STRENGTHENING PUBLIC HEALTH MANAGEMENT SYSTEM (PHMS) THROUGH THE INTEGRATION OF HEALTHCARE SYSTEMS IN LESOTHO

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Approval of the Thesis

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Abstract

STRENGTHENING PUBLIC HEALTH MANAGEMENT SYSTEM (PHMS) THROUGH THE INTEGRATION OF HEALTHCARE SYSTEMS IN LESOTHO

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The research aims to show that the integration of Information Technology (IT)-based healthcare information systems across healthcare facilities is a strategy that can strengthen the digital Public Health Information Management System (PHIMS) for Lesotho. The problem is that the delivery of healthcare services is not integrated and, therefore, is risky to patients. Three research questions guided the study: a) To what extent do the challenges encountered by healthcare professionals during the provision of care, affect the quality and safety of care? b) What are the appropriate critical success factors for a PHIMS to ensure efficiency? c) How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency? A case study design was adopted to conduct the research, where data were collected through interviews and a focus group meeting.

The Purposive Sampling Method was used to select the research participants to ensure that full insights regarding the healthcare services delivery would be gathered from experienced participants. Notably, due to the COVID-19 pandemic, interviews and focus group deliberations were conducted virtually. Data analysis was performed using thematic analysis techniques, in which after data were transcribed, similar phrases and ideas were categorised into codes, which were further clustered into themes, which were used to interpret the phenomenon under study.

Moreover, the findings reveal that firstly, the challenges encountered by healthcare professionals during the provision of care that compromise the safety and care of the patients are poor management of medical records, unavailability of historical data, and poorly designed Health Information Systems (HIS). Secondly, the critical success factors for an efficient PHIMS are good management of patient records, patient-oriented HIS, and functional HIS. Lastly, the findings indicate that a legal/policy framework is needed to regulate the implementation of a PHIMS and to provide policy guidance for smooth implementation.

Consequently, the research recommends that healthcare facilities migrate their patients' medical records from paper-based to electronic. Moreover, a legal/policy framework must be developed to regulate and provide policy guidance for the implementation of the PHIMS. Furthermore, the research recommends a future study to determine how artificial intelligence can support the envisaged PHIMS to enhance healthcare services delivery and medical research.

Declaration

I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification except as specified.

AI Acknowledgment

Non-Use of AI:

I acknowledge that I have not used any AI tools to create, proofread or produce any text or ideas related to any draft or final versions of the thesis.

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Dedication

This work is dedicated to my family, who supported me throughout the research project over the years, especially my wife, for her patience and editing skills that made my work readable to my target audience.

Acknowledgements

I acknowledge the assistance that my wife provided me throughout the research project in finding time to edit my work to facilitate clean submissions. I recognise my friends who gave me the courage to continue even when I felt I was wasting my time because the work was just getting too cumbersome.

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List of Abbreviations

ACRONYM	**DEFINITION**
Admin	Administration
AI	Artificial Intelligence
CHAL	Christian Health Association of Lesotho
CIS	Clinical Information System
DHIS2	District Health Information System2
EHR	Electronic Health Record
EMR	Electronic Medical Record
FIS	Financial Information System
GOL	Government of Lesotho
HCP	Health Care Professional
HF	Health Facility
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HIMS	Health Information Management Systems
HSS	Health Systems Strengthening
HQ	Head Quarters
ICAP	International Centre for AIDS Care and Treatment Programs
ICT	Information and Communications Technology
ID	Identification Document
IHR	International Health Regulations
IS	Information Systems

ACRONYM	**DEFINITION**
IT	Information Technology
LIS	Laboratory Information System
LPHIMS	Lesotho Public Health Information Management System
LRCS	Lesotho Red Cross Society
MCC	Millennium Challenge Corporation
MOH	Ministry of Health
NHIS	National Health Information System
NHS	National Health System
NIS	Nursing Information Systems
OPD	Outpatient Department
PACS	Picture Archiving Communication System
PHIMS	Public Health Information Management System
PHR	Personal Health Record
PIS	Pharmacy Information System
PIS	Physician Information Systems
PPP	Public Private Partnership
PWC	Price Waterhouse Coopers
REC	Research Ethics Committee
RIS	Radiology Information System
SRH	Sexual and Reproductive Health
TB	Tuberculosis
UHC	Universal Health Coverage

