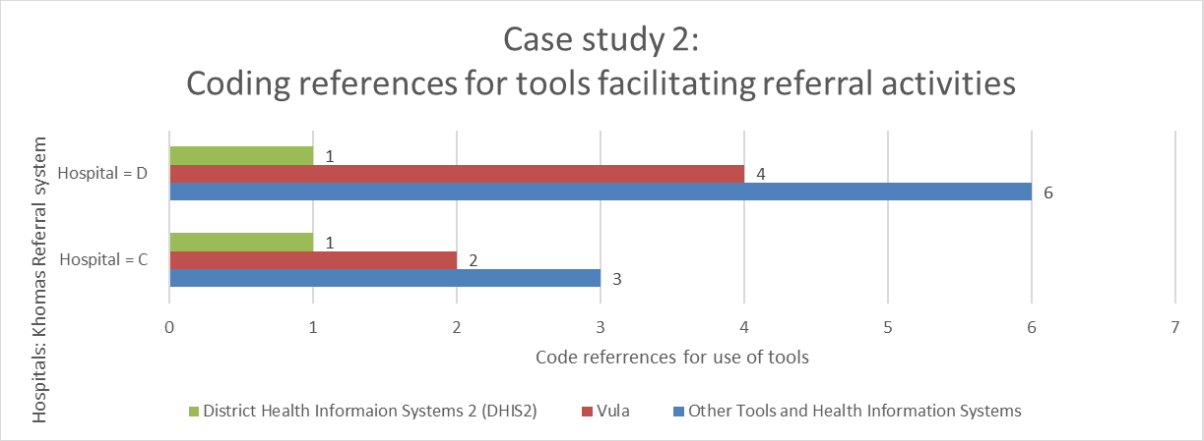


Figure 6.10: **Coding references: Tools used to facilitate referral activities in case study two.**

The study findings did not show extensive use of Vula beyond the HCPs' awareness of the application and not actively using it for referral purposes.

> *"Vula is too much work, especially when you are on call, and you are busy seeing a patient. You find messages of patients that you didn't consult and then they were coming like, you didn't respond on Vula. We don't use it much here in Namibia." [HCP_14]*

A lexical query was thus conducted to uncover and explore the additional tools used for referrals. This search yielded recurring keywords such as patient, WhatsApp, Vula referral and system as shown in Figure 6.11.

Figure 6.11: Word cloud of workarounds- related terms in case study 2

Although the study findings show there were mainly traditional tools facilitating patient referrals, a significant finding shows that WhatsApp was dominantly used to transmit patient information between HCPs. The coding references for workaround practices are shown in Table 6.7 and are discussed in the following sections.

Table 6.7:Coding references for workaround practices in Case Study 2

Improvisation Type	Hospital C	Hospital D
Augmenting	8	3
Fitting	2	0
WhatsApp platform	45	88

6.2.2.2 Augmenting

The study findings show 11 coding references on the augmenting category. Although there were a few references to the augmenting category, other findings from Hospitals C and D show there is a continued reliance on traditional referral methods such telephones, and paper-based methods such as referral notes and registers to facilitate referral activities.

> *"They call, then nurses or medical officers discuss the patient with you, and then they write they write their referral letter." [HCP_14]*

Additionally, patient health passports are still commonly used to capture patient history and refer patients between HCPs. Health passports are used with referral letters as a means of communication to ensure a smooth transition of care between HCPs.

> *"So sometimes for referrals, nurses simply just write all these details in patients' health passport." [HCP_17]*

In some cases, the traditional methods are complemented with emails to follow up on referral cases.

> *"Yes, we have a computer, but then the Wi-Fi is not working. There are times when we patient information by emails." [HCP_14]*

Given the continued use of paper-based referrals, at the time of this study, there was no mandated health information system specifically designed to automate referrals.

Although findings confirm that the DHIS2 system has an inpatient module designed with a patient referral functionality, it is underutilised.

This system is used alongside non-integrated donor-funded information systems supporting different health programmes (Ministry of Health and Social Services (MoHSS) Namibia, 2021). The donor-funded systems at the MoHSS such as the Electronic Patient Management System (EPMS) and Extended Tuberculosis Register (ETR), are vertical health systems running in parallel to the DHIS2 (Khan & Edwards, 2012).

Findings show that none of the identified systems directly supported patient referrals but did provide other health programmes such as tuberculosis (TB), HIV and malaria, in the Namibian public sector.

Since these systems were brought in from different service providers (software vendors) to specifically support these programmes, the systems were not interoperable (Angula et al., 2019; Mutasa, 2022). As a result, the adoption and implementation of these Health Information systems escalated interoperability challenges with DHIS2, as these systems cannot exchange data.

IT personnel highlighted serious fragmentation of various HIS used for data collection and sharing of patient information. This they report is a result of donor funded HIS that are not interoperable.

> *"For instance, the TB system, where they monitor patients, these are donor-funded programmes. These funded systems are administered and controlled by donors." [N_29]*

Given the above-mentioned methods of augmenting DHIS2 with traditional methods such as referral notes and telephones, HCPs were resorting to the use of WhatsApp as a shadow IT to support referral activities. Workaround practices are further explained and discussed in the next section.

6.2.2.3 WhatsApp platform

In case study two, Vula was informally introduced to some HCPs through word of mouth. Although some HCPs have explored using the application, it was not officially adopted and implemented by the MoHSS. During the interviews, some HCPs reported that they were aware of the application but did not officially use it for patient referrals.

> *"I am aware of the Vula application. I know this special app from Cape Town, and they use it specially for patient referrals, but not in this hospital." [HCP_14].*

WhatsApp was thus used as a replacement IT for DHIS2. WhatsApp use is observed in case study two, where 40 references are coded to Hospital C and 83 references are coded to Hospital D respectively (Figure 6.12).

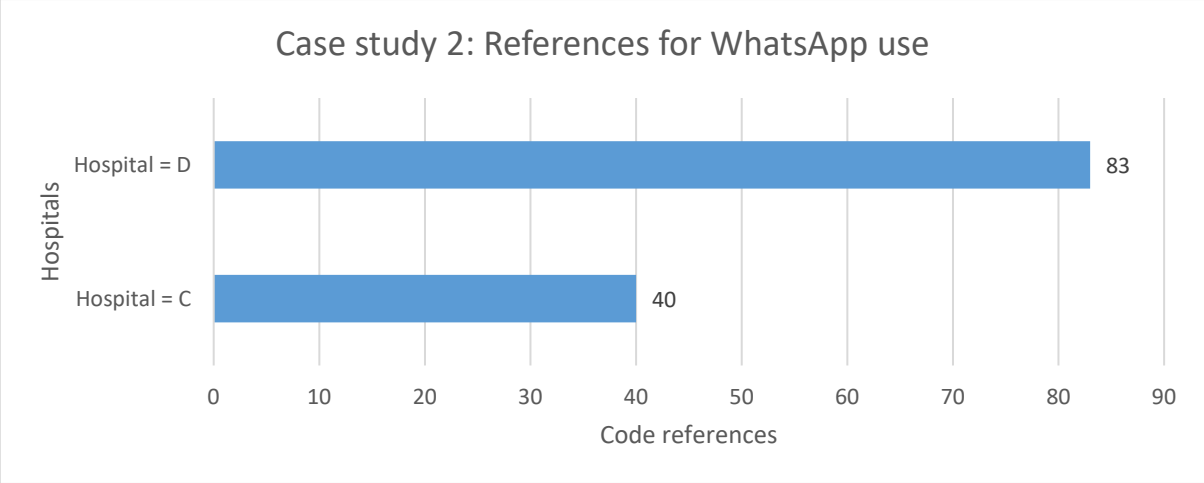


Figure 6.12: Case study 2: Code references for WhatsApp use

Shadow IT are a form of workarounds characterised by the use of WhatsApp messenger for consultations and for seeking second opinion from specialists. HCPs formed online communities of practice to share information on WhatsApp as a shadow IT. Medical officers created WhatsApp groups exclusively for medical officers to share patient information. This can be characterised as an online community of practice where HCPs created a network of other HCPs to bypass resource constraints and dependence on existing HIS.

Many HCPs relied on WhatsApp to seek a second opinion with colleagues and specialists. HCPs were therefore exercising autonomy in seeking alternative ways to communicate with other HCPs.

This finding is in agreement with the Communications Regulatory Authority of Namibia (CRAN) report where it is confirmed that WhatsApp is the most preferred instant messaging platform by the majority of Namibian citizens (Ministry of Health and Social Services (MoHSS) Namibia, 2021).

HCPs deemed alternative workarounds to be more beneficial for consultations particularly for diagnoses of patients and for seeking specialist opinion.

> *"We use WhatsApp also share patient information. Sometimes the doctor from the region sends pictures to seek second opinion on a case." [HCP_15]*

Most HCPs also confirmed that they were members of WhatsApp groups created for their respective departments. Patient information was shared, even though anonymously with other medical officers.

> *"WhatsApp groups. We're not in. I think the WhatsApp groups are more for respective departments so if you happen to be in the surgery department you will be on a WhatsApp group and they just communicate, whatever needs to be communicated regarding maybe a patient that's referred, or maybe problems in the department so for the emergency department we do have a WhatsApp group." [HCP_20]*

Furthermore, causal factors for enacting workarounds are reported to be linked to poor management systems and structures. This is explained in relation to the misalignment between the Information Technology department and the MoHSS as a health organisation. Additionally, in an event where third-party systems are implemented, there is limited involvement and engagement with IT personnel and end-users. Other causal factors are linked to the absence of IT support to govern Shadow IT and the lack of policy awareness from end-users.

Given that there is no formal mandated HIS to support patient referrals, HCPs use WhatsApp on personal devices to facilitate professional work. These causal factors are discussed from a design-reality lens in the next sections.

6.2.2.4 Improvisations and Design-reality gaps

In case study two, there were a total of 68 references of improvisations coded to design-reality dimensions (Table 6.8). The DRG gaps are discussed in the following sections.

Table 6.8 : Case study 2: Improvisation types and relationship mapping to DRG dimensions

Design-reality gap	Description	Improvisation type		DRG -Dimension
		Augmenting	WhatsApp	
CS2_DRG1: Poor management systems and structures.	Poor plans for rolling out and implementing e-health strategies to strengthen healthcare service provision. Poorly executed implementation of donor-funded systems.	22	21	Management systems and structures. Technology. Other resources Privacy and security. Ethical Issues.
CS2_DRG2: Absence of IT policy and Lack of policy awareness.	HCPs lack awareness of referral policies. Lack of IT policies to manage risks of shadow IT.	21	10	Information Process. Management systems and structures. Staffing and skills. Privacy and security. Ethical Issues.
CS2_DRG3: Non-use of DHIS2 and Interoperability issues.	Limited use of DHIS2 for administrative tasks.	30	1	Technology Process Information. Staffing and skills.
CS2_DRG4: Technological issues	Lack of internet access.	3	0	Staffing and skills. Other resources. Information Technology. Management systems and structures.
	Use of personal devices (BYOD) to share sensitive patient data.	16	5	
	Use of personal data due to limited internet access in the hospitals.	2	4	

The themes related to the improvisation types and design-reality dimensions are discussed in the next sections.

6.2.2.4.1 Poor management systems and structures (CS2_DRG1)

Study findings show a misalignment between IT and MoHSS as a health organisation. This is evident in the management structures and how systems are deployed at the MoHSS and public hospitals. IT personnel highlighted constraints related to the commissioning and implementation of health information systems.

Constraints listed in the study findings included lengthy processes of developing relevant strategies and implementation of health information systems. In the Khomas referral system, the coordination and implementation of IT infrastructure, services and applications are undertaken by the office of the prime minister.

IT personnel at the Ministry of Health therefore rely on the office of the prime minister for decisions related to any IT implementation. Consequently, the traditional structures and processes limit the speed at which the IT responds to information needs changes of HCPs in public hospitals.

> *"No, we are not excluded from decision-making. Of course, IT is there to actualise the administration, and the management is to take the final decision. So, if IT advise you to implementation of a certain system might fail. As central IT and management in the office of the prime minister oversee decision-making, they decide we proceed. As the IT department we proceed with the implementation regardless of the risk of failure." [IT_25]*

Additionally, numerous HIS were provided as resources by donor agencies. Given that these systems are not owned by the MoHSS, the maintenance of these systems is not fully offered by the internal IT department, but by consultants from donor agencies. Limited resources are therefore invested in acquiring software applications and licensing to support health service delivery at the hospital level. Due to loss of control from the MoHSS, the systems come with inscribed design and features from developers. The inscribed design disregards the contextual needs of HCPs and public hospitals and the MoHSS in which these systems are implemented.

For example, there is lack of sufficient computer equipment and limited network infrastructure to provide internet access. Despite inadequate access to the internet, these systems were implemented with the design assumption that they can function online.

Kimaro & Nhampossa (2005), explains that projects of this nature lead to unsustainable government initiatives that rely on foreign experts to implement and maintain these systems.

Furthermore, the MoHSS and users are merely regarded as consumers of the technology and are inactively involved in the design and development of HIS. As a result, this created information asymmetries between the IT personnel and consultants supporting donor-funded systems. Information asymmetries in the context of Information Systems consultations occur when one party has more knowledge than the other party (Dawson et al., 2010).

Dawson (2010) explains that this imbalance in Information systems consultations occurs due to limited engagements and lack of thorough screening of proposed Information Systems solutions.

6.2.2.4.2 Absence of IT policy and Lack of policy awareness (CS2_DR2)

Due to unclear IT policies HCPs continued to use third-party software applications such as WhatsApp despite risking patients' privacy and confidentiality.

Additionally, these practices have brought serious security risks to clinical information shared on shadow systems, compromising the privacy and confidentiality of patients.

Findings also showed that there is a serious breach of data security policies where confidential information of patients is shared on social media platforms. Patient medical history, computerised tomography (CT) scans, X-rays and other pictures are shared on WhatsApp messenger and this information is usually stored on personal devices. This compromises the confidentiality of this information, and it poses serious security risks to patient information. Some respondents lack an understanding of the security risks caused by sharing patient information on WhatsApp.

HCPs justify sharing information on WhatsApp using end-to-end encryption as a measure to prevent security threats to patients' information. This misunderstanding is observed in the following HCP's response.

> *"We use WhatsApp as a referral platform because it's more encrypted and fewer patient details are sent across. It's set up so that you don't save the photos on your phone, but it's saved within the application. So, the patient's confidentiality is protected." [HCP_2]*

Moreover, there are informed consent issues. HCPs' inability to seek consent from patients to take pictures is of concern.

Taking pictures without the patient's consent is breaching patient confidentiality because not seeking permission from patients and sharing them for example on WhatsApp and on personal devices, remains the doctor's responsibility to safeguard the confidentiality of such information. This is partly caused by a lack of standardised procedures and e-health strategies for handling electronic information in the Namibian healthcare system.

6.2.2.4.3 Non-use of DHIS2 and interoperability issues (CS2_DRG3)

Although the district health information system (DHIS2) is implemented as the National Health Information system, it was mainly used for administrative purposes (Khan & Edward, 2012). Respondents reported that the DHIS2 contains an in-patient referral module which is not adopted in the hospitals under study. The system is instead used for administrative reporting purposes by medical officers at MoHSS and in some wards in the tertiary and district hospitals.

Furthermore, the DHIS2 is used alongside non-integrated vertical programmes and donor-funded health information systems. Although some of these systems were incompatible with existing HIS, the MoHSS does not take into consideration country-specific factors to ensure the donor-funded systems fit and support user needs in public sector hospitals but simply adopts the system due to the availability of resources.

> *"It's a bit difficult to see how far it will go because somehow every year there's an introduction of a new system. And also, I think somehow there's also a weakness in controlling this introduction of systems because the majority of the time they come through donor funding and with donors, they want to give you money, but you must give us this. So, that's one major challenge." [IT_30]*

The donor-funded systems are geared towards supporting specific health programmes. These systems were adopted from universal designs and models that presumed the systems seamlessly integrate with existing systems in developing contexts.

However, the adoption of these systems brings about interoperability challenges (Angula & Dlodlo, 2018; Shaanika & Nehemia, 2019). Furthermore, these systems usually do not support contextual needs in public hospitals. Designers of these HIS also presumed skilled end-users will interact with the system in developing contexts.

In reality, most of these systems were built on different healthcare standards restricting them from integrating with existing systems such as the DHIS2. For example, some systems required internet connectivity but were deployed at regional offices with limited internet connection. Respondents remarked that the newer version of DHIS2 has an offline option (updating reports once connectivity is restored). They, therefore, recommend a similar design for other system applications to enable work to be conducted in an offline mode.

Despite these challenges, efforts are made to address them through the adoption of free and open-source software (FOSS). One notable initiative is the implementation of OpenMRS within the Ministry of Health and Social Services (MoHSS). OpenMRS is implemented to handle tasks such as patient registration, clinical data management, pharmaceutical management, laboratory services, and report generation (Namibia, 2021).

OpenMRS is one of the most widely used FOSS and electronic health record systems in low and middle-income countries (LMIC) due to its versatility.

To bridge the design-reality gaps, it is crucial to leverage software applications and tools that are adaptable to different countries and contexts to effectively address the contextual challenges (Verma et al., 2021). For example, Verma emphasises the pivotal role free and open-source software can play in offering sustainable and scalable solutions, especially in resource-constrained settings. In their study, they assert that OpenMRS in particular has received recognition as a “global good” application attributing this to its versatility, and adaptability to integrate with other systems using health standards such as HL7 (Health Level Seven).

OpenMRS stands as one of the pioneering and possibly the most widely implemented systems classified as a “Global Good in LMICs”.

Given that the Ministry of Health in Namibia has adopted OpenMRS, it is imperative to scrutinise the value of this open-source software and how it can be leveraged to address local challenges. For example, adopting the collaborative or community-driven development approaches ensures that context-specific features are accommodated in the OpenMRS modules such as user interfaces, and operational workflows (OpenMRS, 2023). This approach can be adopted with similar free and open-source applications that can be adopted in LMIC settings.

Given these limitations and initiatives to addressing them, there remains a gap between the user needs and systems available to support referral activities. The role of IT is hence crucial in not only identifying user requirements and specific contextual needs but also in selecting applications categorized as "Global Goods," which are digital healthcare software tools adaptable to various countries and contexts, to effectively address key healthcare system challenges (Digital Square, 2023). IT personnel should additionally ensure that the implementation of these Health information systems serves their objectives and further integrates with other systems to achieve referral outcomes.

6.2.2.4.4 Technological issues (CS2_DRG3)

Findings show that most HCPs use personal devices for storing both personal and professional information. The use of personal devices (Bring your own device-BYOD) is not ideal for storing patient information as it is sensitive. Furthermore, the privacy and confidentiality of patients is compromised. The use of personal devices was motivated by lack of IT support.

While HCPs used their personal devices, they expected management or IT to provide personal devices and support concerning the regulations on software applications to install on these work devices.

> *"I am thinking, I actually need two cell phones. One, just to take pictures, that one is just for work. These should ideally be provided by my employer." [HCP_14]*

In reality, some of these expectations were unmet, as IT and management were not in a position to provide devices to HCPs due to resource constraints. Although HCPs viewed this as lack of IT support, this is an issue as lack of IT alignment and MoHSS.

There is therefore a gap between the function of IT within the MoHSS and services offered by central IT from the office of the prime minister.

> *"Those were some of the factors that we highlighted earlier before the implementation of the system, but the Ministry and maybe the government as a whole were too ambitious to have this system implemented. So, there was pressure from the State House. They wanted the system to be implemented within a shorter period. The Office of the Prime Minister was also putting pressure on the management here, so that's why we were advised to proceed." [IT_25]*

In case study two, the resources to render the services to end-users are controlled by the central IT at the office of the Prime Minister. In some cases, internal IT personnel from MoHSS encouraged the use of third-party applications such as WhatsApp even though there was no formal support rendered for these applications. Additionally, the absence of IT policies motivated the use of WhatsApp as there was no established protocol for the adoption, approval, and use of third-party applications.

6.2.2.4.5 Other Gaps (CS2_DRG4)

In case study two, it is evident from the study findings that there were limited engagements between the IT personnel responsible for offering technical services to the public hospitals and the central IT in the office of the prime minister.

> *"Those were some of the factors that we highlighted earlier before the implementation of the system, but the Ministry and maybe the government as a whole were too ambitious to have this system implemented. So, there was pressure from the State House. They wanted the system to be implemented within a shorter period. The Office of the Prime Minister was also putting pressure on the management here, so that's why we were advised to proceed." [IT_25]*

Due to lack of these engagements, the consultants from the donor agencies are therefore at an asymmetrical advantage as they possess more knowledge and experience on the technology functionality than the client organisation (MoHSS).

Consequently, this leads to dependency on consultants for the maintenance of these systems, and this suggests a "resource dependency" on donor agencies.

"So it can be that the system is also not functioning to its full capacity. And now the problem is also that it's a donor-funded system and nobody in Namibia actually has access to support these users for that system." [IT_30]

While the donor funders play a crucial role in contributing to programmes for tackling infectious diseases such as tuberculosis, HIV and malaria, there remains limited coordination from MoHSS, especially with the identification of user requirements and implementation of e-health solutions offered by donors.