ACRONYM	DEFINITION
UK	United Kingdom
UPI	Unique Patient Identifier
WHO	World Health Organisation

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CHAPTER 1: INTRODUCTION

Overview

Lesotho is a mountainous country with ten districts, divided into lowlands and highlands. There is at least one Hospital in each district owned by either the Government or the Christian Health Association of Lesotho (CHAL). On the other hand, in the capital city, Maseru, there is one referral hospital and several other hospitals privately owned by institutions, groups of individuals or a consortium of companies. Furthermore, in each district, there are healthcare facilities known as health centres that offer primary healthcare, and transfer patients to district hospitals for specialised care. The health centres are available in the communities within the catchment area of a hospital and get their support at the district hospitals. The Lesotho healthcare service delivery is divided into three levels (Ministry of Health, 2016), the Primary Healthcare Level: where health centres offer healthcare services at the community level; the Secondary Healthcare Level: where healthcare services are provided by the district hospitals; and Tertiary Healthcare Level: which is a referral hospital that supports hospitals at the districts. Moreover, because of the availability of health centres in the communities, potential patients are free to seek healthcare services at any healthcare facility, when the need arises.

At all levels of healthcare in the country, each facility manages the patients' records independently of other facilities, using its medical records-keeping methods. Some facilities store medical records in physical files, written by hand, and each patient is given a file number to use as reference in subsequent visits; while in public facilities a patient must have a health booklet, which is presented to the healthcare professionals to record medical information. Therefore, generally, medical records are paper-based, with a few exceptions that use a combination of paper and electronic-based medical records. Consequently, one patient has as many medical records as the number of healthcare facilities he/she has visited to seek medical services. Furthermore, the healthcare facilities do not share patients’ medical records except in situations where a patient has been referred to the Hospital from a healthcare centre or a district hospital, and the medical information would be written on paper for the next healthcare professional to use during the provision of care. Contrarily, when a patient is not on a referral from one healthcare level to the other, medical information is found within the healthcare booklet, if medical information was recorded, sometimes the booklet is not available to provide historical data and is replaced by a new blank health booklet.

Lesotho currently does not have a public health management system that assists the Ministry of Health (MoH) in providing health management oversight as the health principals in the country because the medical information is scattered and stored in all the healthcare facilities in the country in the manner that suits the environment or style of management at each facility, which may not necessarily be similar across the facilities. Therefore, timely reporting on national health status at any point in time is a challenge because MoH does not have a system that collects generated data from public, CHAL or private healthcare facilities.

Since it is clear that the Ministry of Health needs to have control over the management of healthcare data generated and collected in the healthcare facilities in the country, as one of the strategies in the National Vision 2020 health component is to lower HIV prevalence by increasing the number of healthcare facilities to hear-to-reach places (Ministry of Health, 2016). Therefore, it will be useful for the Ministry to set standards, guidelines or a legal framework to ensure that all the stakeholders of the healthcare services delivery in Lesotho are aware of the Ministry’s intentions and that all stakeholders’ interests would be taken care of, and all who are involved would be protected by law.

In a country where health facilities' systems are not integrated, and the patient's medical records are fragmented across many healthcare facilities, it can be very risky to the patient's health. This is because when medical records are fragmented, there is a lack of continuity of care as medical information is never complete, yet a healthcare professional may need to make difficult decisions in providing healthcare (Bourgeois, Olson, & Mandl, 2010; Persaud, 2019; WHO, 2018). According to Bourgeois et al. (2010), incomplete medical information poses a serious threat to the quality of care and patient safety, increasing chances of medication errors and unnecessary medical costs as healthcare professionals may have to repeat medical tests, and other authors in the health academy support this (Mira, 2019; Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020; Mulac, Taxis, Hagesaether, & Granas, 2021).

To address the fragmentation of healthcare services, for example, between primary and secondary healthcare, Trankleet al. (2019) argue that the solution can be integrated care, which has been implemented in Australia to manage elderly chronic diseases. Furthermore, Armitage, Suter, Oelke, & Adair (2009) suggest that integrated healthcare systems can help governments across the world to maintain accessibility and quality of healthcare to patients.