Study findings also showed a serious issue with poorly executed implementation of donor-funded systems as they were not supporting referral activities. Adoption of donor-funded applications leads to interoperability challenges between DHIS2 and other systems. The lack of IT support and absence of IT policies encouraged users to resort to readily available software applications such as WhatsApp.

The relationships between improvisation types and design-reality dimensions highlighted several gaps that need to be addressed to reach optimal use of implemented e-health interventions in public hospitals. These gaps are depicted in Figure 6.13.

Design-reality dimension	References coded to dimension	Magnitude of gap
Management systems and structures	43	very high
Information	31	high
Processes	31	high
Technology	30	Medium
Patient privacy and confidentiality/Ethical issues	4	Low
Objectives and values	2	very low
Staffing and skills	1	very low
Other resources	1	very low

Figure 6.13: Case study 2: Code references to Design-reality dimensions

In case study two, there are more gaps observed from the management systems and structures, technology, information, and processes.

Medium gaps were also observed along the staffing and skills dimension. There are a few gaps observed on the staffing and skills, other resources: objectives and values of health information systems.

6.3 Conclusion

This chapter presented findings from individual cases. Substantial evidence from both case studies shows misfits between the work of HCPs and e-health applications used to facilitate and support the activities of HCPs. Improvisations related to fitting, augmenting and workarounds were observed from the study findings. Workaround practices were enacted because of gaps between the design of the e-health applications and the contextual realities in which e-health applications were implemented. These gaps are explained as causing factors driving the enactment of workarounds to e-referrals in public hospitals. The gaps are related to poor management systems and structures; lack of user involvement and IT support; inadequacies of existing e-health applications; lack of IT policies to regulate the use of third-party applications and lack of HCPs awareness of existing policies.

The design-reality gap framework was adopted to gain an in-depth understanding of assumptions built into the e-health applications and real-life needs of HCPs in both case studies. Findings suggest that e-health applications used to support referral activities have fallen short of the designed objectives. Some practical considerations to overcome the gaps observed, include involving end-users in the selection of health information systems from the outset to ensure the system meets their needs and is successfully implemented in the given healthcare settings. Secondly, effective user education and change management are essential in mitigating the risks of workarounds and Shadow IT. Thirdly, workarounds are not necessarily negative, but they can a source of innovation and an opportunity for process improvements for health organisations. The critical analysis and practical implications of DRG gaps on HCPs, patients and health organisations are discussed in Sections 7.4 and 8.4. A comparative analysis of the multiple cases is presented in the next chapter to contrast and compare findings and to highlight measures for closing design-reality gaps.

CHAPTER 7: Cross-case Analysis and Findings

7.1 Introduction

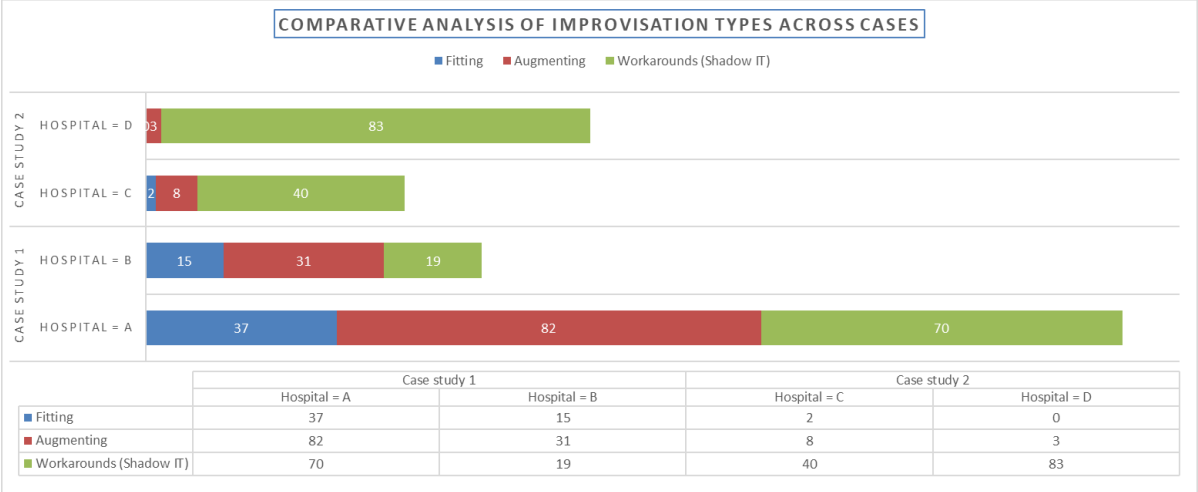
This chapter provides a cross-analysis of design-reality gaps (DRG) giving rise to workaround practices of healthcare providers (HCPs). A cross-case comparison is conducted between case studies one and two, paying particular attention to similar and contrasting findings. Rival explanations are reported to offer explanations as to why HCPs were enacting workarounds. This chapter further offers an explanation of how workarounds and design-reality gaps are affecting e-referral outcomes for patients, health care providers (HCPs) and health organisations.

This chapter is structured as follows: A comparative analysis of improvisation types and design-reality gaps are discussed in section 7.2. The next section (7.3) discusses relationships in the data. Section 7.4. explains how design-reality gaps (DRG) are affecting referral outcomes. Lastly, a summary of the chapter is presented in Section 7.5.

7.2 Comparative analysis of improvisation types and design-reality gaps

Contrasting patterns in the data are explored to explain the phenomenon of interest. A co-occurrence analysis was conducted in NVIVO to explore relationships between improvisations observed from the data and design-reality dimensions. To compare these findings from multiple cases, matrix coding was adopted to map improvisations to seven dimensions of the DRG model. The relationships in the data are presented in a form themes consisting of code references which illustrate instances of data and their relationships to relevant concepts (Crabtree, 2023; Williams & Moser, 2019).

Findings from both cases show different improvisation types were enacted due to design-reality gaps experienced with IT artefacts implemented in each case. In both cases, an electronic application was implemented with the objective of facilitating and transmitting patient referral information. However, in both cases, the applications designed and deployed in both cases were a mismatch with referral tasks. A detailed discussion of these applications and their functionalities is provided in Sections 6.2.1 (case study one) and 6.2.2 (case study two). Given the mismatch between these applications and referral tasks, HCPs were enacting improvisations in a form of fitting, augmenting and workarounds as shown in Figure 7.1.



	Case study 1		Case study 2	
	Hospital = A	Hospital = B	Hospital = C	Hospital = D
Fitting	37	15	2	0
Augmenting	82	31	8	3
Workarounds (Shadow IT)	70	19	40	83

Figure 7.1: Coding references: Comparative analysis of improvisation types across cases by number of mentions

In case study one where Vula was implemented with an objective of automating referral activities, HCPs were augmenting the application with traditional referral methods such as telephones, emails, and paper-based methods such as referral letters. Augmenting was minimally observed (11 references) in case study two.

Vula was reported to consist of inadequacies which limited the HCPs to complete their work. As a result, HCPs were adapting (fitting) the application to complete their work. Fitting is reported in case study two with 52 references, and 2 references in case study one respectively.

A significant finding shows a total of 212 code references related to workarounds. Although there were electronic applications implemented in the two cases to support e-referrals, HCPs were using WhatsApp for referral purposes. The findings in Hospitals A, C and D confirm that HCPs were not utilising the tools designed to support e-referrals but were resorting to WhatsApp as a Shadow information technology (shadow IT). Workarounds were observed in Hospitals A, C and D as shown in Figure 7.2.

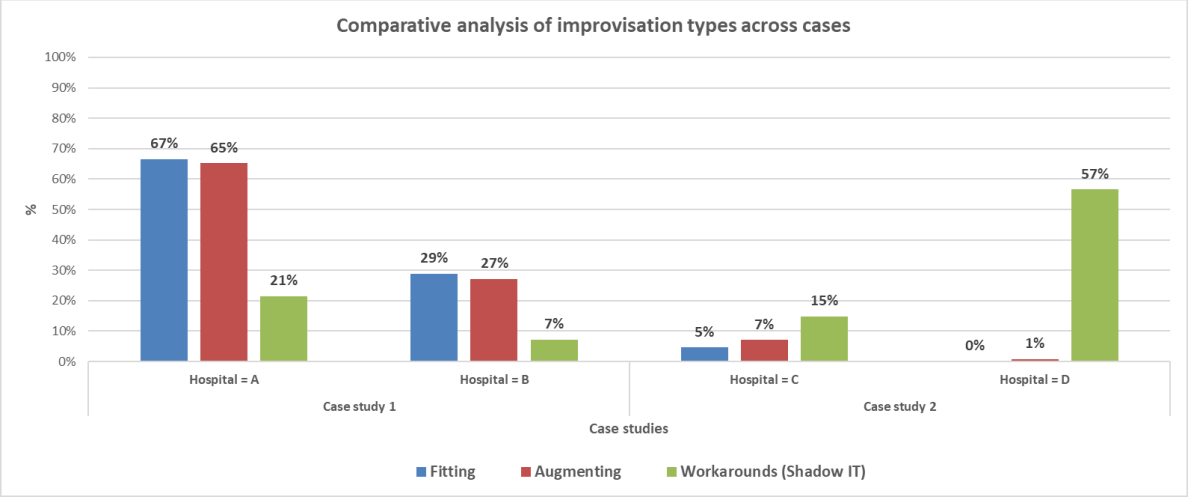


Figure 7.2: Comparative analysis of improvisation types across cases by % of use

The causal factors for enacting workarounds were related to gaps in the design of the electronic applications and realities of HCPs. A comparative analysis of improvisation types and design-reality gaps is discussed in the next section. These findings are an outcome of the inductive analysis outlined in section 4.10.1.2

7.3 Improvisations, Design-reality gaps, and referral outcomes

The empirical findings presented in Sections 6.5 and 6.7 demonstrated a relationship between design-reality gaps and workaround practices enacted by HCPs in both case studies. This section provides a further elaboration of design-reality gaps (DRG) and their effect on referral outcomes as they relate to organisational, patients and healthcare practitioners (as shown in Table 7.1). The observed workaround practices highlighted gaps between the design of existing healthcare information system (HIS) and user needs within the specific contexts. Building on these findings, the Process framework for healthcare IS workarounds and impacts (Section 3.5.2) was extended to incorporate concepts from the Systems Engineering Patient Safety (SEIPS 3.0) framework (Section 3.5.1) and the design-reality gap model (Section 3.3). This led to the development of an integrative framework, presented in Figure 8.1, which provides a comprehensive elaboration of workarounds related to electronic referrals in public hospitals. This theoretical contribution to the body of knowledge is discussed in Section 8.3, 8.4 and 9.3.1.

Table 7.1: Cross-case comparative findings: Improvisations, Design-reality Gaps, and Referral Outcomes

Design-reality Gaps	Description	Improvisation type	Case study 1	Case study 2	Negative outcomes		
					Patient safety	HCPs	Organisational
Poor management systems and structures.	Poor plans for rolling out and implementing e-health strategies to strengthen health service delivery.	Workarounds (Shadow IT)	30	47	None	Unawareness of e-health strategies and policies.	Poor integration and loss of synergies.
Lack of end-user involvement.	Lack of user involvement during the selection process of the e-health application.	Fitting Augmenting Workarounds (Shadow IT)	20	1	None	Inaccurate user requirements lead to inadequate user interface design. Misunderstanding of end-user needs.	Synergy loss and creation of inefficiency.
e-referrals Inadequacies and shortcomings.	Inadequacies of e-referrals application User interface restricting work of HCPs.	Fitting Augmenting Workarounds (Shadow IT)	18	0	Compromised patient privacy. Ineffective care rendered to patients.	Incomplete data entry	Data inconsistency and loss.
	Software incompatibility with user devices.	(Workarounds (Shadow IT))	5	12		Resistance to e-referrals.	Lack of user buy-in.

Design-reality Gaps	Description	Improvisation type	Case study 1	Case study 2	Negative outcomes		
					Patient safety	HCPs	Organisational
IT Infrastructure and technological Issues.	Limited training on the HIS and Vula Applications.	Fitting Augmenting Workarounds (Shadow IT).	61	2	Loss of control (Data) Unintended use of HIS leading to incorrect information on patients.	None	Uncontrolled vendor dependencies. Unknowledgeable workforce. Lack of user buy-in.
	Use of personal devices (BYOD) to share sensitive patient data.		19	0	Compromised privacy of patient information.	Lack of control over HCPs devices containing sensitive patient data.	Legislative (POPIA) non-compliance with POPIA.
	Slow responsiveness of IT on implementing requests.	Workarounds (Shadow IT),	5	10	None	Dissatisfaction and limited use of HIS.	Lack of user buy-in.
	Lack of integration with official systems.	Augmenting,	2	15	None	None	Limited adoption of the Vula application in some hospitals.
	Lack of internet access.	Augmenting Workarounds (Shadow IT),	17	20	None	Limits HCPs to connect and sharing information with other HCPs. Inability to connect to the HIS.	None
Absence of IT policy and Lack of policy awareness	HCPs lack awareness of referral policies. Lack of IT policies to manage risks of Workarounds (Shadow IT).	Fitting Augmenting Workarounds (Shadow IT).	25	33	Compromised patient privacy. Ineffective care rendered to patients	Non -compliance to referral protocols /policies. Poor understanding of data security breaches Incomplete data entry.	Data inconsistency and loss. Lack of control for the IT department.

7.3.1 Poor management structures, implementation of e-health strategies and referral outcomes

Empirical evidence from both case studies shows that there are poor management structures emanating from misalignment between IT and health organisations. There are similarities in how e-health interventions were deployed at public hospitals in both case studies. A top-down approach was adopted in the implementation of e-referrals. Employing this top-down approach in deploying the tools, leads to poor integration of Vula and DHIS2 in the referral pathway and ultimately the referral system as a work system.

In case study one, DHIS2 was poorly integrated with existing systems to serve public hospitals. Similarly, in case study 2, Vula was not successfully integrated, especially in Hospital A as HCPs covertly resisted the application. This poor integration contributed to a loss of synergy from HCPs as end-users of the system.

In addition, due to poor management of systems and structures, there were poor plans for rolling out and implementing e-health interventions and strategies to strengthen health service delivery. While there were detailed and documented e-health strategies in case study 1, the process of rolling out the guidelines for Vula was poorly conducted. For example, the Vula application was deployed in Hospitals A and B at the time of this study, but there were no further guidelines published after the initial training. In addition, there was a slow response from management in the Department of Health in the Western Cape Government to make a decision on making Vula a mandatory patient referral application. The application was made the official referral application in 2018 only after it had been in use for approximately two years (Western Cape Government, 2022).

As a result, this created a perception among the HCPs that Vula was not mandatory and therefore not compulsory to use to facilitate referrals.

In addition, there was no specific guideline or training manual pertaining to the use of Vula, which weakened the use of the application by some HCPs.

In contrast, case study two findings showed that Vula was informally introduced to some HCPs through word of mouth but never officially implemented. This explains why the application was not officially adopted in Namibia.

Additionally, the process of developing and rolling out e-health strategies was poorly conducted. For example, the e-health strategy was drafted and took approximately 2 years to be completed and implemented at the MOHSS (Ministry of Health and Social Services (MoHSS) Namibia (2021). HCPs were therefore not aware of these e-health strategies even though they were drafted to strengthen e-health initiatives and delivery of health services. Practical recommendations for addressing poor management structures and systems in public hospitals are presented in Section 8.4 and Table 9.1. The next section discusses effects of lack of end-user involvement and referral outcomes.

7.3.2 Lack of end-user involvement and referral outcomes

There was limited engagement between the IT personnel and HCPs. from both case studies who reported they were minimally involved in the decision-making process of choosing e-referral applications. While the IT personnel were entrusted with the implementation of Vula, they consulted only senior management and not HCPs as end-users to gather the business and user requirements. There was minimal involvement of the HCPs in the selection process of the application. In addition, in case study one, there was user training conducted at the initial implementation of Vula, where HCPs were introduced to the functions of the initial version of the software. However, there was no further involvement of HPCs for follow-up training especially for establishing additional user needs after implementation. When such training was conducted, the end-users' needs were sometimes not considered at all and were not implemented in a timely manner.

The lack of user needs resulted in a poor user interface design that constrained HCPs to complete their work and reduced the effectiveness of the application.

As a result, some referral messages on Vula were processed with incomplete information, which in turn affected the referral outcomes. This occasionally resulted in an ineffective referral process at the organisational level (hospitals).

Recommended strategies for enhancing end-user involvement are outlined in section 9.3.3.1. The next section provides an interpretation of study findings on inadequacies of e-referrals and t referral process outcomes.

7.3.3 e-referrals inadequacies and referral outcomes

Inadequacies of Vula were reported in case study one. The inadequacies were observed with the user interface of Vula. For example, specific text fields were not adequately designed to capture patient data.

These inadequacies lead to various data issues such as incomplete data entry, compromised patient privacy, and data loss and inconsistencies.

Furthermore, workaround practices were a result of the inadequate Vula interface. The use of WhatsApp as a shadow IT is a non-standard practice for HCPs to complete their work. Given that workarounds are non-standard practices, they bring about data quality and security issues not only for health organisations but also for HCPs and patient safety. For example, HCPs could not effectively render the required care and service to patients as the patient history was incomplete. Incomplete data entry at the point of care escalated the data quality issues at an organisational level. The data loss ultimately affected how data was reported in the Vula referral reports.

Another finding from case study one was the software incompatibility with user devices. This had an effect on the adoption of Vula specifically for Hospital A. At the time of the study, there was lack of buy-in from some HCPs because Vula was not available in the Android operating system. In a nutshell, HCPs in case study one covertly resisted Vula because of the above-mentioned gaps.

7.3.4 IT Infrastructure and Technological Issues

HCPs from both cases reported that the IT department was slow in fulfilling their needs. For example, HCPs indicated that IT support did not fully implement the requirements they outlined in the meetings held with management. Furthermore, HCPs from both cases reported that there was lack of IT support with regards to providing guidelines on how to use personal devices for professional work.

Other findings show that existing e-health applications worked in silos with other systems that were part of the health organisations (Department of Health and MoHSS). This finding points to lack of integration between Health Information Systems and other official systems.

The lack of support and lack of integration was a motivator to augmenting these official systems with other traditional referral methods or altogether resorting to third-party applications such as WhatsApp. The effect on health organisations, in particular, Hospital A in case study one, was that there was limited adoption of the Vula application.

In both cases it was reported that internet service provision from IT was limited and, in some cases, non-existent. The cost of providing internet-dependent applications was not considered during the implementation phase.

HCPs in both cases were therefore left to use personal mobile devices and personal data bundles to complete professional tasks. Due to the cost burden, there was lack of buy-in from some HCPs, and they resorted to Shadow IT such as WhatsApp. The effects of these are the loss of control for data as the data was stored on personal devices. IT as a business unit could not control the data transmitted or stored on these personal devices. Other effects on health organisations are uncontrolled vendor dependencies because patient data was stored on third-party servers. The IT department therefore did not have control over applications deployed by HCPs.

Furthermore, there was non-compliance with POPIA (Protection of Personal Information Act) with regards to storing patient data. In both case studies, HCPs did not seek consent to take patient photos. As a result, the privacy of patients' information was compromised.

In case study two, there was limited support and guidance from IT on e-health applications to use for patient referrals. Even though the DHIS2 consisted of an inpatient module with patient referral capabilities, HCPs had limited access to HIS and it was used only by medical officers in the wards for administration purposes. There was therefore an inability from HCPs to connect and use DHIS2. Related to the IT infrastructure are the policies that regulate how IT artifacts are to be utilised in the settings understudy.

The next section outlines how these policies were not developed and how lack of HCPs awareness of these polices affected referral outcomes.

7.3.5 Absence of IT policy, Lack of policy awareness and referral outcomes

HCPs in both case studies were not aware of referral policies and strategies governing the referral process.

They reported that for most critical patient cases, they consulted with senior specialists to seek second opinion. Given this lack of awareness, HCPs were prone to ignore referral policies and protocols, which further led to workarounds.

Workaround practices were observed in a form of Shadow IT in both cases. Although the use of WhatsApp brought about productivity gain from HCPs and health organisations, it posed serious patient safety concerns. The use of Shadow IT brought about security risks related to unintentional disclosures of patient data on the WhatsApp platform. In addition, IT policies regulating third-party applications were absent from public hospitals under study.

Due to the lack of shadow IT policies in both cases, health organisations could not manage the adoption and use of third-party applications to ensure patient data privacy, regulatory compliance, and efficient operations of the referral process.

In addition, HCPs from both cases report lack of awareness of referral policies and general e-health strategies.

Given this lack of awareness, there was a poor understanding of data security risks. HCPs were therefore prone to ignore relevant policies and procedures, which lead to unintentional disclosures of patient data. Furthermore, lack of policy awareness from among HCPs posed significant security to health organisations.

When HCPs are unaware of these policies, they unintentionally enact workarounds practices that compromise patient safety, jeopardise data security and fail to meet compliance standards. Additionally, this lack of awareness lead to HCPs using third-party applications such as WhatsApp which introduced security vulnerabilities.

7.3.6 Privacy, security, and ethical issues

From the above findings, it can therefore be argued that workarounds to mandated health applications poses significant security risks. An extended concept on privacy, security and ethical issues was adopted from the adapted design-reality gap model by Albertus and Makoza (2023). This concept was later renamed to 'patient safety' as shown in the integrative framework in Figure 8.1.

Findings show that workarounds to mandated systems raise several ethical concerns. Firstly, the use of WhatsApp by HCPs involves transmission and storage of patient data on a third-party application which is not controlled by the IT department. This increases the risk of data breaches and unauthorised access to sensitive patient information as it is stored on third-party servers and personal devices. Storing and transmitting patient information on personal devices endangers patient safety and compromises the security of their personal information. WhatsApp lacks proper security controls to prevent unauthorised users from accessing patient data. For example, WhatsApp is used on personal devices, which blurs the boundaries between personal and professional data, further compromising patients' privacy and security.

Secondly, transmitting patient information on unauthorised applications impedes continuity of care, as information is not shared between existing systems in hospitals.

This in turn has adverse effects on referral outcomes and more ethical obligations of HCPs to protect patients' information.

The use of WhatsApp in the public hospitals under study presents significant ethical concerns. One of the primary concerns is the compromise of patients' privacy and confidentiality when information is shared on social media platforms. WhatsApp and personal devices of HCPs do not consist of security measures to safeguard patient information. This leaves the patient information vulnerable to security risks.

Thirdly, lack of proper regulation of shadow IT by the information technology department can lead to potential harm to patient safety.

This includes increased risk of data breaches of POPI act, lack of separation on use of personal devices on WhatsApp for personal and professional work, thereby privacy and confidentiality. Additionally, the lack of adequate regulations, IT policies, and e-health strategies regarding Shadow IT impedes the ability of IT units to identify unauthorised practices and systems, thereby compromising ethical standards.

Findings therefore show that the hospitals understudy do not uphold ethical standards on transmission of patient data and there is no robust policy governing the use of Shadow IT. Recommendations on how to bridge gaps related to policy awareness, IT infrastructure are discussed at length in section 9.3.3.1. The use of WhatsApp and its effect on referral outcomes is discussed in the next section.

7.3.7 Workarounds and referral outcomes

The gaps discussed in the previous section are giving rise to workaround practices, and these are affecting referral outcomes. Even though HCPs collaborated well on WhatsApp, this increased negative outcomes both for patient safety and health organisations.

For example, when HCPs use shadow IT, the privacy of patients is compromised as this information is shared on personal devices. Furthermore, the data stored on personal devices comprises patient confidentiality, thereby jeopardising patient safety. Moreover, sharing of patient information on WhatsApp raises regulatory and ethical concerns.

Patient information shared on WhatsApp resides on the sender's or recipient's device. Sharing and storage of confidential patient information on personal devices, therefore, yields privacy, data security and IT governance issues.

The absence of clear guidelines on sharing data and storage serves to increase regulatory and legal concerns for patient privacy. In addition, a lack of understanding of security risks related to data storage is common among HCPs. For example, there was a general misconception that deleting messages on personal mobile phones is an ethical obligation of healthcare practitioners' oaths.

While this is relevant, confidential patient information was stored on personal devices, which in some cases were stolen or content was inadvertently shared. This, therefore, puts the patient's privacy at risk. At the organisational level, IT as a department does not have control over the Shadow IT, which creates synergy loss with organisational processes. Furthermore, the use of covert applications such as WhatsApp results in non-compliance with privacy laws.

7.4 Improvisations and positive outcomes for HCPs, patients and health organisations

Despite the clear negative outcomes described in the previous section, workarounds can equally have positive outcomes, depending on who, what or when they are initiated (Boonstra et al., 2021). Empirical evidence shows that augmenting mandated systems and processes or using WhatsApp as the primary tool for communication in the absence of an official system has proven to be advantageous for healthcare practitioners (HCPs), leading to improved efficiency and productivity in the execution of referral activities. Various positive outcomes are discussed in Table 7.2.

Table 7.2 : Improvisations and positive outcomes on HCPs, patients and health organisations

Improvisation Type	Positive outcomes		
	HCPs	**Patient**	**Organisational**
Fitting	Conscious adaptions by fitting Vula application interface (such as text fields) were helpful for HCPs to get access to additional information.	Efficient and effective delivery of healthcare services.	Improved referral workflow.
Augmenting	Reduced misinterpretation of diagnosis as a result of including an additional description in the text fields. Continuation of referral work despite the inadequate functionalities of the existing HIS.	Continuation of referral activities when traditional tools (phone etc.) are used for triage (prioritise patients with medical emergencies).	Patient Information completeness on the Vula application enhanced the referral process.
WhatsApp	Efficiency strengthened communication and collaboration within the community of practice. Flexibility to accommodate complex or unexpected misfits. Continual professional development for staff members	Efficiency of healthcare services rendered to patients.	Productivity in the execution of referral activities leading to a streamlined referral process. Workarounds to existing management systems and structures present opportunities for innovation and process improvements. Resource optimisation and cost savings when HCPs use free WhatsApp software. Reduces IT budget for software.

Workarounds were reported to provide instant access to patient information thus improving the referral workflow efficiency. For example, in case two where a mandated health information system was not officially adopted for patient referral purposes, HCPs relied on the WhatsApp platform to exchange images, X-rays and other patient-related information. Sharing this information in real-time allowed HCPS to make the necessary diagnosis and treatment decisions at the point of care. As a result, using WhatsApp thus streamlines communication, care coordination and increases the productivity of HCPs. Ultimately, leading to more efficient and effective patient care and services.

Secondly, WhatsApp was used for consultation and seeking second opinion from senior consultants and specialists. This flattened the hierarchy in the patient referral pathway by allowing HCPs to directly communicate and consult specialists in real-time, instead of following the referral pathway guidelines which can be time-consuming. This yielded positive outcomes to the referral process in the public hospitals, as non-critical cases could be addressed at lower levels of care and therefore resolving delays and bottlenecks in the referral process. In healthcare settings, specialists possess the medical knowledge which nurses and medical officers lack, and this causes information asymmetries. In resource constraint settings, WhatsApp was beneficial in facilitating and coordinating the transmission of information to handle this constraint. HCPs could seek instant second opinion from specialists who may not work at the same healthcare facility or hospital. This presents opportunities for sharing information and HCPs receiving expert advice which can improve the quality of care rendered to patients.

Thirdly, WhatsApp was also used as a platform to disseminate information and to share knowledge among the community of HCPs and specialists. In Case study one, useful information such as journal articles, and medical books and clinical guidelines were shared on WhatsApp and Telegram. Sharing the best practices and educational resources is beneficial because HCPs and doctors are improving their knowledge and skills.

Positive outcomes for health organisations include continual professional development for staff members.

Continued education ensures that healthcare professionals are up to date with new medical advancements, evidence-based practices and fostering professional growth.

Improvisations and use of WhatsApp for healthcare service delivery present opportunities for innovation and process improvements for health organisations.

When HCPs are enacting workarounds to a mandated system or are using WhatsApp in the cases under study, this is an indication of inefficiencies in the current process or inadequacies with existing systems. These workarounds reveal important insights about the current mandated systems, processes and referral workflows.

Identification of workarounds in public hospitals has a positive outcome, as they can be a starting point for evaluating them and deciding the course of action. For example, the use of WhatsApp to share non-sensitive patient information has fewer consequences. On the other hand, identifying workarounds and the use of WhatsApp for sharing sensitive information can have broader consequences for health organisations. Identifying workarounds and their consequences therefore can lead to process improvement initiatives for health organisations. Health organisations can for example identify the real needs of end-users, predict and make realistic assumptions for systems analysis and design for health information systems. When workarounds are anticipated, existing referral processes and systems facilitating these processes can be designed to accommodate misfits addressing the real-life needs of HCPs.

Cross-case analysis was conducted to validate the research findings. Internal validity was established by comparing empirical data from both case studies. Rival explanations for improvisation types and design-reality gaps, discussed Section 7.2, were used to develop the theoretical propositions outlined in Section 8.2. The empirical findings from this phase are thus generalised to theory and generalising from empirical statements to theoretical statements. These findings and empirical statements can be generalised to other public hospitals in similar settings.

7.5 Conclusion

The explanation of workaround practices is attributed to the design-reality gaps experienced with IT artefacts implemented in both case studies. The gaps identified are related to the poor management systems and structures, lack of end-user involvement and IT support, absence of IT policy and lack of policy awareness.

These gaps can generally be interpreted as misalignment between IT and health organisations. This has resulted in ineffective implementation and use of e-health applications in both case studies. Electronic applications were implemented without fully understanding the context and needs of HCPs. This led to the introduction of e-health applications such as DHIS 2 which is not fully implemented to support the referral process. In case study one, Vula was implemented with lack of involvement of HCPs.

Given the lack of involvement in the software selection process, the application did not adequately address unique users' needs and some requirements for HCPs. This resulted in frustration and decreased satisfaction with the application. Consequently, HCPs resorted to workarounds to accomplish their work.

These workaround practices emanate from the autonomy exercised by HCPs to deliberately subvert mandated systems to complete work activities. Arguably the aim of enacting workarounds is to find alternative ways of effectively and efficiently completing work. The findings of this study, however, demonstrate that in effect workarounds amplify patient safety concerns and negative outcomes for IT as a business unit. Identifying workarounds in healthcare settings offers a valuable opportunity to initiate process improvement efforts. By analysing workarounds and their consequences, healthcare organisations can gain insights into the real needs of HCPs, thereby informing system analysis, design, and implementation of HIS. Anticipating potential workarounds enables the development of HIS that are more adaptable to the challenges faced by healthcare providers in real-world settings. The broader implications of the design-reality gaps to HCPs, patients and health organisations are discussed in section 8.4, 9.3 and Table 9.1. The discussion in these sections makes recommendations on future IT strategies related to HIS design and implementation in healthcare settings.

The theoretical elaboration of the findings and contribution to the existing body of knowledge is discussed in the next chapter.

CHAPTER 8: Theoretical Elaboration

8.1 Introduction

This chapter provides a theoretical elaboration of the empirical findings. The study set out to investigate the use of electronic referrals to facilitate the patient referral process. The context of the study was public hospitals in South Africa and Namibia. Health Information Systems (HIS) in these hospitals are currently not used as intended and healthcare providers (HCPs) are increasingly resorting to Shadow IT to accomplish their work. The primary purpose of this chapter is twofold. Firstly, it aims to build a theoretical understanding of improvisations enacted by HCPs because of design-reality gaps. Secondly, the theoretical interpretations of the data are conducted to formulate the study propositions.

A comprehensive explanation of empirical findings underpinned by theoretical frameworks is outlined in Sections 3.3; 3.4 and 3.5. Firstly, the theoretical elaboration explores key concepts from the Process Framework for Healthcare Information System Workarounds and Impacts (Yang et al., 2012) as described in Appendix 21 and discussed in Section 3.5.2. Concepts related to workarounds, augmenting, fitting and impacts were adapted in this research. Secondly, the Systems Engineering Patient Safety (SEIPS 3.0) framework (Holden & Carayon, 2021) as outlined in Section 3.5.1 was also employed to explain workarounds as a socio-technical phenomenon. The concepts of the SEIPS model are described in appendix 21. Thirdly, the design-reality gap framework (Heeks, 2006; Gómez & Heeks 2016) was adopted to explain the assumptions built into the e-health applications and real requirements of HCPs in the study settings. The concepts adopted in this research are described in Appendix 20 and further discussed in Sections 4.10.1 and 4.10.1.2. Relevant concepts from these frameworks were combined in the proposed integrative framework as illustrated in Figure 8.1.

This chapter is structured as follows. The first section discusses propositions developed from empirical findings. The second section provides theoretical interpretations of study findings in a form of an integrative framework. The third section discusses possible measures for bridging the design-reality gaps.

8.2 Theoretical propositions

The following propositions demonstrate relationships between concepts that answer the research questions under investigation. The propositions in Table 8.1 are formulated based on the relevant theories and empirical findings. These concepts are outlined and discussed in Figure 6.7 and Section 3.2,3.3 and 3.5, respectively.

Table 8.1 :Summary of Theoretical propositions and related concepts

Concepts	Theoretical Propositions
Staffing and skills. Technology. Process. Management systems and structures.	***Proposition 1:*** *When end-users are not involved in the selection process or roll-out planning of health information systems, end-users are more likely to perceive the HIS or digital health application as inadequate and ineffective.*
Fitting. Augmenting. Staffing and skills. Technology. Patient Privacy. Security and Ethical issues.	***Proposition 2a****: When end-users experience inadequacies of the HIS, they are more likely to resist its use or resort to fitting and augmenting the mandated HIS.* ***Proposition 2b****:* *When end-users adapt (fitting or augmenting) an existing Health Information System (HIS), this is likely to enhance information completeness, consequently leading to improvement in the referral workflow and continuity of patient care.*
Work system Workarounds. Patient safety. Information. Process. Technology. Impacts	**Proposition 3a:** *The use of Shadow IT to complete work increases some negative outcomes for patient's safety and health organisations.* **Proposition 3b:** *The use of Shadow IT enhances healthcare providers' productivity and ultimately improves efficient communication within the referral process.*
Management systems and structures. Technology. Process. Staffing and skills. Other resources. Impacts	**Proposition 4a**: *Donor-funded health information systems (HIS) enhance the delivery of health services for specific public health programmes (e.g. HIV/AIDS, malaria).* **Proposition 4b**: *Implementation of prescribed health information systems by donor-funders regardless of their inability to integrate with existing systems and processes results in more interoperability challenges and end-user resistance behaviour.*

Proposition 1: When end-users are not involved in the selection process or roll-out planning of health information systems, end-users are more likely to perceive the HIS or digital health application as inadequate and ineffective.

Lack of HCPs and other end-users' involvement in the selection of HIS can result in negative outcomes. Firstly, without user input, the IT team or management may not adequately meet the unique needs and requirements of HCPs (Fennelly et al., 2020; Heeks, 2006). When these needs are not accommodated in the chosen systems, end-users are more likely to perceive the HIS as inadequate or ineffective because the system functionality does not align with their work activities and existing processes. Secondly, information systems that are not user-friendly can emerge from a lack of user involvement. The corroborated studies therefore highlight the importance of user involvement and engagement in the pre-implementation phase and implementation processes (Gesulga et al., 2017; Alzghaibi & Hutchings, 2022).

Thirdly, lack of user involvement can lead to negative perceptions of system ineffectiveness and decreased user satisfaction. O'Donnell (2024) highlights that lack of end-user involvement can result in non-adoption of electronic medical record systems.

This lack of adoption, he explains, stems from a negative attitude or disposition by evaluating a particular system as being unfavourable. Furthermore, corroborated literature demonstrates that lack of end-user involvement can lead to decreased user satisfaction (Hudson et al., 2018; Martikainen et al., 2020).

Lastly, lack of user involvement can bring about a higher risk of system failure because of the resistance from users. Alohali, Carton and O'Çonnor (2020), argue that the lower the user involvement, the more likely the perceived dissatisfaction from users. It can be concluded that the covert resistance from HCPs in case study one is resulting from lack of involvement of HCPs in the decision-making of the HIS.

In their study, they underscored the sense of being undervalued and lack of involvement among nurses and physicians due to their exclusion from the decision-making process concerning the implementation of the Health Information System (HIS), as it directly impacted their work.

The consequences of lack of user involvement may include increased costs, wasted resources, and compromised patient care. Ultimately, the lack of end-user involvement undermines the effectiveness and successful implementation or usability of Health information systems in health organisations (Fennelly et al., 2020; Bano & Zowghi, 2015).

The importance of involving end-users in the selection of e-health applications and roll-out planning cannot be overlooked. End-user involvement ensures that the needs and requirements of HCPs are taken into consideration during the decision-making process. Apart from administrators in public health organisations, management therefore needs to actively involve end-users including medical officers and nurses to gather needs, but also to understand the realities on the ground that can act as input to the selection and implementation of health information systems in the public hospitals. The involvement of end-users promotes buy-in, adoption and in turn, enhances the usability of the systems.

For example, the active involvement of HCPs through training sessions, and seeking their input regarding new features on Vula, has the potential to incentivise users to opt for Vula instead of turning to alternative platforms such as WhatsApp.

In addition, end-user involvement also fosters a sense of ownership and engagement which can lead to buy-in from potential users and reduced resistance to change. Furthermore, when management takes time to get input and feedback from users before rolling out HIS, it helps to pre-identify pitfalls, constraints, and areas of improvement. This then hopefully leads to the selection of HIS that aligns with the unique needs and goals of the health organisations.

End-user involvement is therefore crucial for the successful implementation and utilisation of health information systems, as it promotes user-centred design and enhances system usability.

This theoretical proposition is corroborated in literature where various scholars discuss the lack of user involvement in the process of rolling out health information systems in public health organisations. User involvement is necessary to ensure a fit between the system and the work processes of end-users.

For example, Ishijima et al., (2015) highlight user involvement as one of key factors in the development process to understand the realities on the ground before rolling out health information systems in health organisations.

Furthermore, the focus on management systems and structures is a crucial concept to take into consideration when management selects new information systems in organisations. Effective management systems and structures encompass various considerations including stakeholder involvement. The involvement of end-users enhances the ability of management to align design expectations with practical realities. Although literature has reported that end-users such as nurses and doctors are willing to participate in the HIS development process, there remains limited methods and lack of feedback in the development process (Martikainen, et al., 2020).

End-user involvement and participation is equally important in the software selection process in healthcare organisations as it contribute to the successful adoption and use of the system (Kushniruk & Nøhr, 2016; Sligo, Gauld, Roberts & Villa, 2017).

Choosing a group of representatives comprising of health care providers and specialists to provide input, has therefore been recommended as an effective way of ensuring adequate user involvement in system design.

Proposition 2a: When end-users experience inadequacies of the HIS, they are more likely to resist its use or resort to fitting and augmenting the mandated HIS.

Management selects health information systems which they deem fit for managing and facilitating health services, but they are not without shortcomings. These shortcomings and inadequacies can stem from lack of consultation with users in the software selection process, and ultimately lack of understanding of the user needs.

When end-users encounter system inadequacies, they resort to workarounds such as fitting and augmenting. This empirical statement is supported by other scholars confirming that system inadequacies can result in workarounds. For example, Davison, Wong, Alter & Ou, (2021), confirm that the persistent inadequacies with the enterprise system at a multinational firm resulted in employees enacting workarounds.

This empirical statement is further substantiated in literature by Alter (2014) and Azad & King (2012) when in their studies they assert that when technology does not fulfil its intended use, users enact alternative solutions and workarounds to fit contingencies of daily work.

Improvisations such as fitting and augmenting, though valuable to completing work, can lead to several negative outcomes for patients, HCPs, and health organisations (Blijleven et al., 2017; Yang et al., 2012).

In HIS context, fitting can involve generating data reports with different input e.g., patient history, impeding coordination of care because the information is inconsistent. On the other hand, when users experience system inadequacies, they compensate the existing systems by using other tools and methods to overcome the HIS limitations. This involves using paper-based methods, external applications, and alternative workflows to the existing mandated systems. Boonstra et al., (2021), contend that working around mandated health information systems jeopardises patient safety. For example, entering incorrect data or subverting specific functions of an information system could lead to a risk of inaccurate reflection of patient information and data loss altogether.

Where official health information systems are designed to safeguard patient information, its quality and flow through a health organisation, working around the safeguards lead to compromised data quality and incomplete patient data. The positive outcomes of fitting and augmenting are discussed in the next proposition.

Proposition 2b: When end-users adapt (fitting or augmenting) an existing Health Information System (HIS), this is likely to enhance information completeness, consequently leading to improvement in the referral workflow and continuity of patient care.

When end-users adapt the mandated HIS, this is likely to enhance information completeness, consequently leading to improvement in the referral workflow and continuity of patient care. HCPs made conscious adaptations by fitting the Vula application interface (such as text fields). This was helpful for HCPs to get access to additional information to diagnose patients and make important clinical decisions. Although some information was filled in the inappropriate text fields, HCPs picked up this information in the referrals and it reduced the misinterpretation of the clinical information. The additional information thus enabled continuity of work and improved the referral workflow.

Moreover, augmenting the mandated HIS with traditional methods, such as the use of phones and paper-based methods, fostered the seamless flow of referral work. The traditional methods enabled the continuation of referral activities by utilising these tools for triage (prioritising patients with medical emergencies).

The Process Framework for Healthcare Information System Workarounds and Impacts posits that augmenting can have both positive and negative outcomes for patients, and health organisations (Yang et el., 2012). Positive outcomes range from enabling HCPs to address immediate needs, improve efficiency, and adapt to specific clinical or administrative requirements. Augmenting also allows HCPs to customise and alter systems to match their unique needs and preferences leading to increased productivity, efficient workflow, and user satisfaction (Roder, 2014; Mallmann & Macada, 2018)

Proposition 3a*: Use of Shadow IT to complete work increases some negative outcomes for patients' safety and health organisations.*

Health Information Systems (HIS) in public health institutions are currently not used as intended, and HCPs are increasingly resorting to workarounds or informal

systems known as Shadow Information Technologies to accomplish their work (Ogundaini & de la Harpe, 2022; Beerespoot et al., 2019). In this study, Shadow IT was adopted by HCPs for the sharing and transmission of patient information to overcome the limitations of HIS.

While workarounds, offer temporary solutions for overcoming system shortcomings and inadequacies, they can yield negative outcomes for health organisations (Klotz et al., 2019; Blijleven, Koelemeijer & Jaspers, 2017; Yang et al., 2012).