Following the literature on appropriate healthcare, the research observes that the Lesotho healthcare services delivery needs to be thoroughly investigated to determine with empirical data the current status of the healthcare services delivery so that where problems are identified, solutions can be formulated to enhance the healthcare services delivery and improve both the quality and safety of care and to enhance the health outcomes. As mentioned above, private healthcare services are not coordinated with public healthcare services, which results in critical information not reaching the Ministry of Health (MoH) Headquarters on time to facilitate timely decision-making by those in charge of health management and coordination in the country. Secondly, even though public healthcare facilities have some organisations, their healthcare systems are still fragmented, such that one patient has records stored in as many facilities as he/she has visited and are not integrated, which poses a risk to the patient's healthcare (Bourgeois, Olson, & Mandl, 2010; Montenegro, et al., 2011; Armitage, Suter, Oelke, & Adair, 2009; WHO, 2018).

It was important to conduct the study in Lesotho because one of the key strategies in developing the National Health Strategic Plan for the country was for the Health Sector to prioritise finding ways to use technology to enhance healthcare services delivery and build a resilient health system (Ministry of Health, 2016). Moreover, some of the challenges the country has are that the structures that form the health system are weak, and data analysis cannot fully support decision-making processes (Ministry of Health, 2016). Therefore, the study highlights other critical issues in the health sector and recommends a system that could assist the country through the MoH to mitigate the challenges.

The study investigates the challenges healthcare professionals encounter within the current status of fragmented medical records and suggests strategies to address the problems. Secondly, the study has gathered from the participants their understanding of what they consider to be the critical success factors of a Public Health Information Management System (PHIMS) that will make the system sustainable in meeting the requirements of its key stakeholders, namely the healthcare professionals, healthcare administrators and patients. Finally, the study has also determined, through interviews and the focus group meeting deliberations, the policy/legal framework that could be suitable to regulate the design and implementation of a Public Health

Information Management System to ensure that it is effective, efficient, and its usage is within the confines of the laws of Lesotho.

This study is of great importance now for many reasons. First, the country has just discontinued an Electronic Medical Record System, which was not fully accepted by healthcare professionals nationwide. Some of the reasons include the following:-

a) Some healthcare professionals believed there was a lack of user training to facilitate smooth usage of the EMR System.

b) As a result of lack of training, healthcare professionals take longer to attend to the patients and sometimes resort to the manual paper-based system, which they are familiar with

c) The system was considered not user-friendly.

d) Some healthcare professionals said the EMR did not meet the requirements of healthcare services, and

e) When using the system, healthcare professionals lose doctor-patient attention as they spend lots of time on the system without paying attention to the patient.

Moreover, the COVID-19 pandemic brought to the attention of the Ministry of Health that the coordination of healthcare services across healthcare facilities, regardless of which proprietor owns which facility, monitoring and controlling the pandemic is critical. Therefore, conceptualising a design for a public health Information Management system, which will ensure that all healthcare service providers participate in its design, will assist the country in designing and implementing a healthcare system that can deal with all kinds of diseases or pandemics in the future. Finally, the National Health Strategic Plan ended in the year 2022. Therefore, the Ministry of Health should consider developing a new National Health Strategic Plan to cater for current and future activities in organising healthcare service delivery, incorporating lessons learned from the previous National Health Strategic Plan (Ministry of Health, 2016).

Statement of the Problem

This study seeks to address the integration knowledge gaps concerning health information management systems in Lesotho, as in other African countries. The research focuses on issues regarding the integration of health information management systems across all healthcare facilities in the country into a Public Health Information Management System, ensuring that each patient has a single, updated record at any healthcare facility each time the patient receives care.

Insofar as the integration of Health Information Systems is concerned, the following are some of the common literature assumptions:-

1. Healthcare facilities use information technology to manage their patients' medical records (Roehrs, et al., 2019; Almunawar & Anshari, 2012; Kerrissey, et al., 2022; Azadi & García-Peñalvo, 2023).
2. Standardisation of medical records facilitates interoperability of digital HIS, which leads to successful integration of IT-based HIS (Shahmoradi, et al., 2020; Saripalle, Runyan, & Russell, 2019).
3. Integration of IT-based Health Information Systems leads to accurate decision-making (Roehrs, Costa, & Righi, 2017; Azadi & García-Peñalvo, 2023; Kouroubali & Katehakis, 2019)

Assumption 1: Healthcare facilities use information technology to manage their patients' medical records.

The researchers assume that in this day and age, all healthcare facilities have IT-based medical information systems (Roehrs, et al., 2019; Almunawar & Anshari, 2012; Kerrissey, et al., 2022; Azadi & García-Peñalvo, 2023). Therefore, it is concluded that the integration of HIS will be possible if the systems are electronic, as opposed to being paper-based (Kerrissey, et al., 2022).

The assumption that healthcare facilities manage their patients' medical records electronically, because Information Technology (IT) is popular in managing systems, fails for

Lesotho and other African countries, because most healthcare facilities in Africa, including Lesotho, still use paper-based patient medical record systems. Therefore, these countries must first formulate processes that will assist them in migrating from paper-based to IT-based health information systems.

Assumption 2*:* Standardisation of medical records facilitates interoperability of HIS, which leads to successful integration of HIS

According to the literature, to facilitate the sharing of information among healthcare facilities, health information systems must be developed using the same information technology standards within and across healthcare facilities to facilitate interoperability of such systems (Shahmoradi, et al., 2020; Saripalle, Runyan, & Russell, 2019). If the standards are different, the communication between the systems would face challenges (Shahmoradi, et al., 2020).

This assumption may fail where standards do not favour the current IT environment for some healthcare facilities, such that it would be costly to acquire services to re-design or re-configure to the acceptable standard. A legal/Policy framework would have to be formulated to ensure that healthcare facilities adhere to the preferred national standard.

Assumption 3: Integration of HIS leads to accurate decision-making

Researchers believe that integration of HIS assists healthcare professionals in making accurate decisions at the point of care (Roehrs, Costa, & Righi, 2017; Azadi & García-Peñalvo, 2023; Kouroubali & Katehakis, 2019). If within a healthcare facility, such as a hospital, electronic medical information systems are integrated, data sourced from such systems can be unified to form a complete record for a patient, and this assists the healthcare professionals to make informed decisions at the point of care, resulting in improved health outcomes (Azadi & García-Peñalvo, 2023).

However, integrating medical information can provide too much information, which may ultimately confuse decision-making by healthcare professionals. And, the confusion may delay decision-making, resulting in compromising the safety and quality of care.

The disadvantages of not carrying out the study are that:-

a) The Ministry of Health would remain passive in dealing with the healthcare data in the country because it would continue running the health sector using incomplete and fragmented patients' medical records and not having control of the Health Sector.

b) No improvements would be made to strengthen health systems so that when a pandemic emerges, the Ministry of Health can quickly act on informed decision-making processes to deal with the pandemic systematically. The study provides recommendations for strengthening healthcare service delivery processes.

c) No legal/policy framework would be developed to regulate healthcare facilities' sharing of patients' medical information to facilitate access to complete patients' historical medical information at the point of care.

d) The current status of not having an all-inclusive Health Information Management System for Lesotho, the development partners from other countries would continue to assist Lesotho in strengthening healthcare systems (PWC, 2013; ICAP, 2015), sometimes through the donation of electronic Health Systems that they have seen their successful implementation elsewhere, which may not necessarily be sustainable for the Lesotho Health Sector. However, being aware of challenges encountered by healthcare professionals when using those systems developed in a work environment outside Lesotho, the country may have the opportunity to decide on what system will be suitable for managing the healthcare services delivery in Lesotho and ensuring the safety of the citizens of Lesotho. For example, the Millennium Challenge Corporation donated the Electronic Medical Record System (PWC, 2013), which was later discontinued by the Ministry of Health as there were challenges encountered during implementation, such as not being user-friendly or not conforming to the disease codes that the healthcare professionals wanted; other users claimed that the system slowed down their performance because of missing functionality or wrong clinical terminology used in the healthcare system.

e) The inclusion of healthcare facilities in the private sector will remain a challenge if there is no Public Health Information Management System that integrates data from all healthcare facilities in the country and no policy/legal framework that compels and regulates the sharing of patients' medical information, ensuring that one patient has one record regardless of the facilities he/she has visited seeking medical attention.

Consequently, due to the disadvantages of not conducting the research mentioned above, healthcare service delivery in Lesotho would remain risky to patients' lives. Without complete and accurate medical information for the patient during the provision of care, the safety and quality of care will be compromised.

The Purpose of the Study

The purpose of this qualitative study is to establish mitigation measures for the risks inherent to the current healthcare service delivery in Lesotho and contribute towards the improvement of the quality and safety of care.