Negative outcomes can range from gaps in transparency between end-users and IT (Chua and Storey, 2016; (Zimmermann et al., 2017). The use of Shadow IT cannot be fully controlled by IT and further undermines IT governance in health organisations and management intentions (Roder et al., 2016; Raković et al., 2020).

In the healthcare context, negative outcomes such as poor data quality and loss of patient data on Shadow IT such as WhatsApp are common patient safety concerns (Blijleven et al., 2019; Mars & Escott, 2016).

Negative outcomes are thus a potential compromise of patient safety. Use of WhatsApp increases the risk of data loss of patient data because data is not stored centrally. Furthermore, the use of shadow IT breaches patient privacy and confidentiality (Mars & Scott, 2016; Kauta et al., 2020; Morris et al., 2021).

Overall, workarounds and Shadow IT should not only be viewed in a negatively but also positively. The aforementioned scholars highlight positive outcomes. Their emphasis is on managing these practices to ensure they take into consideration the contextual needs of HCPs and patients alike. While workarounds and Shadow IT can produce both positive and negative outcomes, implementing effective governance strategies is crucial for assessing their impact on patient safety and ensuring its protection. Health organisations should not only manage the potential risks associated with these technologies but also leverage their positive aspects.

Specifically, IT departments can identify and assess Shadow IT to understand its effects and risks on patient care, thus gaining insights into HCPs needs at the point of care. This information can enhance IT decision-making and guide the regulation or integration

of Shadow IT. Additionally, workarounds can reveal the context needs and requirements of end-users, promoting innovation and process improvements. Collaboration between IT teams and HCPs is crucial to ensure that e-health solutions meet organisational IT strategies and effectively address patient and HCPs needs.

It can be argued that the use of Shadow IT not only highlights existing system gaps but also identifies the real needs and requirements of health practitioners in their specific settings. Therefore, Shadow IT offers innovative solutions to overcome limitations in existing health information systems, particularly in the context of improving healthcare delivery for referral processes. Positive outcomes of Shadow IT are discussed in the next proposition.

Proposition 3b: Use of Shadow IT enhance healthcare providers' productivity and ultimately improving efficient communication within the referral process.

While workarounds and Shadow IT can present negative outcomes for patient safety and health organisations, they can equally improve communication between HCPs and ultimately improve efficient communication within the referral process.

For instance, WhatsApp's easy accessibility on HCPs' devices enables seamless communication and flexible collaboration. This in turn facilitates faster decision-making as HCPs have real-time access to patient information and can directly communicate with specialists for seeking second opinion, ultimately enhancing patient care, and streamlining the process to be more efficient and effective.

The above benefits serve as a clear demonstration that Shadow IT addresses the specific needs of HCPs, fostering better collaboration and engagement among them. Therefore, management should not solely focus on the potential negative outcomes but also recognise the valuable opportunities and positive outcomes offered by Shadow IT.

While workarounds can present opportunities for innovation and process improvements for health organisations (Beerepoot et al., 2021; Beverungen et al., 2024; Davison et al., 2021), in the long term, reliance on Shadow IT can undermine the health processes, workflow and health organisation’s ability to leverage mandated health information systems to its full potential and achieve optimal referral outcomes.

Furthermore, Shadow IT empowers HCPs to adapt and customise digital applications according to their unique needs, workflows, and to foster efficiency and productivity.

By leveraging readily available tools like WhatsApp, health organisations, especially their IT departments, can gain insights into the type of Shadow IT employed by end-users and assess the associated security risks. If the risk is deemed non-critical and the applications are used for collaborative and non-sensitive communication, HCPs can be allowed to utilise them, as they facilitate creative problem-solving.

Engaging HCPs in understanding the risks of Shadow IT, and involving them in finding solutions to their challenges, fosters a culture of innovation and continuous process improvement (Beverungen, et al., 2024).

This collaborative approach encourages HCPs to actively seek creative ways to optimise processes and achieve better outcomes. By embracing the positive aspects of Shadow IT in this manner, healthcare practitioners can become more effective and efficient, ultimately benefiting both HCPs and the patients they serve. This proactive involvement of HCPs in identifying and implementing solutions aligns with the goal of enhancing healthcare delivery and underscores the importance of empowering healthcare professionals at the point of care to contribute to the improvement of healthcare systems. Beerepoot et al., (2021), agree with this view that workarounds can be a starting point for organisational learning and process improvements.

Other studies on workarounds in the Information Systems discipline confirm that workarounds and Shadow IT also bring about positive outcomes related to efficiency, allowing employees to overcome limitations with existing systems and complete their work (De Vargas Pinto et al., 2018, Kopper & Westner, 2016).

Proposition 4a: Donor-funded health information systems (HIS) enhance the delivery of health services for specific public health programmes (e.g., HIV/AIDS, malaria)

Proposition 4b: Implementation of prescribed health information systems by donor-funders regardless of their inability to integrate with existing systems and processes results in more interoperability challenges and end-user resistance behaviour.

Although the donor-funded health information systems (HIS) enhance the delivery of health services for specific public health programmes (e.g., HIV/AIDS, malaria), the empirical findings indicate that the implementation of health information systems prescribed by donor-funders poses a significant challenge.

The prescription of specific systems by donor agencies exacerbates the inability of these systems to integrate with existing systems and work processes in public hospitals globally (Kobusinge, 2020; Moucheraud et al., 2017). These systems are usually fragmented and isolated from existing formal systems leading to information silos. Lack of interoperability between systems jeopardises information flow between HCPs and health organisations (Glaser, 2011).

The above views are corroborated in literature, especially for public health organisations in the global south. The sustainability of investments on software solutions and health information systems provided by donor agencies is of concern (Moucheraud et al., 2017) contend that the key to sustainability of donor-funded health information systems is full stakeholder engagement with local governing ministries of health and potential end-users, as well as integration of healthcare processes within these health information systems. In addition, Kobusinge (2020), in particular emphasises the importance of thoroughly analysing information systems and identifying salient contextual factors that can support HIS implementations.

In addition, it is also important for the IT department to be involved in taking stock of existing health applications, and to effectively identify required health standards before implementation of prescribed systems to ensure they are interoperable. The ability to exchange and use information across different health information systems is critical in sharing information to achieve healthcare goals.

Other contextual factors such as organisational culture should be considered in the settings where these systems are implemented. Health information systems are built with cultural assumptions that do not align with local contexts. For example, the design of the system assumes live transmission of health information using the internet, while most health facilities such as hospitals and clinics lack basic infrastructure such as access to modern computer equipment and the internet.

Moreover, these Health Information Systems (HIS) funded by donors presuppose a specific degree of technological proficiency and availability of modern technology. When resource-constrained, there is limited technological infrastructure, low literacy rates, or reliance on outdated devices; the effectiveness and usability of the system may be compromised.

Contextual factors thus impede effective implementation and ultimately use of these HIS. Recognising and addressing these cultural assumptions is essential for selecting and developing HIS that are inclusive, effective, and accepted within diverse healthcare contexts.

Additionally, when top-down approaches are adopted to implement systems without the involvement of end-users, it generally results in resistance to these applications by users. Resistance to HIS implemented using top-down approaches results in these systems not being institutionalised and often are unsustainable for health organisations. The theoretical elaboration of workarounds to e-referrals in public hospitals is discussed in the next section.

8.3 Theoretical elaboration of workarounds to e-referrals in public hospitals

The conceptual framework in Figure 6.1. is reviewed and extended with emergent concepts from the empirical data. An integrative framework in Figure 8.1 is hereby proposed to illustrate the relationships between concepts from relevant theories. The initial conceptual framework explained the empirical findings based on the benefits and constraints of traditional and electronic referrals with a particular focus on the Vula mobile application.

The conceptual framework also explained the post-implementation issues related to the use of Vula, its benefits and limitations related to patient referrals.

The impacts of these practices were also discussed. This elaboration was underpinned by the Systems Engineering Patient Safety model (SEIPS) process framework for healthcare Information system workarounds and impacts. Concepts related to fitting, augmenting and workarounds were explained as observed from the empirical data.

The original conceptual model was subsequently revised to form an integrated framework (Figure 8.1) that incorporated emerging concepts derived from the empirical data. A design-reality lens was employed to explain privacy and security, ethical issues and gaps discovered along the different dimensions of the model.

The theoretical propositions in section 8.2. were derived from the empirical data and relevant theories to explain the phenomenon of interest.

The final integrative framework is expanded with additional concepts such as gaps, privacy security, ethical issues, and improvisations. The framework also includes improvisations and their outcomes as they relate to patients, HCPs, and health organisations.

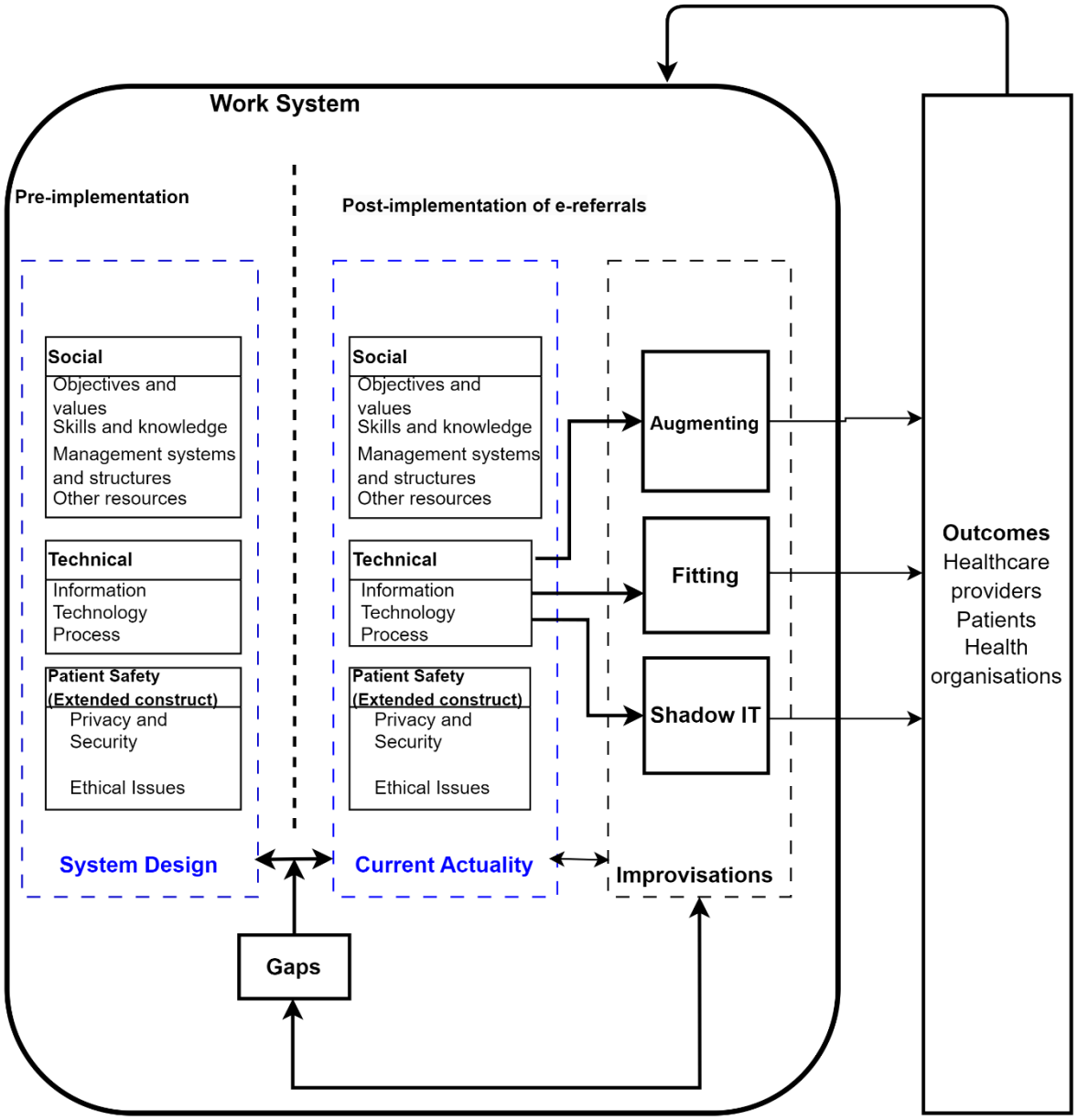


Figure 8.1: Theoretical elaboration of workarounds to e-referrals in public hospitals.

From the proposed theoretical statements, it can be concluded that improvisations (fitting, augmenting and Shadow IT) enacted as alternatives to official health information systems are a result of the gaps between the system design and the current realities of healthcare providers.

These gaps range from poor management systems and structures, e-referrals shortcomings and inadequacies, Lack of end-user involvement in the selection process of software applications, lack of IT support and absence of IT policies.

The theoretical elaboration of workarounds to e-referrals has implications for HIS developers, HCPs and policy makers. These practical implications are particularly crucial for public hospitals operating in resource-constrained settings. The next section provides practical recommendations for bridging design-reality gaps.

8.4 Recommendations for bridging the Design-reality gaps

Bridging the gaps between system design and current actualities within health organisations requires a systematic approach. The following measures can thus be considered to close the design-reality gaps.

Firstly, the designers and developers of HIS must consider key strategies to ensure end-users and different stakeholders are contribute and are engaged throughout the design, rollout, testing, and implementation phase. Engaging users early in the design and development process helps gather valuable insights into end-users needs and preferences. For example, adopting participatory design approaches, Information systems developers can elicit practical requirements and reduce usability issues related to functionality and interface design. Moreover, adopting iterative and incremental approaches (e.g. Agile methodologies) can simplify the development of the system in manageable phases, with regular feedback loops allowing designers and developers to continuously refine the artifacts based on user input. Likewise, techniques like prototyping and pilot testing software applications in real-world environments can provide early insights into how the system performs and how users interact with it before a full-fledged systems implementation. In a case where commercial off the shelf software applications are acquired, software developers should opt for HIS that have options for customisation. Developers can for example tailor the functionalities of the HIS to the specific needs of the users in the public hospitals. For example, the DHIS2 consisted of the in-patient module which could be customised for patient referrals.

Management should also engage relevant stakeholders including healthcare practitioners, patients, and administrators from the early stages of the decision-making process for the selection of health information systems. The involvement of users ensures that stakeholders' especially HCPs, perspectives and needs are considered. By actively involving end-users such as HCPs, administrators and other staff members, health organisations can leverage their expertise and get insights and feedback on how to address effectively the limitations and inadequacies of health information systems. Additionally, management in health organisations should identify champions from the health professionals. Identifying champions and involving them in the decision-making and implementation process of health information systems is essential for the successful adoption and ultimately use of Health information systems. Although the implementation processes and user guidelines are mandatory, once these health professionals are identified they can act as champions of change and promote the benefits and value of HIS to other healthcare providers.

Their support and involvement can assist in garnering buy-in from other HCPs and overcome resistance from HCPs who may be sceptical about adopting or using new ehealth interventions.

Secondly, educating and training users on the risks of Shadow IT and change management is crucial to the appropriate adoption and use of information systems.

Management in health organisations should develop change management strategies that support the implementation of processes and systems. HCPs should receive adequate training and support to adapt to new versions of software release and new processes. This support can be provided by IT in the respective departments or ministries of health. Training HCPs to capacitate them not only with the necessary skills to use Information systems, but also to educate them on security risks that come with subverting official information systems.

Thirdly, subversion of official information systems using third party applications can have both positive and negative outcomes. These practices should not been in a negative way, instead their positive impacts on health organisations should also be considered.

For IT governance, policymakers should develop clear and comprehensive IT policies to manage third-party applications and Shadow IT. Based on the IT policies, strategies should be developed with a clear plan of action of how privacy, security, and ethical issues will be minimised to ensure patient safety. To achieve this, detailed procedures and guidelines that outline what constitutes unauthorised applications, services and IT should be developed. These policies should be communicated to the healthcare professionals to ensure they understand the security risks and implications of non-compliance to these policies. Additionally, the strategies should outline a clear criterion for acceptable use. For example, a risk assessment and analysis of third-party applications can assist in identifying the magnitude of risks that comes with use of Shadow IT. Conducting a risk assessment will assist in identifying vulnerabilities related to patient information security. IT management will then ensure that third party applications such as use of WhatsApp and other Shadow IT do not expose sensitive patient information or compromise patient safety. Specific IT strategies and health strategies should thus emphasise stringent privacy and data security requirements, including encryption and secure access controls, while aligning with relevant regulations such POPIA and other data protection laws. In general, these strategies should focus on maintaining patient safety by specifying how technology must adhere to ethical and clinical safety standards.

When shadow IT poses significant risks to an organisation, robust IT governance strategies are imperative to mitigate associated financial liabilities. Corrective strategies and measures such as regular IT audits can effectively identify unauthorised hardware, software, and cloud services involved in the collection, storage, processing, and transmission of sensitive patient data. Furthermore, the provision of organisation-owned mobile devices to healthcare professionals can enhance control over systems handling high-risk information. These practical implications are not only limited health organisations but also apply to contemporary organisations in various industries.

Fourthly, there is a need for ongoing evaluation and monitoring of health information systems.

Electronic health strategies should be established and updated to continuously monitor feedback on the effectiveness and efficiency of health interventions. Implementing regular checks is crucial for assessing whether the design of HIS aligns with the goals of users and process outcomes. Open communication with different stakeholders should be encouraged for IT to make the necessary adjustments to the HIS features in a timely manner. Additionally, training different stakeholders regularly ensures that they are up-to-date and the HIS meets the organisational goals.

Lastly, the use of social media platforms is embedded in the lives of HCPs. Like digital natives, we expect HCPs to retain access to social media at work. Access to social media platforms encourages the use of shadow IT applications for professional work.

Governance of Shadow IT in healthcare organisations is thus crucial to ensure patient safety and effective use of these third-party applications.

Investments and other resources should be made available by the ministries and the Department of Health for the IT department to provide HCPs with appropriate and reliable technological resources to meet their clinical needs. By providing clear guidelines and policies, tools and other resources, health organisations can minimise the motivation for HCPs to seek third-party solutions and alternative tools outside the approved applications from IT. The next section draws conclusive remarks on the links between theoretical explanations and practical implications.

8.5 Conclusion

In conclusion, this chapter has offered a theoretical elaboration on the empirical evidence presented in the study. Through the development of theoretical propositions, a deeper understanding of e-referrals use and design-reality gaps giving rise to workaround practices in Southern African public hospitals. The mandated Health Information Systems (HIS) in these hospitals are currently not used as intended by HCPs due to design-reality gaps. There were assumptions built into the e-health applications and there were misfits with real requirements of HCPs in the study settings.

It can be concluded that the involvement of end-users in the selection and planning stages of health information systems is crucial for fostering a positive perception, system uptake and ultimately use. When end-users are excluded, there is a higher likelihood of perceiving the system as inadequate, leading to potential resistance or improvisations (fitting, augmenting or workarounds) to an existing system. It is thus crucial for system developers and designers alike to prioritise user involvement throughout the HIS development process. Engaging healthcare providers in the design and testing phases, and adopting agile development methodologies, system developers can significantly enhance system usability and effectiveness in supporting organisational processes. Furthermore, system developers must address the design-reality gap issues to develop effective measures for bridging these gaps, as workarounds can provide valuable insights for improving information systems design (Wiesche, 2024). For example, customising HIS functionalities to end-user specific needs, fosters a culture of change management.

Additionally, adapting an existing Health Information System (HIS) can contribute to improved information completeness, positively impacting the referral workflow. Improvisations such as the use of phones and of paper-based methods bring about positive outcomes related to the efficiency and effectiveness of health services, ensuring continuity of care for patients and a seamless continuation of the referral process within health organisations. In addition, other improvisations, and workarounds are also enacted as solutions for overcoming system shortcomings and inadequacies. HCPs are increasingly resorting to workarounds or informal systems known as Shadow Information Technologies to accomplish their work. Workarounds observed in the form of WhatsApp may yield negative outcomes ranging from poor data quality and loss of patient information shared on WhatsApp. The use of WhatsApp breaches patient privacy and confidentiality. To prevent or address data breaches, it is essential to implement strong IT governance strategies. These strategies are critical for optimising HIS performance and managing the risks associated with using third-party applications. IT governance can put a strong emphasis on patient safety through risk assessments and enforcing data security measures to manage sensitive patient information.

Equally, the continuous evaluation of HCPs practices, their needs, work systems where activities are undertaken and implementing the user feedback is essential for ensuring long-term success of the HIS. When positive outcomes and minimal risks are associated with the use of Shadow IT, health organisations should encourage a culture of change management by embracing the innovations and process improvements that result from these workarounds.

Lastly, the study's empirical findings highlight the impact of implementing donor-funded health information systems in resource-constrained settings. While these systems improve health service delivery for specific public health programmes, their implementation without regard for contextual factors can lead to interoperability challenges, resistance from end-users, and ultimately, unsustainable government initiatives that depend on foreign experts for system implementation and maintenance.

To ensure donor-funded health information systems (HIS) are optimally adopted and used in resource-constrained environments, designers must prioritise the integration and interoperability of these systems with existing IT infrastructure. It is equally important to engage local developers in the design and implementation process of these systems to ensure that the systems are well-suited to the local context and can address specific needs HCPs. By involving local expertise and encouraging participatory approaches to systems development, developers can ensure that HIS solutions are tailored to the available technological resources, and specific healthcare settings. These efforts will contribute to stronger, and more responsive healthcare systems.

Policymakers in these settings should also ensure that donor-funded health information systems (HIS) focused on disease surveillance, are strategically coordinated with existing official health information systems to facilitate seamless integration. The next chapter outline practical implications of the research.

CHAPTER 9: Conclusion

9.1 Introduction

This chapter concludes the study by discussing and summarising the research findings with the study aims, and research questions as well as the significance and contribution thereof. Study limitations and opportunities for future research are highlighted.

The chapter is structured as follows: Section 9.2. presents the study overview by revisiting research questions. The study's contribution to theory and practice is discussed in Section 9.3. Reflections on the research process and specific study challenges are captured in Sections 9.4 and 9.5, respectively. Study limitations and future research directions are covered in Section 9.6. Conclusive remarks are highlighted in Section 9.7.

9.2 Revisiting the research questions

The purpose of this study was to investigate the use of electronic referrals (e-referrals) for facilitating the patient referral process in public hospitals.

The first research question is addressed in Chapters 5 and 6 where referral activities and tools facilitating these activities are discussed. Tools and means of coordination and collaboration include both traditional referral methods such as paper-based referrals and electronic methods as outlined in section 5.2.2.2. While both traditional and electronic methods are used for referrals in both case studies, the study findings show that Health Information Systems (HIS) in public health institutions are currently not used as intended; HCPs are increasingly resorting to workarounds or informal systems known as “Shadow Information Technologies” to accomplish their work. This study set out to answer the questions shown in Table 9.1. A summary of the answers to these questions is presented below.

Table 9.1 : Summary of the research questions and answers

Research questions	Elaboration of implications in the research
How do health care providers (HCPs) use e-referrals to facilitate the patient referral process in Southern African public hospitals.	Healthcare providers are using both electronic referrals (Vula) and traditional methods (referral letters, patient passports, referral registers, telephonic bookings) to facilitate patient referrals. These findings are shown in Chapter 5 (Section 5.2) and Chapter 6 (Section 6.2). Although there is evidence of implemented electronic referrals which are deemed to be beneficial to HCPs with regards to mobility, efficiency, and improvement in communication, HCPs were resorting mainly to WhatsApp as Shadow IT.
Why do Health care providers (HCPs) enact workarounds to e-referrals in public hospitals?	Healthcare providers were enacting workarounds because of gaps between the design of existing health information systems and the local realities of end-users. The empirical evidence discussed in Chapters 7 and 8 thus confirms gaps related to: • **Poor management systems and structures** in managing the selection of health information systems. Management in the public hospitals under study showed poor plans for rolling out and implementing e-health strategies to strengthen health service delivery. This resulted in a synergy loss between HCPs and management. For example, there were barriers of communication on the Vula application implementation from managers in some units. Medical officer sometimes was hesitant to share insights on how the app was to improved leading missed opportunity for feedback. • **Lack of end-user involvement** in the process of selection of software applications and planning of Health information systems. This resulted in a misunderstanding of HCP's user needs. The work of the HCPs could thus not be completed effectively therefore affecting referral outcomes. • E-referrals inadequacies and shortcomings constrained HCPs in completing their work. • **Lack of IT support**: The use of personal devices by HCPs was motivated by lack of IT support. The use of personal devices (Bring your own device-BYOD) is not ideal for storing patient information as it is sensitive, and it compromises patient privacy and confidentiality. • **The technological infrastructure** such as the internet was not stable enough to support access and use of Vula and District Health Information systems (DHIS2). • **Absence of IT policy and Lack of policy awareness**: HCPs were generally not aware of referral guidelines but relied on senior consultants for a second opinion. Additionally, some referral guidelines from the department of health were not inscribed or incorporated in the design of the e-health applications. Although there was prevalent use of Shadow IT, there was no evidence of IT policies designed to manage the risks of shadow IT.

Research questions	Elaboration of implications in the research
How do Health care providers' (HCPs) workaround practices affect referral outcomes?	While the study findings clearly show the above design-reality gaps, Healthcare providers equally acknowledged the benefits of using Shadow IT: • Improves communication within the referral process. • Flattens organisation hierarchy as medical officers had direct access to specialists to seek second opinion. • Utilising Shadow IT and circumventing mandated systems, HCPs effectively enhanced their productivity in completing tasks. For example, adopting WhatsApp significantly improved communication, particularly in the referral process, as it was deemed more efficient and instantaneous. Additionally, the use of WhatsApp groups helped flatten the organisational hierarchy, granting medical officers' direct access to specialists for seeking second opinions. This stands in contrast to the referral protocols that mandate specific pathways for patient referrals.

Workaround practices were explored in Chapter 6 for individual case studies (Sections 6.2.1 & 6.2.2). This finding lead into further exploration of workarounds practices to e-referrals in public hospitals under study. The benefits of WhatsApp as a Shadow IT are summarised in Table 5.5.

The causal factors for engaging in workaround practices and use of Shadow IT are explained in Chapter 6, Table 6.3. These factors are later interpreted through the Process framework for Healthcare Information System Workarounds and Impacts. While the Activity Analysis and Development (ActAD) framework was useful as a sensitising tool for data collection, it was imperative to find other theories explaining the emergent findings related to workarounds.

In Chapter 7, the workaround practices suggested design-reality gaps in failing to accommodate user requirements in the design of the e-referral application. The design-reality framework was thus adapted to explain the gaps along the relevant dimensions.

The "why" part of the research question is answered by demonstrating that workarounds were enacted for the following reasons namely poor management systems and structures, lack of end-user involvement and IT support, inadequacies of HIS, absence of IT policy and lack of policy awareness.

From the empirical evidence presented in prior chapters (7 & 8), it is evident that workarounds affect the referral process and ultimately the referral outcomes for health organisations, HCPs and patients. Strategies to optimise the use of e-referrals can ultimately streamline the referral process and improve referral outcomes. Further research and policy measures are crucial to foster the successful adoption and implementation of digital health interventions like e-referrals, thus enhancing the overall efficiency and quality of healthcare services rendered to patients. The next section discusses the study's contribution.

9.3 Study contribution

This research makes several contributions to theory, practice, and methods. Given that this study is interpretive in nature, it was appropriate to adopt a set of principles for evaluating a study contribution from interpretive studies (Klein & Myers, 1999; Barret & Walsham, 2004; (Byrne & Sahay, 2007).

The categories and types of generalisations by Byrne and Sahay (2007) are adopted to evaluate the study the contribution of the interpretive case studies conducted in this research. Table 9.2. illustrates the adapted categories and types of study generalisations which are adapted in this research to present the study's contribution.

Table 9.2 :Type of contribution (Adapted from Byrne and Sahay, 2007)

Type of contribution	Empirical to Theoretical
Developing concepts and generating theory.	Developing single concepts as part of a broader network.
Contributing rich insight.	Drawing specific implications from particular case studies or research settings.
Drawing specific implications.	Insights that are neither concepts nor specific implications of theories.
Study validity and generalisability.	Generalisability of observations, concepts, or other descriptions of theory.

9.3.1 Developing concepts and generating theory

The theoretical contribution of this research to theory is the development of an integrative framework with various concepts from relevant theories. The theoretical contribution of this research is primarily the theoretical framework in Chapter 8 (Figure 8.1). The framework draws concepts from relevant theories to explain workaround practices to e-referrals in public hospitals in Southern Africa and other low- to- middle-income settings.

Firstly, the research builds on existing theoretical perspectives on workarounds in the Information Systems discipline (Gasser, 1986; McGann and Lyytinen, 2008; Yang & Yip, 2012; Alter, 2014; Alter, 2018).

In particular, the study integrates the *Process Framework for Healthcare Information System Workarounds and Impacts* (Yang et al., 2012); the *Systems Engineering Patient Safety* (SEIPS 3.0; 101) model and the design-reality gap framework (Heeks, 2006; Gómez & Heeks 2016).

Secondly, a theoretical contribution is reached by proposing theoretical propositions (Section 8.2) showing a unique relationship between the dimensions of the design-reality gap model giving rise to improvisations of electronic referrals. Although there are existing studies examining improvisations, and workaround behaviour to health information systems, these concepts are under-theorised in the healthcare context. This research, therefore, fills this gap by contributing to the body of knowledge, particularly by offering an extended explanation of how and why design-reality gaps can result in end-users enacting improvisations to health information systems in low to middle-income settings.

9.3.2 Rich insights

This research contributes to the ongoing discussions on workarounds in the information systems and healthcare disciplines. The work systems snapshot was employed as a modelling tool to illustrate the nature of referral activities and to understand the tools used to facilitate these activities.

The snapshots (Table 6.1. & Table 6.6) developed for both case studies provided rich insights and understanding of the referral activities, electronic referral methods and workaround practices of HCPs.

While existing studies argue and demonstrate the prevalent use of telemedicine services (Mars, 2016); the general use of WhatsApp (Morris et al., 2021; Thomas, 2018; Williams & Kovarik, 2018) and general workarounds to information systems (Ogundaini and Dela Harpe, 2022), this study provides rich insights into design-reality gaps giving rise to these workaround practices. The design-reality gaps discussed from multiple cases in Chapters 7 and 8 provide a deeper understanding of why workarounds occur in public hospitals and measures to bridge them (Section 8.4). These measures can be applied to policy development and implementation of e-health interventions in health organisations.

9.3.3 Drawing specific implications

The e-referral system capabilities did not fully fit the local realities of the public hospitals in which it was implemented. Although the application was partially adopted, there were still limitations and constraints to traditional and electronic referrals which persisted at the time the study was conducted.

Practical contributions of this study, therefore, show the workaround snapshots (Tables 6.6 and 6.7) capturing the knowledge of e-referrals and workarounds from the two case studies. These snapshots can be used to provide insights for other studies. The snapshots can be adopted fully or partially by practitioners or researchers in studying workarounds of other health information systems in similar settings.

9.3.3.1. Study recommendations

The practical recommendations are outlined in Table 9.3.

Table 9.3 :Practical contributions and recommendations for this study

Design Reality Gaps	Practical recommendations
Patient safety	Workarounds and Shadow IT can have both positive and negative outcomes. They should not be solely seen as negative, and it is essential to employ governance strategies to determine their effect on patients, HCPs, and processes in health organisations. Apart from implementing governance strategies to manage negative outcomes, health organisations should also harness the positive outcomes by adopting the following practical strategies: • The IT department in health organisations should identify Shadow IT and assess their potential effect and risks to business processes and patients, respectively. Once they are identified, the IT team can gain valuable insights into the real needs of HCPs at points of care to enhance the provision of healthcare services. This information can then be utilised to inform IT decision-making processes involving regulating or commissioning Shadow IT. • Workarounds can help the IT team identify real needs and end-user requirements, making them valuable for fostering innovation and process improvements. • IT teams should collaborate and work closely with HCPs to understand their needs and identify potential e-health solutions that align with the organisation's overall IT strategy.

Design Reality Gaps	Practical recommendations
Poor management systems and structures.	Management and IT units in health organisations should recognise that Health care practitioners are digital natives and social media is an integral part of their lives. Given the potential that HCPs will retain access to social media at work, Management and IT units should predict when users are likely to adopt and decide to use to shadow IT and manage that process. Governance of Shadow IT should be first done by: • Identification of the instances and types of Shadow IT enacted by end-users and how they are affecting organisational processes such as patient referral processes. • Conducting a risk assessment and analysis of Shadow IT to derive appropriate strategies for responding to and managing Shadow IT.
Lack of end-user involvement. **E-referrals inadequacies and shortcomings.**	Lack of user involvement in the selection of HIS can lead to negative perceptions of system ineffectiveness and decreased user satisfaction. Additionally, when HCP when end-users experience inadequacies of the HIS, they are more likely to resist its use or resort to improvisations such as fitting and augmenting the mandated Health information systems. The following are practical recommendations for management of the public hospitals: • Adoption of bottom-up initiatives and user-driven approaches in rolling out and implementing e-referrals. • Identification of champions. • Educating and training end-users on implemented e-referrals.
Absence of policies. **Lack of HCPs' awareness of policies.** **Privacy, security, and ethical issues.**	Healthcare providers' limited awareness of referral protocols and lack of IT policies to regulate third-party applications leads to privacy, security, and ethical issues in health organisations. The following are practical recommendations to address these gaps: • Develop comprehensive IT policies that regulate access to third party applications and Shadow IT, emphasising privacy, security, and ethical considerations to ensure patient safety. • Educating and empowering end-users by creating awareness on the security risks associated with the use of Shadow IT. • Educating and training end-users on existing e-health strategies and policies.

This section discusses practical recommendations and implications of the research on healthcare IT and systems practice, emphasising the strategic importance of understanding and managing workarounds within health care settings and beyond.

Firstly, it is crucial to identify instances and types of Shadow IT enacted by end-users and how they are affecting organisational processes such as patient referral processes. Shadow IT deployed by HCPs must be clearly identified by paying attention to instances of when these Shadow ITs are enacted, and to their effect on main organisational processes in public hospitals. In particular, when for example the instances of WhatsApp use are identified, it can be determined how its use affects the strategies related to the use of official health information systems and other e-health interventions such as Vula. For instance, the use of WhatsApp can support or undermine mandated health information systems.

Using WhatsApp can support mandated health information systems such as the district health information systems or the Vula application by enhancing efficiency in communication between health care providers. Additionally, the use of WhatsApp and other third-party applications can undermine the use of Vula because referral guidelines and protocols are not inscribed in the Shadow IT.

The strategic importance of IT governance in managing Shadow IT within healthcare organisations is crucial. IT units in healthcare organisations should assess the criticality of Shadow IT instances in relation to healthcare processes, IT security, compliance with existing policies and procedures; and IT service management (Rentrop & Zimmermann, 2012). Literature highlights several Shadow IT evaluation models, and governance approaches which can be adopted to identify Shadow IT to assess their criticality and their associated risks in organisations (Zimmermann et al.,2016; Chua et al., 2014; Kopper et al., 2020). Additionally, it is important to employ governance strategies that identify whether Shadow IT are considered positive or negative. Kopper et al., (2020) for example used an approach to differentiate positive and negative forms of Shadow IT and business-managed IT. Their methodology can be applied in health organisations to identify certain conditions that can support practitioners in making systematic decisions about Shadow IT.

For example, to determine if the Shadow IT is aligned with existing health information systems or whether they are volatile and they are disrupting the existing clinical flows.

Secondly, management should consider adopting bottom-up initiatives to promote end-user involvement. Chua and Storey (2016) have concluded that bottom-up initiatives are recommended and promote opportunities for dialogues between end-users and management IT departments.

Additionally, Beverungen et al., (2024), argues for the involvement of participants in the process of identifying, analysing, assessing, and implementing workarounds. Their study also recommends a bottom-up approach to promote user-involvement.

In healthcare settings, dialogue between management, IT and end-users will allow for gathering of actual user needs and taking into account the reality of the context in which work is undertaken. For example, end-users can identify the limitations of e-referral applications and inadequacies which could be addressed through their involvement in the requirements gathering and design phase Dialogues can further be initiated by identifying champions in respective departments where e-referral interventions are planned to be implemented.

Moreover, management in health organisations should identify champions from the health professionals. Identifying champions and involving them in the decision-making and implementation process of health information systems is essential for the successful adoption and ultimately use of Health information systems. Health professionals can therefore act as champions of change and promote the benefits and value of HIS to other healthcare providers. Their support and involvement can assist in garnering buy-in from other healthcare providers and overcome resistance from HCPs who may be sceptical about adopting or using new e-health interventions.

Identifying Shadow IT and involving end-users in the process of rolling out health information systems can lead to the successful implementation of e-health initiatives.

Studies conducted by Heeks (2006), Rowe, Ngwenyama & Richet, (2020), and Ishijima et al., (2015) have all arrived at similar conclusions, emphasising the crucial role of user involvement in effectively deploying HIS. When system users actively participate in the design and implementation of systems, management can effectively mitigate covert and overt resistance to digital interventions. For example, Wiesche et al., 2024, argues that workarounds offer valuable insights for designing more usable information systems by revealing user behaviour related to workarounds and potential solutions for better alignment with user requirements and organisational context.

Moreover, end-users should be involved and trained on assessing the criticality of risks, they can evaluate the quality concerning the services, information, and handling of business processes when they use Shadow IT. User involvement promotes understanding of system users' social-technical realities instead of partial knowledge from system designers. This in turn will ensure effective adoption and use of newly introduced e-health interventions in public hospitals. In addition, end-users should also be involved in the governance of Shadow IT.

Given that HCPs are openly utilising WhatsApp and other third-party applications to facilitate communication and patient referrals, a thorough assessment should be conducted to identify potential security vulnerabilities and threats of using Shadow IT. This assessment should be conducted in a participatory approach where end-users are engaged to determine the effect and likelihood of risks, compliance violations and data security breaches of sharing sensitive information on third-party applications. Using this approach of engaging end-users will educate them on security risks related to the use of Shadow IT.

Conducting risk assessments and analysis of Shadow IT can ultimately enable the IT department in partnership with end-users to develop appropriate strategies in response to Shadow IT in health organisations.

Practitioners and IT managers need to recognise that workarounds are common and will occur even though they are non-compliant with existing organisational policies. They do not only bring about negative risks and consequences but can also be beneficial for bringing about innovative ways of completing work and process improvements.

IT managers provide guidelines on relevant strategies to accommodate these adaptations or policies commissioning these Shadow IT. For example, management could come up with strategies for assessing the criticality of Shadow IT and how they affect patient safety, HCPs and health organisations. In cases where there is a lower criticality level, the risks could also be lower and might not have adverse effects on health processes.

It is equally important for policy makers to develop eHealth strategies and health IT policies that prioritise training of healthcare professionals about the risks and vulnerabilities associated with workarounds and Shadow IT, emphasising how they can compromise patient safety. It is also crucial to ensure follow-up training is conducted with end-users to ensure they are introduced to updates and newer versions of the software applications. This will equip system users with knowledge of new system functionalities and in turn promote effective use. Policymakers can play a critical role in ensuring compliance to national data protection laws or, where such laws are absent, develop interim guidelines to safeguard sensitive patient information. Policymakers should collaborate with IT governance units to enforce strict data security measures and create a framework for ongoing monitoring and compliance. By proactively addressing these issues, policymakers can help bridge the gaps between current practices and the safe, effective use of HIS.

Workarounds and use of Shadow IT in healthcare organisations should not only be viewed as negative or risky but as opportunities for IT innovations and process improvement. For instance, developers could explore adopting functionalities in WhatsApp and other third-party applications which end-users deem useful and incorporate these features in the mandated e-referrals. In doing so, management can focus more on managing change and promoting IT innovations in health organisations.

Moreover, proactive approaches are adopted to manage workarounds. For example, organisations should anticipate workaround behaviours and predict when they will occur. Being able to identify and predict the occurrence of workarounds can help health organisations determine if these can pose security threats and whether they disappear or become institutionalised.

Having a thorough knowledge of workarounds will help in determining how they affect process outcomes and further their management before they occur. The next section captures reflections on the study validity and generalisability.

9.3.3.2 Reflection on study validity and generalisability

Explanatory case studies were the focus of this study. It is crucial that case study findings demonstrate robust internal validity. To achieve internal validity, two analytical techniques—explanation building and examining rival explanations were applied to the research (Yin, 2018). Comparing the empirical data from case one and case study two allowed for the development of theoretical propositions. Rival explanations of improvisation types and design-reality gaps were achieved through the use of matrix coding.

Using these analytic strategies, contrasting perspectives of study participants from multiple case studies produced rival explanations of how e-referrals were used and why HCPs were using WhatsApp as Shadow IT. Furthermore, the rival explanation strategy was adopted by employing rival theories. The initial ActAD framework was adopted as a sensitising theory to guide data collection. However, the theory was limited in explaining the study results. A "rival theory" approach was employed where different theoretical frameworks, namely the Process Framework for Healthcare Information System Workarounds and Impacts, Systems Engineering Patient Safety (SEIPS 3.0 and 101) framework, and design-reality gap framework were employed to explain the empirical data. Additionally, this framework can be generalised to similar settings.

The empirical findings from this research are generalisable beyond this study through "analytic generalisation". This type of generalisation is defined as generalising from case study findings to theory and generalising from empirical statements to theoretical statements (Yin, 2003; Lee and Baskerville, 2003). The theoretical elaboration was achieved through the development of propositions discussed in Section 8.2. This study further adopted an abductive approach to explain the emergent findings.

The empirical findings from multiple cases were generalised to theory. An integrative framework (Figure 8.1) is a novel contribution explaining workarounds to electronic referrals in South Africa and Namibia. It can thus be concluded that an analytic generalisation was achieved in this study. Analytic generalisation was thus achieved in this study as this framework can be generalised to other public hospitals in similar settings.

9.4 Reflection on the research

In interpretive qualitative research, maintaining rigour is crucial throughout the research process. Interpretive rigour involves demonstrating how data interpretations are derived from empirical findings. The seven principles of interpretive by Klein and Myers (1999) serve as a valuable framework that can be employed for interpretive researchers to critically reflect on their research. The next section discusses how these principles were applied to this study to achieve research rigour. The next section discusses the hermeneutic circle and its application in the research

9.4.1 Applying the fundamental principle of the hermeneutic circle (Principle 1)

This study applied the fundamental principle of the hermeneutic circle to broaden the understanding of e-referrals and the work of HCPs. Furthermore, this principle also assisted in answering the research questions of this study. “In practice, this involves repeatedly and cyclically moving between the parts or aspects of the phenomenon and the whole, to gain a growing understanding of the phenomenon,” (Paterson & Higgs, 2005, p. 345). The study objectives (whole) were carefully examined considering the findings of the two cases (parts).

Multiple iterations of data analysis were undertaken by repeatedly employing different lenses and frameworks. In the first iteration, the ActAD perspectives were examined to understand referral activities and e-referral tools used to support the work of HCPs. The findings from this stage of the analysis were used to comprehend the results within the whole study of other referral practices emerging from the use of e-referrals in public hospitals. This analysis process “as a part” was repeated until the best-fit framework was found. In case study one, the ActAD analysis was conducted and there

were learnings from the research informed by this hermeneutic cycle. The next section outlines how the principle of contextualisation is applied in this research.

9.4.2 Applying the principle of contextualisation (Principle 2)

This principle was applied by generating a firm understanding of the phenomenon of interest through a literature review, pilot study and overall research objectives of the study context.

An overview of the status of e-referrals use in public hospitals in the Western Cape province and Khomas region was studied. The social and historical setting of the two referral systems in the respective regions was surveyed as a means of contextualising the study. Referral systems as work systems and tools used to support referrals were studied in their setting to understand HCP practices. The outcome of this contextualisation principle is the work system snapshots for the multiple cases (Table 6.1 and 6.6).

This principle was the most interesting to apply because the two referral systems between South Africa and Namibia share similarities. As a researcher, I was more familiar with the Namibian referral system and referral pathways. My knowledge of the Namibian context helped to inform my research in the South African setting by drawing on similarities of health facilities at different healthcare levels. The two contexts were useful in gaining a firm understanding of the referral pathways and electronic referrals used in the two systems. The next section discusses the application of principle 3 in this research.

9.4.3 Applying the principle of interaction between the researcher and subjects (Principle 3)

This study applied this principle by describing how the data was handled and interpreted (Klein & Myers, 1999). As a first step, this principle was applied during the pilot study, where the interaction occurred between the researcher and subjects to get a better understanding of the phenomenon of interest.

At the outset of this research, accessing medical practitioners in public hospitals posed a considerable challenge due to their demanding schedules. To overcome this challenge, a specialist affiliated with Hospital A, played a crucial role in facilitating my access to HPCs. Establishing the initial contact through this specialist was instrumental

in building trust with the medical practitioners. As a researcher, this facilitated the ease of scheduling appointments, and medical practitioners were more receptive to engaging with me.

The senior specialist who was the head of the unit also offered me a place to seat in the tearoom where the necessary contacts were made. I was occasionally introduced to medical practitioners as they came to take their tea break from the busy schedules. In the tearoom, I conducted formal interviews but also used the space to conduct informal interviews. I also used this opportunity to follow up on discussions to seek clarification on formal interviews. This informal setting proved to be valuable, as interactions with medical practitioners were more open and they revealed more information as they felt less scrutinised because there was no recording.

In Hospital B, the senior specialist overseeing the department introduced me to the medical practitioners in his office. This office was used as a space to meet medical practitioners during their break times. During the research times I spent time in this office, fostering relationships with medical practitioners, and employed the snowball method to leverage these connections for the recruitment of additional participants in the research. This approach not only facilitated access but also enriched the depth of interactions as medical practitioners were more trusting and open during these informal sessions. The next section discusses the application of principle 4 in this research.

9.4.4 Applying the principle of abstraction and generalization (Principle 4)

This principle is applied by relating the data interpretation through the application of theories (Klein & Myers, 1999). The research data is explained by general concepts from Activity Theory, Theory of Workarounds, and related frameworks. The data for this research is explained by applying the general concepts from the above theories.

The primary outcome of Phase 1 is the presentation of referral activities and mediating tools used in facilitating these activities. In-depth insights were later gathered from a deeper analysis of cross-cases. Findings drawn from case studies suggest implications that may be valuable in other contexts of public hospitals.

This principle was applied where different theories were employed as a lens to identify and apply specific theoretical concepts from the raw data, and generalising this to the empirical findings.

As a researcher, I struggled during the deductive phase of this research. Because the concepts from the ActAD framework were limited and did not give me the explanatory power I needed at the stage of the data analysis. Subsequently, I explored with other concepts from relevant theories to further interpret the empirical data. Interpreting the data in the initial analysis phases was challenging but also interesting as I needed to find meaningful interpretations not only from the ActAD perspective but also find other meanings through abstract concepts of improvisations and workarounds. I thus needed to analyse inductively the data in order to understand the broader and abstract concepts that go beyond explaining the referral activities but explore the workaround practices and make conceptions to relevant theories explaining this phenomenon.

Additionally, generalisation was achieved through foregrounding contextual factors discovered from the case studies. This principle was mainly applied by remaining open to emerging themes from the data and particular contextual factors. The principle of dialogical reasoning is discussed in the next section.

9.4.5 Applying the principle of dialogical reasoning (Principle 5)

This principle entails the researcher challenging her initial preconceptions embedded in the original research design, rather than being guided by the data that emerge through the research process (Klein & Myers, 1999).

Implementing this principle proved to be the most challenging aspect of this research because of my IT background, which contributed to my preconceptions about the typical implementation and adoption of mandated systems in organisations. My understanding of an Information system implementation was a conventional approach and any deviations I negatively viewed. Becoming aware of this "prejudice" or "historicity" was necessary in reaching an understanding of improvisations to a formal e-referral process. As a researcher, I needed to challenge my preconceptions and deliberately seek and explore multiple perspectives from my interview respondents.

Ongoing dialogues were, therefore, necessary not only with medical practitioners but also with IT personnel closely collaborating with healthcare professionals daily. I carefully challenged and assessed my own assumptions about the practices and social actions of Healthcare Professionals (HCPs).

Consequently, I shifted my focus to examine these practices from both negative and positive perspectives. Rather than concentrating solely on the negative outcomes of workaround practices, it was necessary to explore equally the potential positive impacts and outcomes for patients, HCPs, and organisations. The principle of multiple interpretations is discussed in the next section.

9.4.6 Applying the principle of Multiple Interpretations (Principle 6)

This principle requires the researcher to take into account multiple viewpoints (Klein & Myers, 1999). In this research, I actively sought diverse perspectives of not only medical practitioners, but also nurses, IT personnel, and other administrative personnel who played a role in the referral process.

Applying the principle involved addressing conflicting interpretations from various data sources. I evaluated diverse perspectives from administrators, IT personnel, medical officers, and specialists. This inclusive approach required recognising both complementary and contradictory views, allowing the researcher to uncover multiple valid truths.

For instance, I observed that some Healthcare Professionals (HCPs) signed up for a Vula application account but remained inactive on the platform. This finding and viewpoints of HCPs were cross-referenced with interviews of IT personnel. This revealed that while some of these HCPs claimed to use the application, in reality, they only had an inactive account. To capture multiple valid truths such HCPs profiles, viewpoints from medical officers, specialists, and other respondents were thus compared.

This principle also encouraged active engagement with research participants. In cases of data uncertainty, I sought consultations with relevant respondents; and I attended workshops and meetings related to Health Information System (HIS) implementation and hospital work environments providing valuable insights.

This not only broadened the researcher's understanding, but also enriched the research process by incorporating diverse perspectives. The exploration of different viewpoints allowed for a critical examination of assumptions regarding how HCPs should use Health Information Systems. The focus shifted from merely scrutinising the negative consequences of workaround practices to exploring potential positive impacts and outcomes for patients, HCPs, and organisations. This principle fostered an open and active engagement with research participants, ensuring a nuanced and comprehensive understanding of the studied phenomena.

9.4.7 Applying the principle of Suspicion (Principle 7)

This principle was applied by critically interviewing, analysing, and interpreting the research data. For example, informants' responses were not taken at face value but triangulated with other sources. Supporting insights were sought from observations of the Vula application use and documentation. During interviews, further probing was initiated to get more insights. Responses from participants were compared to other inputs from other participants and contextual backgrounds. Care was taken during the analysis phase to interpret the data not only based on text, but in the context of the whole study. The next section discuses additional challenges encountered in the study, research limitations and potential future research directions.

9.5 Reflection on other study challenges

Part of phase two of this study was conducted during the COVID-19 pandemic. This presented several challenges and limitations. The timeframe for data collection was extended because there was limited access to health professionals in public hospitals. The study was halted in the year 2020 to 2021 because the Department of Health in South Africa had revoked all research permissions for non-COVID-related research projects in public hospitals.

Consequently, the researcher went on to gather data in Namibia, where access to public hospitals was still allowed until October 2020. During this phase, the researcher experienced several challenges. Some healthcare professionals were not available for interviews as they were part of the COVID-19 emergency response teams. Furthermore, the COVID protocols at the time of the study needed to be adhered to.

Social distancing as per COVID-19 protocols was practised when conducting Interviews. A dedicated office, accessible only to the respondent and researcher, was made available during interview sessions. Wearing of masks was always mandatory during the interviews and in the public hospitals. Additionally, public hospitals required interview appointments set ahead of time as there were only a few visitors allowed in certain departments of the hospitals. This was the most challenging form for research because on some occasions, when health professionals were not available, I had to reschedule some appointments and navigate the COVID register in Hospital D.

Given these challenges, some interviews with healthcare professionals, representatives from ministries of health, and IT personnel were followed up by telephone and electronically using Microsoft Teams and Zoom applications. Telephonic and electronic interviews were conducted to verify some of the data collected during this phase. The study limitations are discussed in the following section.

9.6 Study limitations and future research directions

While this research revealed interesting insights on design-reality gaps at play in the emergence of workarounds to e-referral use in public hospitals, it is important to point out the research limitations and boundary conditions that should be considered.

Firstly, the study was conducted during the early phases of the implementation of the Vula smartphone application in some public hospitals in case studies one and two. In case study one, Vula was later adopted in the year 2021 as the official e-referral application of the Western Cape Department of Health. The empirical evidence presented in this study is therefore limited to the experiences and work practices of health care providers interviewed prior to the official adoption of Vula. In case study two, Vula was re-introduced in 2022 as an innovation for patient referrals in different regions (Vulamobile, 2023).

The empirical data in this research was collected before and during the COVID-19 pandemic. Given that COVID-19 accelerated advancements in Health Information Systems (HIS) and propelled technological innovations such as remote consultations, future studies could investigate the adoption of new technologies that emerged as a result of the pandemic.

Equally, future studies should examine whether workaround practices persist after e-referrals (Vula) was mandated by the respective governing Department of Health.

Secondly, information asymmetries between donor agencies providing health information systems as resources to government institutions were observed in case study two. Future studies could also examine the information and power asymmetries from different theoretical perspectives as this could provide unique insights into how donor-funded systems are affecting the use behaviours of health information systems by end-users in limited resource settings. For example, policy makers in these settings should ensure that funding for health information systems (HIS) from donor partners—focused on disease surveillance such as HIV/AIDS, TB, and malaria are strategically coordinated. This will ensure that these systems integrate seamlessly with existing official health information systems. Policies should establish clear strategies to avoid fragmentation caused by vertical programs, which often involve separate data systems different staff members (often not employed by these government institutions), and instead foster a more cohesive and effective health response

Thirdly, this research investigated workarounds emerging from e-referrals use within two case studies employing an interpretive paradigm. This limits the researcher to interpret the study findings to interpretive cases in the contexts understudy. Future studies can employ other philosophical perspectives to offer other insights or measure the impact of workarounds on Information systems use, referral outcomes and health organisation processes.

This study is also limited by specific theoretical frameworks, namely the Process Framework for Healthcare Information System Workarounds and Impacts, the Systems Engineering Patient Safety framework, and the design-reality gap model. For instance, the model for technology appropriation can be adopted to offer rich insights into roles that end-users can play in the design of IT artifacts (Carroll, 2004). The model can also be employed to track how workarounds evolve during different phases of adoption, use and adaptation. This model can also illuminate how innovations can be designed and adapted to users' organisational, social and personal practices, and then to gather users' needs and requirements from the appropriated innovation in order to improve its design.

Future research could also explore longitudinal studies to examine the characteristics of workarounds and assess whether they are temporary or persistent. If workarounds prove to be persistent, this approach can provide deeper insights into how these practices evolve over time in work systems.

Future studies should additionally, look into employing alternative frameworks to explore information and power asymmetries between the donor-funded systems and ministries where these systems are implemented. These different theoretical perspectives could provide unique insights into how donor-funded systems are affecting the use behaviours of health information systems by end-users in limited resource settings. The theoretical framework developed in this study has the potential to be adapted into other disciplines (e.g., education, engineering) to help public institutions understand this phenomenon by developing more effective measures and governance strategies to address these practices.

Lastly, this research is also limited to a qualitative methodology. Other scholars could use mixed or quantitative methods to study the phenomenon of interest, as combining methods could provide more scientific rigour and generalisations to other contexts.

9.7 Conclusion

While this research advanced an understanding of how HCPs use electronic referrals (e-referrals) for facilitating the patient referral process in public hospitals. The research uncovered that electronic referrals did not fully streamline the referral workflow and improve the work of HCPs as per design objectives. HCPs were resorting to workaround practices to complete their referral activities.

This finding is supported by several scholars arguing that workarounds result from misfits between systems and work practices of actors (Ejnefjäll, Ågerfalk, & Hedrén, 2023; Davison, 2021; Van Offenbeek et al., 2024). As a result, users institute workarounds to appropriate solutions to these misfits or gaps (Ogundaini and Dela Harpe, 2022; Blijleven et al., 2022).

Research findings are therefore in agreement with these scholars, that an alignment between the social contexts of HCPs needs to be matched to their needs and the IT artefact Vula. System developers need to pay attention to design-reality gap issues in order to devise measures to address the gaps, because workarounds can inform the information systems design (Wiesche et al., 2024)

Practitioners and management in healthcare organisations need to recognise that workarounds are common and will occur even though they are non-compliant with existing policies. Given the prevalent use of workarounds in healthcare settings, healthcare organisations should invest in developing effective strategies for managing security risks, prioritising patient safety, and safeguarding sensitive patient information. Workarounds are an opportunity for innovation and process improvements in health organisations.

The findings of this study explain why HCPs enact workarounds to official HIS. Since this research was limited to public hospitals, future studies can replicate the research in other settings. It would be useful to apply and test this framework in other contexts for example, in settings like Botswana (Williams & Kovarik, 2018), Israel (Siegal et al., 2016), and India (Joshi et al., 2018; Neogi & Panda, 2020), where WhatsApp is predominately used alongside official information systems. The framework could provide an explanation of why workarounds to HIS occur and use of third-party applications are prevalent in these settings. Equally, this research can also be applied to other provinces in South Africa to better understand workaround behaviors (Ogundaini, 2023; Chipps et al., 2015; Kauta et al., 2020; Morris et al., 2021).

Since this study focused on developing a framework to explain healthcare professionals' workarounds to health information systems (HIS), future studies in other contexts could expand on this by exploring how understanding workaround behavior can improve information system design and increase user acceptance and usage. For instance, examining digital desire paths could help HIS designers and developers resolve design issues (Wiesche, 2024).

In conclusion, this research highlights the strategic importance for public health organisations to implement effective measures for managing Shadow IT, supported by robust change management strategies. Addressing this issue is essential for improving operational efficiency and ensuring that IT aligns with organisational objectives.

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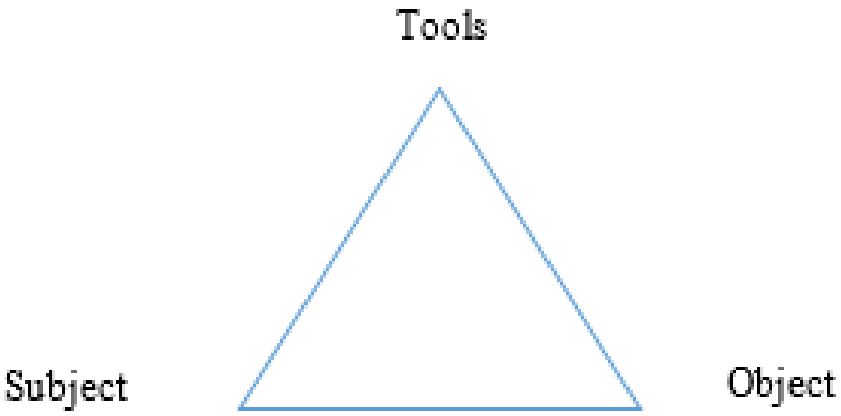
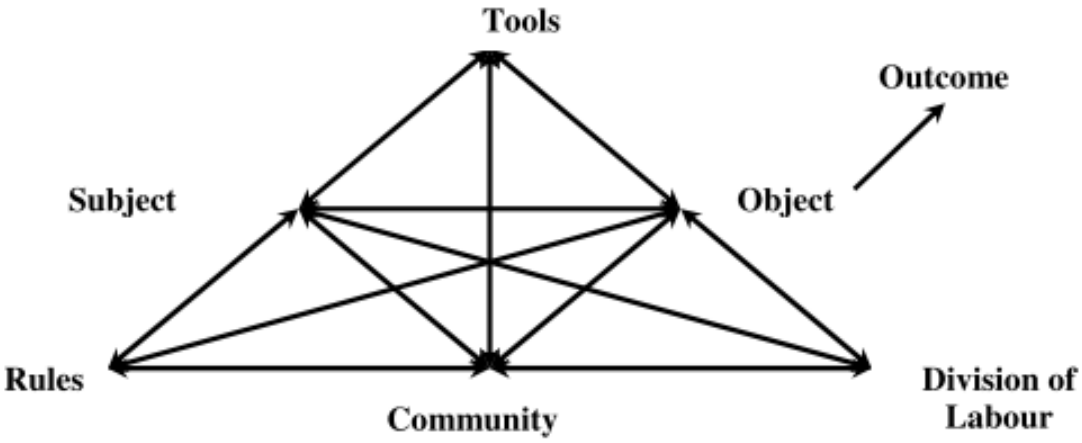
APPENDICES

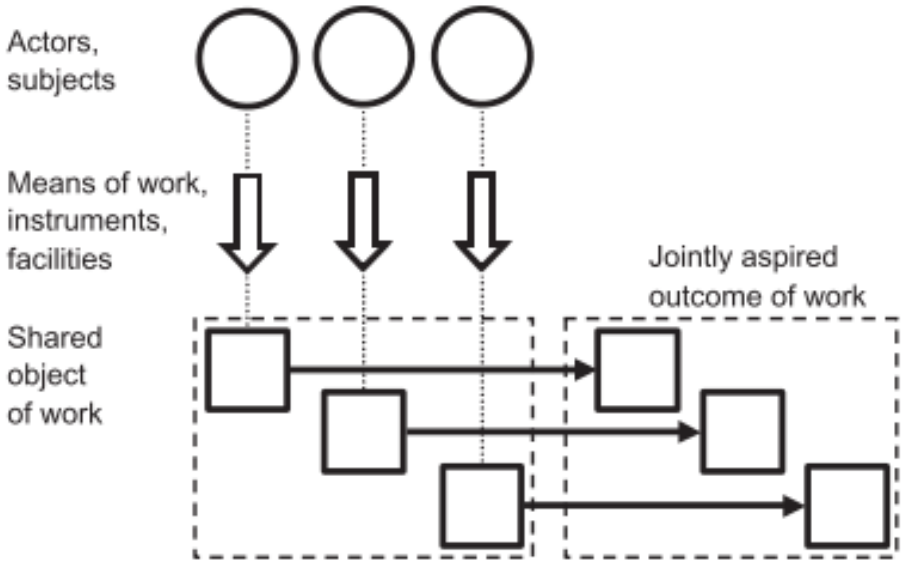
Appendix 1: Vygotskian Triad of Mediated Action (Source: Vygotsky, 1978).



Appendix 2.: The mediational structure of an activity system (Engeström, 2001)



Appendix 3: Joint activity (Korpela, 2000; Korpela, Mursu and Soriyan, 2002)



Appendix 4: Summary of literature on enablers and motivators of Shadow IT

Motivators/enablers for Shadow IT	**Source (Author & year)**
Shortcomings of mandated systems.	Wong et al., (2022); Ogundaini et al. (2021); Davison et al. (2019); Zimmermann et al. (2017); Laumer et al. (2017); Reiz & Gewald (2016); Van Beijsterveld & Van Groenendaal (2015); Strong & Volkoff , (2010).
Lack of business-IT alignment.	Furstenau et al. (2017); Thatte et al. (2012); Silic & Back (2014)
Limited or inefficient IT support.	Walterbusch et al. (2017); Silic & Back (2014); Thatte et al. (2012).
Employee motivation/impact orientation and Peer behaviour.	Davison et al. (2021); Mallmann & Maçada (2021); Magunduni & Chigona (2018); Rentrop & Walterbusch et al. (2017); Buchwald et al. (2014).
Users' technical accessibility to applications (software as a service; web services; BYOD).	Morris et al. (2021); Kapepo et al. (2021); Neogi & Panda (2020); Kauta et al. (2020); Joshi et al. (2018); Williams & Kovarik (2018); Dulipovici and Vieru (2016); Siegal et al. (2016); Chipps et al. (2015).

Appendix 5 : Comparison of research Paradigms (Saunders et al., 2009, p.74)

	Fundamental beliefs			
Research Paradigms	**Ontology**	**Epistemology**	**Axiology**	**Data collection techniques**
Positivism	External, objective and independent of social actors.	Only observable phenomena can provide credible data and facts. Focus on causality and law-like generalizations, reducing phenomena to the simplest elements.	Value-free research is undertaken in a value-free way. The researcher is independent of the data and maintains an objective stance.	Highly structured, large samples, measurement, quantitative, but can use qualitative.
Interpretivism	Socially constructed, subjective, may change, multiple.	Subjective meanings and social phenomena. Focus upon the details of the situation, the reality behind these details, subjective meanings, and motivating actions.	Research is value bound. The researcher is part of what is being researched, cannot be separated and so will be subjective.	Small samples, in-depth investigations, qualitative.
Realism	Objective. Exist independently of human thoughts and beliefs or knowledge of their existence but are interpreted through social conditioning (critical realist).	Only observable phenomena can provide credible data and facts. Focus on explaining within a context or contexts.	The researcher is biased by world views, cultural experiences, and upbringing. These will impact the research.	Methods chosen must fit the subject matter, quantitative or qualitative.
Pragmatism	External, multiple, views are chosen to best achieve an answer to the research question.	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data.	Values play a large role in interpreting results; the researcher adopts both objective and subjective points of view.	Quantitative and qualitative (mixed or multimethod design).

Appendix 6 : Streams of Critical research (Source: Myers and Klein, 2011)

	Bourdieu	Foucault	Habermas
Lineage (sources of influence)	Marx, Durkheim, Weber, Saussure, Wittgenstein, Canguilhem (Harker et al. 1990). Early work also strongly influenced by French structuralism (e.g., Levi-Strauss) and later by Heidegger.	Nietzsche, Heidegger (Brocklesby and Cummings 1996), and Canguilhem (Macey 2000).	Kant then Hegel and Marx (Brocklesby and Cummings 1996), followed by Nietzsche.
Main research focus	Forms of behavior—that appear to be spontaneous and natural—that are in fact socially conditioned; the power of symbolic systems and their domination over the construction of reality; hidden mechanisms of reproduction of social and cultural practices (Macey 2000).	Discursive practices from the perspective of history of epistemology and theory of knowledge; he described himself as a "specialist in the history of systems of thought" (Macey 2000, p. 133).	*Until about 1973:* Philosophical examination of the relationship between knowledge and human interests; a reconsideration of the validity of natural science methods for the social and cultural sciences. *After 1973:* Communicative action as the basis of modern societies.
Espoused values	Explicit values are consistent with but not explicitly derived from the enlightenment ideal (e.g., participatory democracy, non-exploitative working conditions, and open education).	Explicitly skeptical of the viability of the enlightenment ideal as revealed in the debate with Habermas, but believed that local and individual emancipation may be possible.	Explicit commitment to complete the unfinished project of enlightenment with endorsement of its linearity based on Kant.
Important concepts	Habitus, field, social, cultural and symbolic capital (Harker et al. 1990).	Discourse; archaeology and genealogy of knowledge, and panopticon.	Cognitive interests, communicative action and strategic action; lifeworld and systems.
Research approach	Ethnographic field studies of exploitative work practices in Algeria and under-representation of working class children in tertiary education in France.	Detailed historical studies of institutions such as the birth of the clinic and the functioning of the penal system revealing the interdependence of knowledge and power in discursive social practices	Applying concepts from the history of social philosophy to rational reconstruction of self-formative processes resulting in cognitive interest theory. Later the complete reformulation of critical social theory in the theory of communicative action.

Appendix 7: Ethics approval Letter: University of Cape Town (Faculty of Commerce)

Faculty of Commerce

Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
Tel: +27 (0) 21 650 4375/ 5748 Fax: +27 (0) 21 650 4369
E-mail: com-faculty@uct.ac.za
Internet: www.uct.ac.za
@Commerce_UCT **UCT Commerce Faculty Office**

12 April 2017

Ms Meke Kapepo
Department of Information Systems
University of Cape Town

Dear Ms Kapepo

Project: Investigating the use of electronic referrals to facilitate the specialty-referral process in the public health sector: a developing country context

Thank you for submitting your study to the Faculty of Commerce Ethics in Research Committee.

It is a pleasure to inform you that the EiRC has **formally approved** the above-mentioned study.

Approval is granted for the period of 12 months. Should you require an extension or make any substantial changes to the research methodology which could affect the experiences of participants, you must submit a revised protocol to the Committee for approval.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Your sincerely

SAMANTHA ALEXANDER
Administrative Assistant
University of Cape Town
Commerce Faculty Office
Room 2.24 | Leslie Commerce Building

Office Telephone: +27 (0)21 650 2695
Office Fax: +27 (0)21 650 4369
E-mail: samantha.alexander@uct.ac.za
Website: www.commerce.uct.ac.za<http://www.commerce.uct.ac.za/>

Appendix 8: Ethics approval Letter: University of Cape Town (Faculty of Health Sciences)

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E3-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

10 March 2017

HREC REF: 104/2017

Prof J van Belle
Department of Information Systems

Dear Prof J van Belle

PROJECT TITLE: INVESTIGATING THE USE OF ELECTRONIC REFERRALS TO FACILITATE THE SPECIALTY-REFERRAL PROCESS IN THE PUBLIC HEALTH SECTOR: A DEVELOPING COUNTRY CONTEXT (PhD-candidate M Kapepo)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

Before formal approval, please address or respond to the following issues:

1. In the informed consent form, please provide more information concerning what type of questions will be asked. Please also include any risks or benefits of participation even if none. Please also include HERC contact details, rights to refuse participation. Please refer to the HREC guidelines for informed consent.

We acknowledge that the student, M Kapepo will be involved in this study.

Please note that no research may occur without formal written HREC approval.

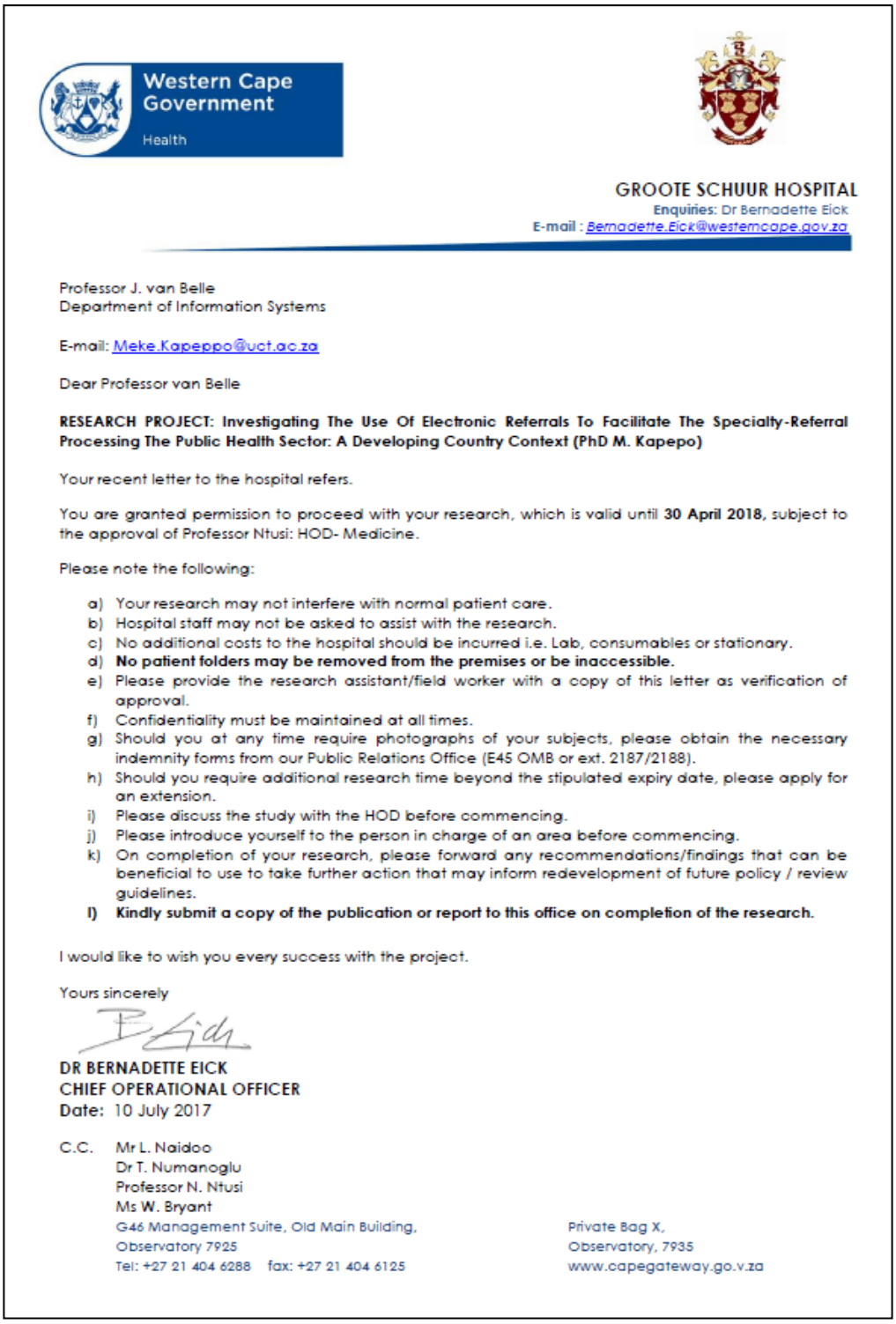
Please quote the HREC reference number in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Hrec/ref;104/2017

Appendix 9: Ethics approval for Hospital A, Western Cape Government (Department of health)



Western Cape Government
Health

GROOTE SCHUUR HOSPITAL
Enquiries: Dr Bernadette Eick
E-mail : Bernadette.Eick@westerncape.gov.za

Professor J. van Belle
Department of Information Systems

E-mail: Meke.Kapeppo@uct.ac.za

Dear Professor van Belle

RESEARCH PROJECT: Investigating The Use Of Electronic Referrals To Facilitate The Specialty-Referral Processing The Public Health Sector: A Developing Country Context (PhD M. Kapepo)

Your recent letter to the hospital refers.

You are granted permission to proceed with your research, which is valid until **30 April 2018**, subject to the approval of Professor Ntusi: HOD- Medicine.

Please note the following:

a) Your research may not interfere with normal patient care.
b) Hospital staff may not be asked to assist with the research.
c) No additional costs to the hospital should be incurred i.e. Lab, consumables or stationary.
d) **No patient folders may be removed from the premises or be inaccessible.**
e) Please provide the research assistant/field worker with a copy of this letter as verification of approval.
f) Confidentiality must be maintained at all times.
g) Should you at any time require photographs of your subjects, please obtain the necessary indemnity forms from our Public Relations Office (E45 OMB or ext. 2187/2188).
h) Should you require additional research time beyond the stipulated expiry date, please apply for an extension.
i) Please discuss the study with the HOD before commencing.
j) Please introduce yourself to the person in charge of an area before commencing.
k) On completion of your research, please forward any recommendations/findings that can be beneficial to use to take further action that may inform redevelopment of future policy / review guidelines.
l) **Kindly submit a copy of the publication or report to this office on completion of the research.**

I would like to wish you every success with the project.

Yours sincerely

DR BERNADETTE EICK
CHIEF OPERATIONAL OFFICER
Date: 10 July 2017

C.C. Mr L. Naidoo
Dr T. Numanoglu
Professor N. Ntusi
Ms W. Bryant

G46 Management Suite, Old Main Building,
Observatory 7925
Tel: +27 21 404 6288 fax: +27 21 404 6125

Private Bag X,
Observatory, 7935
www.capegateway.go.v.za

Appendix 10: **Ethics approval for Hospital B, Western Cape Government (Department of Health)**

Western Cape Government
Health

TYGERBERG HOSPITAL
REFERENCE:
Research Projects
ENQUIRIES: **Dr GG Marinus**
TELEPHONE:**021 938 5752**

Ethics Reference: 104/2017

TITLE: **INVESTIGATING THE USE OF ELECTRONIC REFERRALS TO FACILITATE THE SPECIALTY-REFERRAL PROCESS IN THE PUBLIC HEALTH SECTOR: A DEVELOPING COUNTRY CONTEXT (PhD-candidate M Kapepo)**

Dear Prof van Belle

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL.

1. In accordance with the Provincial Research Policy and Tygerberg Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Tygerberg Hospital.

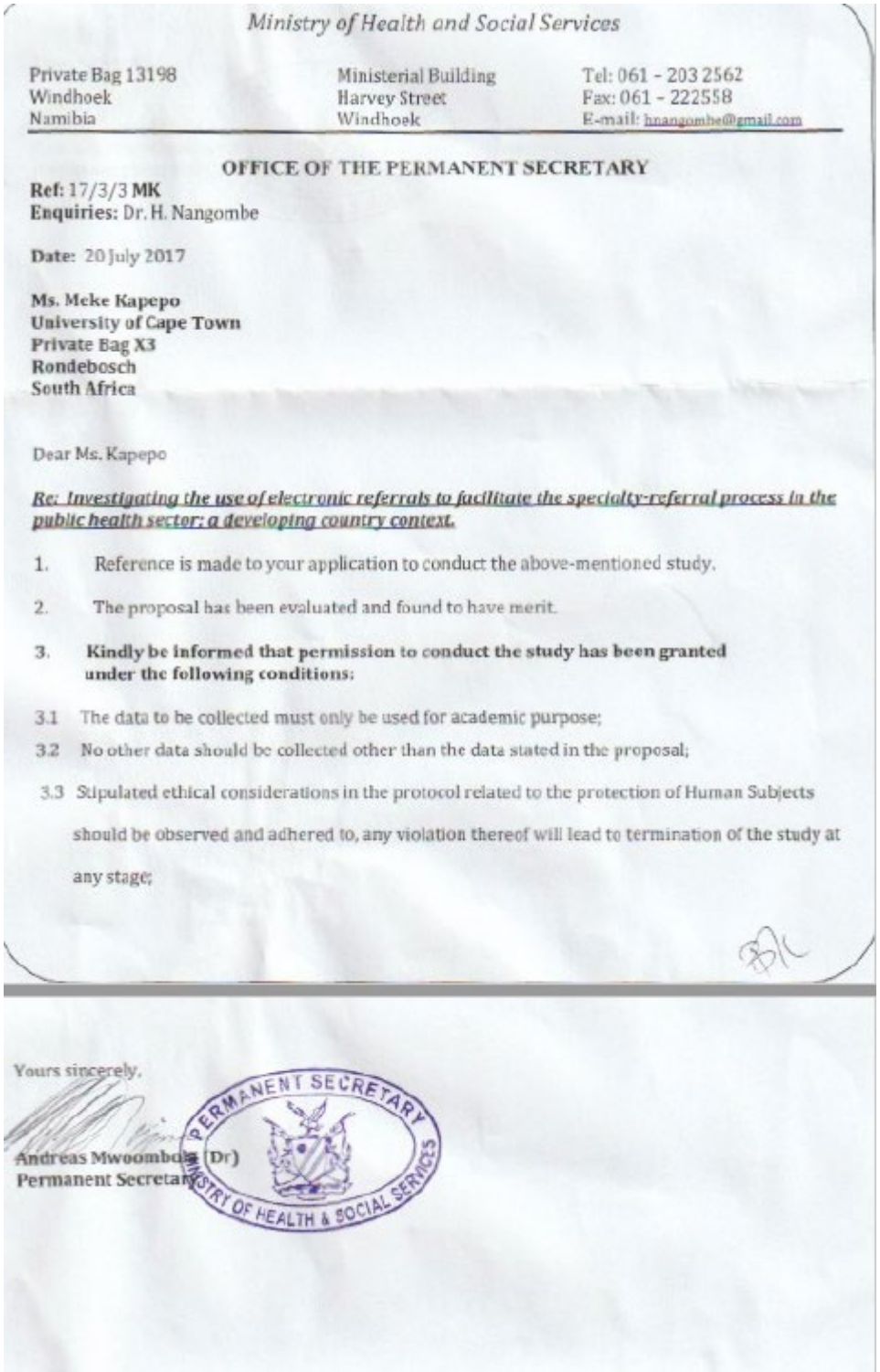
2. Researchers, in accessing Provincial health facilities, are expressing consent to provide the Department with an electronic copy of the final feedback within six months of completion of research. This can be submitted to the Provincial Research Co-Ordinator (Health.Research@westerncape.gov.za).

DR GG MARINUS
MANAGER: MEDICAL SERVICES

DR D ERASMUS
CHIEF EXECUTIVE OFFICER
Date: 24/8/17

Administration Building, Francie van Zijl Avenue, Parow, 7500 Private Bag X3, Tygerberg, 7505
tel: +27 21 938-6267 fax: +27 21 938-4890 www.capegateway.gov.za

Appendix 11: Ethics approval Ministry of Health and Social Services, Windhoek, Namibia



Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 - 203 2562
Fax: 061 - 222558
E-mail: hnangombe@gmail.com

OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3 **MK**
Enquiries: Dr. H. Nangombe

Date: 20 July 2017

Ms. Meke Kapepo
University of Cape Town
Private Bag X3
Rondebosch
South Africa

Dear Ms. Kapepo

Re: Investigating the use of electronic referrals to facilitate the specialty-referral process in the public health sector: a developing country context.

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**

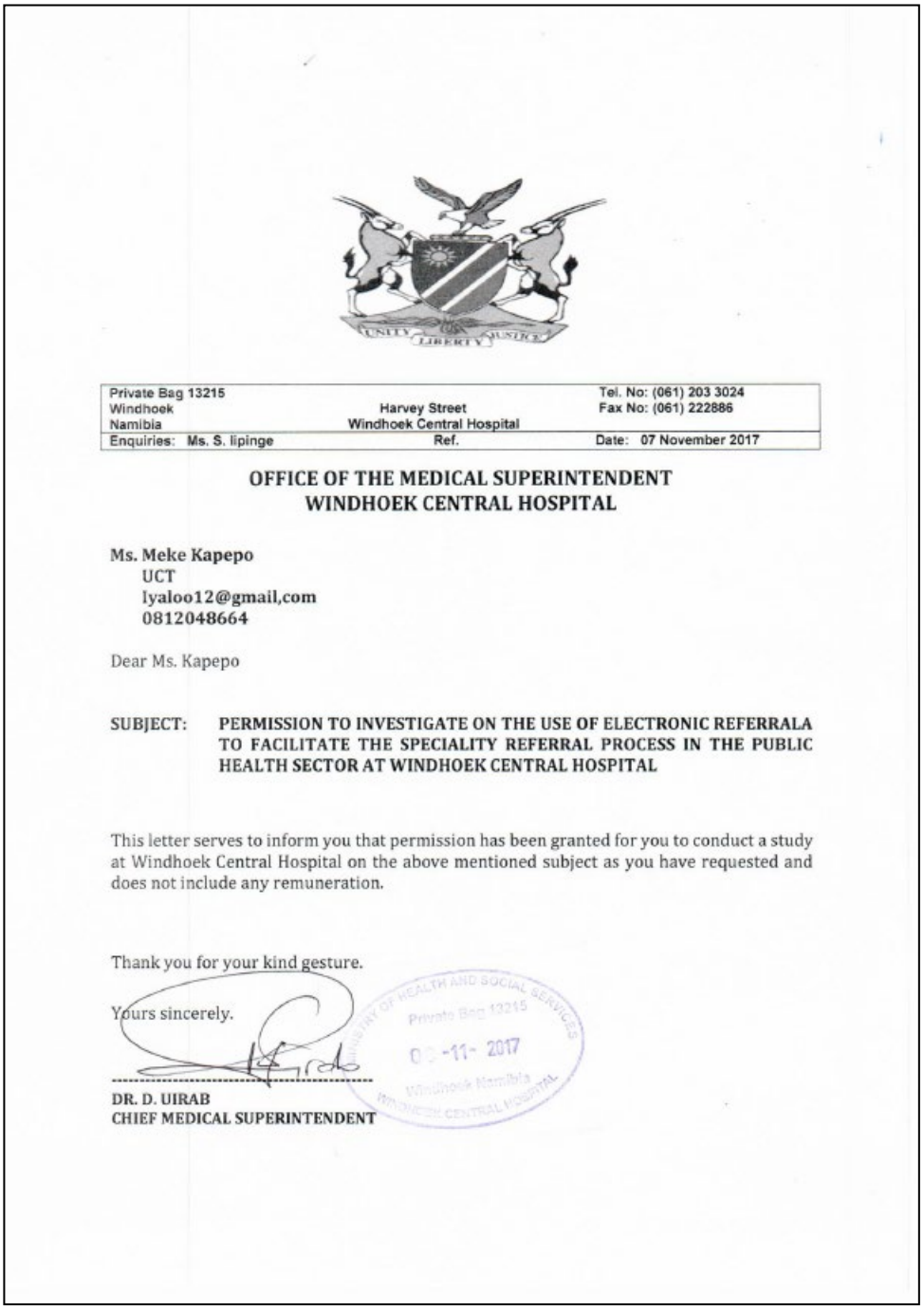
3.1 The data to be collected must only be used for academic purpose;
3.2 No other data should be collected other than the data stated in the proposal;
3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;

Yours sincerely,

Andreas Mwoombola (Dr)
Permanent Secretary

PERMANENT SECRETARY
MINISTRY OF HEALTH & SOCIAL SERVICES

Appendix 12 : Permission to conduct research in Hospital C (Windhoek Central Hospital)



Private Bag 13215 Windhoek Namibia	Harvey Street Windhoek Central Hospital	Tel. No: (061) 203 3024 Fax No: (061) 222886
Enquiries: Ms. S. Iipinge	Ref.	Date: 07 November 2017

OFFICE OF THE MEDICAL SUPERINTENDENT
WINDHOEK CENTRAL HOSPITAL

Ms. Meke Kapepo
UCT
lyaloo12@gmail,com
0812048664

Dear Ms. Kapepo

SUBJECT: **PERMISSION TO INVESTIGATE ON THE USE OF ELECTRONIC REFERRALA TO FACILITATE THE SPECIALITY REFERRAL PROCESS IN THE PUBLIC HEALTH SECTOR AT WINDHOEK CENTRAL HOSPITAL**

This letter serves to inform you that permission has been granted for you to conduct a study at Windhoek Central Hospital on the above mentioned subject as you have requested and does not include any remuneration.

Thank you for your kind gesture.

Yours sincerely.

DR. D. UIRAB
CHIEF MEDICAL SUPERINTENDENT

Appendix 13: Ethics Application renewal for Study Phase 2

UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938) This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30/11/2020
☐ Not approved	See attached comments		
Signature Chairperson of the HREC		Date Signed	14/11/2019

Comments to PI from the HREC
Thank you for the deviation request

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	04/11/2019		
HREC REF Number	104/2017	Current Ethics Approval was granted until	30th April 2019
Protocol title	Investigating the use of electronic referrals to facilitate the specialty-referral process in the public health sector: a developing country context		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	☐ Yes ☐ No		
If yes, could you please provide the HREC Ref's for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.			
Principal Investigator	Prof. Jean-Paul Van Belle		
Department / Office Internal Mail Address	Information systems		

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

FHS016
HUMAN RESEARCH ETHICS COMMITTEE
11 NOV 2019
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

Appendix 14: Informed consent

Department of Information Systems
Leslie Commerce Building
Engineering Mall, Upper Campus
OR
Private Bag X3 - Rondebosch - 7701
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21 650 2280
Internet: http://www.commerce.uct.ac.za/informationsystems/

PARTICIPANT CONSENT FORM

Thesis Title: Investigating the use of electronic referrals to facilitate the specialty-referral process in the public health sector: a developing country context.

June 2020

My Name is Meke Kapepo, and I am a student at the University of Cape Town, studying towards a PhD in Information systems. I would like you to participant in my study that aims to investigate the use of electronic referrals to facilitate the patient referral process in Southern African public hospitals. Your institution has been selected as one of the case studies in South Africa. Another case study will be conducted in Namibia.

The purpose of this study is thus to investigate the use of electronic referrals (phenomenon of interest) for facilitating the patient referral process in public hospitals (empirical situation). The study also seeks to examine workaround practices to mandated health information systems to understand why they occur and how they affect referral outcomes. The results of this study will be used to as a proposed guidelines to practitioners in Namibia and South Africa on how to improve the referral process outcomes.

Your participation in this interview will assist me in gaining insight and achieving the above-mentioned study objectives. Due to COVID-19 and regulations related to social distancing, an option for a telephonic or electronic interview (Ms Teams, Zoom, Skype or Tool of the participant's choice) is also available. This interview will take approximately 20 -25 minutes.

Participation in this study is voluntary and you may withdraw at any time. The results of this study will be used for research purposes only and confidentiality and privacy of participants will be protected by anonymizing results.

If you require information regarding your right as a participant, or complaints regarding this study, you may contact.

Researcher: Meke Kapepo
Email address: iyaloo12@gmail.com/meke.kapepo@uct.ac.za
Office number: (+27) 0216502199

Supervisor: Prof Jean Paul-Van Belle
Department of Information Systems
Email address: Jean-Paul.Van Belle@uct.ac.za
Office number: (+27) 0216504256

Co-Supervisor: Prof Edda Weimann
The University of Cape Town and Groote Schuur Hospital
Western Cape Government: Health
Email address: Edda.Weimann@westerncape.gov.za
Office number: (+27) 021-404 3175

Declaration by participant

I..... (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

_____ _____

Signature of participant Date

Appendix 15: Initial Interview guides

INTERVIEW GUIDES

SECTION A: Head of Departments

General information

1. Public hospital name and type:
2. Department:
3. Position/ role:
4. How long are you employed in this public hospital:

Part 1

1.1. Briefly describe the referral process.
1.2. Which facilities do you receive your referrals from?
1.3. Who are the health care providers involved in this process?
1.4. Briefly explain the roles of these specialists in the referral process.
1.5. Who else is involved in the referral process?
1.6. Are there healthcare providers that do not use any means communication mentioned and why?
1.7. Who is in charge of the referral system in your institution?
1.8. What means of communication of communication are used by your department to facilitate patient referrals?
1.9. Have experienced any constraints in using these means of communication?
1.10. In your opinion is the current referral process working?
1.10.1. **If No**, what needs to be improved?
1.9 Are there any protocols or guidelines that guide the referral process?
1.10. What are the rules and regulations that guide healthcare providers with regard to different types of referrals (Paper-based and e-referrals) in public hospitals?

SECTION B: Specialists and Referring providers

General information

1. Public hospital name and type:
2. Department:
2. Position/ role:
3. How long are you employed in this public hospital:

Part 1: An activity system – Understanding the referral process

<table>
<tr><th>Specialists</th><th>Referring providers</th></tr>
<tr><td colspan="2">1.1. Briefly describe the specialty-referral process? What activities are you are involved in?

1.2. How do you keep a record of patient referral information?

1.3. Do you encounter inefficiencies in the current referral process?

1.3.1. IF So, what are the inefficiencies and what causes these inefficiencies?</td></tr>
<tr><td>1.4. What means of communication/collaboration do you use to receive referrals?

1.5. What means of communication are used to deal with counter-referrals?

1.6. How would you define an efficient and effective referral process?

1.7. Do you have any computer systems that assist with recording patient referral information?
<table><tr><td>Yes</td><td>No</td></tr></table>
1.8. In your opinion, what are the main reasons why the referrals sometimes do not make it in time to you?

1.9. Do any electronic referrals solutions help you manage triage referrals and how?</td><td>What means of communication do you use to refer cases?

Do you routinely use this means of communication to alert the next level of care when a referral is made?

How much time does it take for a referred patient to reach a specialist?

In your opinion, what are the main reasons why the referrals sometimes do not make it in time to specialists?</td></tr>
</table>

Part 2: Actors and their roles in the referral process

Specialists	Referring providers
2.1. To which health facility do you usually receive cases? 2.2. How frequently do you receive referred patients? 2.3. How do use the means of communication to manage collaboration of referrals with referring providers?	To which health facility do you usually refer cases? How frequently do you refer patients? How do use the means of communication to manage collaboration of referrals with specialists?

Part 3: Tools: e-referral solutions

Specialists	Referring providers
3.1. What tools are used to mediate healthcare provider's activities in the referral process? 3.2. If using e-referrals systems, How long (in months) have you been using electronic referral systems?	
3.3. Which of the systems are used to support patient referrals?	3.4. How frequently do you use electronic tools to refer patients? 3.5. Which of the systems are used to support patient referrals?
3.6. Is there a system in place that is used record and monitor the time lapse between when a referral was made and when a client reached the receiving facility? IF SO, can you please elaborate how the system works? 3.7. Do these tools help you to facilitate communication and collaboration with other healthcare providers? How? 3.8. In your opinion what needs to be done to improve the referral process outcomes? Interplay between different activity systems.	

Part 4: Structures and institutional factors

Specialists/ referring provider
4.1. Who decides which electronic systems to be used in hospitals? Who decides how it should be used? [who should be involved in your opinion] 4.2. Are there cases where you would prefer to use a particular referral mode? [paper-based or electronic] Please explain why 4.3. If preference is selected to use a certain mode, do you have channels in place to voice your suggestions, preferences, please clarify]. 4.4. Do you know of any policy by the MOH on the use of electronic referral systems? 4.5. Is the role of the current electronic systems enhancing the referral process in the hospitals? 4.6. To what extent are electronic referral solutions integrated into referral practices? 4.7. Has the use of referral solutions transformed your practice? If So, How? 4.8. Has the referral solutions changed your work routine? If so, How? 4.9. Are there any referral protocols or guidelines that govern the referral process? 4.10. In what ways does the use of referral solutions enable your tasks? 4.11. In what ways does the use of referral solutions constrain your tasks?

SECTION C : Administrative personnel

General information

1. Public hospital name and type:
2. Department name:
3. Position/ role:
4. How long are you employed in this public hospital:

Part 1:

1.1. What are the challenges and barriers that confront the realization of an efficient referral process?
1.2. What electronic referral solutions do primary healthcare providers use to mediate collaboration with specialists?
1.3. Are there system manuals for referral solutions used?
1.4. What support do you provide in the referral process?
1.5. How do the system manuals enable use of e-referrals for healthcare providers?
1.6. Do the system manuals constrain use of e-referrals by healthcare providers?
1.6.1. If so how?

Appendix 16: Revised interview-guide

INTERVIEW GUIDES

General information

1. Public hospital name and type:
2. Department:
3. Position/ role
4. How long are you been employed in this public hospital

SECTION A: referring providers

Part 1: An activity system – Understanding the referral process

1.1 I understand you are in one way or another involved in the referral process. Can you briefly describe an ideal referral process for me?
1.2 What constraints/challenges do you experience in the current referral process?
1.3 What do you aim to achieve at end of this process?
1.4 How do you keep a record of patient referrals?
1.5 What are the intended outcomes of the referral process?
1.6 When outcomes of the referral process are not achieved, what measures are put in place to meet these outcomes?

Part 2: Actors and their roles in the referral process

2.1. Who are the health care providers involved in this process? What are their role in the process?

Part 3: Tools: e-referral solutions

3.1. What current referral modalities do you use to send referrals to other healthcare providers?
3.1.1. Why do you choose these tools over other modes e.g. telephone, referral notes etc. Please describe any challenges you have experienced by using these current modes?
3.2. What electronic means of communication do you currently use to send referrals?
3.3. Are there specific tools important specifically for the type of work you do?
3.3.1. If yes; what benefits do these system offer?
3.3.1.1. How does the use of these tools enable your work practice?
3.3.1.2. If no; Do these tools constraint your work??

PART 4: Workarounds and Augmenting

4.1. When you experience constraints with the current modalities, what alternative tools do you use to accomplish your work?
4.2. When constraints are unresolved, how do you adapt ensure referrals are completed?
4.3. Do you use alternative ways to refer patients when certain tools don't work?
4.4. How do you use other referral modes to purposely and effectively complete your work?
4.5. What other additional work do you undertake to make up for any lack of resources to complete your work?
4.6. Do you achieve any referral outcomes as a result of using the current referral tools?
4.7. Do you use a combination of tools to complete referrals?

PART 5: General Questions

5.1.Are there instances where you would prefer to use a particular referral mode? [paper-based or electronic] Please explain why.
5.2. To what extent are electronic referral solutions are integrated into your work practices?
Has the use of referral solutions transformed your practice? If So, How?
5.3. When desirable referral outcomes are not achieved, how are areas of improvement identified or recommended to developers?
5.4. Are there any referral protocols or guidelines that govern use of referral tools?
5.7. Before we conclude this interview, are any other issues you would like to talk about that we had not had a chance to discuss?

SECTION B : IT Personnel

General information

1. Public hospital name and type:
2. Department name:
3. Position/ role:
4. Employment duration:

PART 1:

1.1. Briefly explain to me the systems used in hospitals for patient referrals?
1.2. Before the implementation of these electronic systems in the hospital, What e-referral modalities were used by HCPs?
1.3. What benefits are offered by these systems?
1.4. When benefits of these systems are not realised by end-users, what does It have
1.5. What does the IT department aim to achieve by implementing these systems?
1.6. How is the uptake by healthcare providers? Are there any constraints to use e-referrals?
1.7. What are the benefits of these systems?
1.8. Are there any issues that healthcare providers have raised with the current referral modes? Please explain?
1.9. Please describe any issues that have been flagged specifically with e-referral systems. (e.g. any issues with regards to the design , adoption, end-user buy in)
1.10. Are you aware of any third-party systems used in this hospital ?
1.11. What issues were raised with use of these systems?
1.12. When constraints are experienced with e-referrals, are they highlighted to the IT department? How are these resolved?
1.13. Are there guidelines or procedures on managing third party systems?
1.14. What kind of support do you provide to end-users utilising e-referrals?
1.15. How is the use of any e-referrals regulated? Are there any rules or procedures?

SECTION C: Specialists

Part 1:General questions

1.1. Briefly describe the specialty-referral process? What activities are you are involved in?

1.2. How do you keep a record of patient referral information?

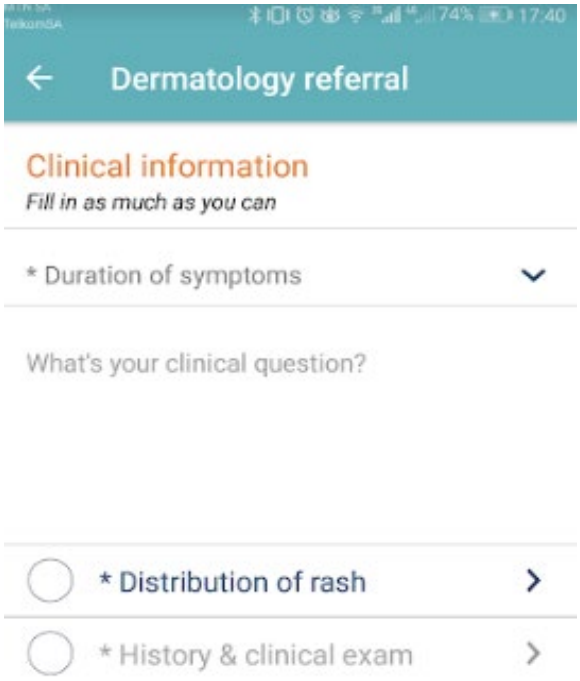
1.3. Do you encounter inefficiencies in the current referral process?

1.3.1. If so, what are the inefficiencies and what causes these inefficiencies?
1.4. What means of communication/collaboration do you use to receive referrals?
1.5. What means of communication are used to deal with counter-referrals?
1.6. How would you define an efficient and effective referral process?
1.7. Do you have any computer systems that assist with recording patient referral information?
Yes No
1.8. In your opinion, what are the main reasons why the referrals sometimes do not make it in time to you?
1.9. Do any electronic referrals solutions help you manage triage referrals and how?

Part 2: Referrals and tools

2.1. To which health facility do you usually receive cases?
2.2. How frequently do you receive referred patients?
2.3. How do use the means of communication to manage collaboration of referrals with referring providers?
2.4. What tools are used to mediate healthcare provider's activities in the referral process?
2.5. How long (in months) have you been using electronic referral systems?
2.6. Which of the systems are used to support patient referrals?
2.7. Which of the systems are used to support patient referrals?
2.8 Is there a system in place that is used record and monitor the time lapse between when a referral was made and when a client reached the receiving facility?
IF SO, can you please elaborate how the system works?
2.9. Do these tools help you to facilitate communication and collaboration with other healthcare providers? How?
2.10. In your opinion what needs to be done to improve the referral process outcomes?
Interplay between different activity systems.

Appendix 17: Vula interface (Observation)



Appendix 18: Research code manual

Code label	Definition	Description
Collective Work activity	A systemic entity comprising several elements which must fit together to some extent.	A referral system or work system is a systemic entity comprising various elements that work together.
Collective Actors: Groups, Team, Community of practice	Collective Actors are members of a working group or team carrying out collective tasks. Specific tasks individually or in a team.	A collective team of healthcare providers is involved in the referral process. specialists, medical Officers, supernumerary and nurses.
Means of Coordination and Communication: division of work and rules. **Means of work**	This includes predetermined documentation, and mediating instruments "social infrastructure" needed within the activity. The tools used by actors to work on their objects.	This includes a mention of policies, standard operating procedures, and tools. Different kinds of tools, facilities or artefacts including mental skills, and knowledge. Where actors source referral information needed in the referral process, how they use referral information and how they record new information. E.g., referral registers, e-referrals, or any health Information systems.
Subjects/Actors: Individuals or Groups	Actors or groups carry out specific tasks individually or in a team.	Actors and subjects are the individual health providers (referring providers, specialists, nurses, doctors) whose activities are being mediated by tools/Instruments (e-referral applications) to achieve improved referral process outcomes which is the specific goal of action.
Work process	Individual and groups conduct activities that form part of the work process.	Referral process conducted by healthcare providers within an activity, the information flows and information management– consisting of various activities
Object	An object is the target of the actor's actions.	The object is the objective of e-referrals.
Contradictions	Imbalances within and between various elements of the activity system.	Contradictions are types of misfits that occur between various elements, or between one element and the common mode of operations within a work activity.

Appendix 19: Query results from Document Analysis

Query Results

Search Project

Name	Files	References
Doc Analysis ehealth	2	287
Doc Analysis Intersectoral	1	1
Doc Analysis_pathways	1	7
Doc Analysis_procedures	6	115
Doc_Analysis _ Triage	1	4
Doc_analysis Downward	2	4
DoC_Analysis HIS	4	24
Doc_Analysis internet	4	13
Doc_analysis Outpatient	2	18
Doc_Analysis Second opinion	1	2
Docanalysis Booking	4	49
DocAnalysis_pathways	1	13
Document analysis queries_Downward referrals	5	122
Document analysis_ICT	4	63

Appendix 20 : ActAD and Design-reality frameworks and description of concepts employed in the research

Theoretical framework	Theoretical concepts	Description of concept
Activity Theory and the ActAD Framework (Mursu et.al., 2007)	**Activity**	Tasks undertaken by actors or subjects in the work activity
	Actors/Subjects	A person or group of people engaged in an activity in order to achieve an outcome
	Group/Team/Community of practice	A social group or team of professionals who share the dame object and are involved in the activity
	Division of labour	The roles and responsibilities within a community
	Means of coordination and communication; Means of work	Physical or mental means used to coordinate or facilitate actions of subjects
	Work process	The sequence and combination of actions undertaken by subjects to achieve the object.
	Tools	The resources and instruments that are used to mediate the activity
	Rules	The norms and regulations that govern the activity
	Object	The objective, goal of the activity that is transformed to achieve an outcome
	Outcome	The result of the activity when object is transformed
	Contradictions	Imbalance within and between various elements of the work activity
Design-reality gap framework (Albertus and Makoza (2023)	**Information**	Information relates to formal or standardized and informal use of information and knowledge that enhances the value to people or organisations.
	Technology	Technology includes hardware, software, and networks that facilitate the use information systems.
	Processes	Processes are interrelated activities or tasks that are carried out to achieve the goals of using the system.
	Objectives and values	Objectives and values are related to the established rules and logic which a system may embody and as well as self-interests and hidden agendas of the system's stakeholders.
	Staffing and skills	Staffing and skills refer to the individuals or groups involved in the activities associated with the information systems.
	Management and structures	Management and structures refer to the systems and structures that support the strategic decisions of organisations or groups of people
	Other resources	Financial or time related resources
	Privacy and security; Ethical issues	legislation and legal frameworks that support protection of privacy of individuals when using technology

Appendix 21: The SEIPS model and Process framework for healthcare IS workarounds and impacts (description of concepts employed in the research)

Theoretical framework	Theoretical concepts	Description of concept
Systems Engineering Initiative for Patient Safety (SEIPS 3.0) model (Yang et., al 2012)	**Work system**	The system within which healthcare activities occur
	Socio-organisational context	The socio-organisational context within which the tools are deployed and used
	Tasks	The tasks and activities performed within the work system
	Tools and technologies	Tools, devices, and information systems used in a healthcare setting
	Organisational conditions; Physical and External environment	The physical and contextual setting where care and services are provided and where tools are utilised to facilitate care or services
	Patient safety	Practices aimed at preventing harm to patients during the course of healthcare service delivery
	Patients	Individuals who receive or are eligible to receive medical care, treatment, or services from healthcare professionals.
	Care givers	Individuals who help and support patients (e.g. family members, friends, or professional healthcare providers,)
	Clinicians	Healthcare professionals who render care and services to patients.
	Healthcare organisations	Institutions or entities who provide medical services, health-related support, or management of health care systems to individuals or communities
Process framework for healthcare IS workarounds and impacts (Carayon, et al., 2020)	**Issues with existing approach**	Issues or limitations of existing approaches in a given healthcare setting.
	Benefits of the system	Benefits the health information system can provide to users to achieve some outcome.
	Issues of the systems	Issues or limitations associated with the health information system
	Unresolved issues	Issues or limitations that are unresolved by management and they have a possibility to reduce the benefits of the system.
	Augmenting	Undertaking additional work to make up for a misfit between an IT artefact and user needs
	Workingaround	Subversion of the official system by users to overcome system issues or limitations
	Fitting	An activity or task of changing the structure of work or computing to accommodate technical misfits
	Impact	Positive or negative impacts that are result of workarounds, augmenting and fitting.