The purpose was achieved through, a) formulation and administration of participants' interview questions and the focus group meeting discussion points. The participants were healthcare professionals (doctors and nurses), healthcare administrators, and potential patients. The bulk of the individual interviews and the focus group meeting deliberations were conducted virtually due to COVID-19 restrictions during the research data collection period. On the other hand, where virtual interaction was not possible for reasons beyond the researcher's control, other interviews were conducted in a face-to-face fashion but still observing COVID-19 protocols, such as the usage of a mask and keeping a reasonable social distance; b) Literature review to determine a full understanding and application of health systems integration, as applied in other countries to strengthen public health management systems, and then establish what Lesotho could adopt and adapt to improve her health management system.

Aims of the Study

The aims of the study are; a) To promote a paradigm shift from independent healthcare systems, that have been implemented at healthcare facilities, to integrated healthcare systems that could enable sharing of patients' medical information across healthcare facilities, regardless of being public or private healthcare services entities; b) To highlight the importance of using the patient-oriented approach for a health system to avoid standalone healthcare services, which are provided by different healthcare facilities, to allow the Ministry of Health to have full control and monitoring of the healthcare services delivery in all healthcare facilities nationwide, regardless of whether being owned by the government, churches, or other proprietors; and c) Develop a concept for an efficient Public Health Information Management System that conforms to international standards, such as the International Health Regulations (IHR) published by the World Health Organisation, and within the confines of the laws of Lesotho.

Objectives of the Study

Meeting the following objectives assisted the researcher in achieving the aims of the research:-

a) To determine why the healthcare service delivery in Lesotho is not coordinated and, therefore, risky to patients' lives. Identifying challenges healthcare professionals encounter while providing care and determining their impact on safety and quality of care reveals to the researcher the reasons for risky healthcare service delivery, against which the researcher recommends possible solutions or mitigations for such challenges, with the view to improving Lesotho’s healthcare system.

b) To establish why healthcare facilities in Lesotho do not share patients’ medical information and facilitate informed decision-making by healthcare professionals at the point of care. Establishing the critical success factors for sharing patients’ medical information assists the researcher in recommending how to share patients’ medical records.

c) To determine why no Policy/Legal Framework in Lesotho binds and regulates the sharing of patients’ medical information by healthcare facilities through a public health information management system to facilitate efficiency in healthcare service delivery and avoid poor management of medical records. Formulating a policy/legal framework that can regulate the sharing of patients’ medical information across healthcare facilities should strengthen healthcare service delivery, especially if the framework includes punitive measures for those who may contravene the regulations.

Nature and Significance of the Study

Nature of the Study

Research Methods and Design

The study was conducted using a qualitative research method. Through the purposive sampling method, the researcher targeted key stakeholders involved in the delivery of healthcare services. Namely, a) the healthcare professionals, especially doctors and nurses as healthcare providers, because they have vast experience in healthcare services delivery in Lesotho; b) the healthcare services delivery administrators, who are in charge of running the healthcare services facilities such as hospitals and healthcare centres; and c) The healthcare services delivery beneficiaries, who are the potential patients that can visit the healthcare services facilities voluntarily to seek medical care, involuntarily brought by next of kin as they may be disabled or routinely as a medical requirement by order of a physician. Therefore, the researcher adopted the case study research design because it allows an in-depth study of a complex phenomenon by the researcher within a specific context (Rashid, Rashid, Warraich, Sabir, & Waseem, 2019).

In the current study, the researcher interviewed eight health professionals (doctors (3) and nurses (5)), 30 potential patients (3 participants per district), and seven hospital administrators and conducted one focus group meeting with doctors. Table 1 below illustrates the criteria for recruiting the hospital administration officers' participants such that they are representative of the hospitals in the country:-

Table 1

Hospital Administration Officers Recruitment Criteria

Criteria for Recruiting Administration Officers Participants		
Proprietor	**Highlands**	**Lowlands**
CHAL	St James Hospital	1. CHAL HQ 2. Scott Hospital
Government	1. Butha-Buthe Hospital 2. Mokhotlong Hospital	1. Leribe Hospital
Private	*There is no private hospital in the Highlands*	Maseru Private Hospital

The research was conducted in a safe environment to ensure that participants were not harmed or endangered by their participation and were requested to provide signed informed consent to participate. Both the interview questions and consent form are attached as **Annexes** I and II.

Data Collection

Data was collected through the interview questions and the focus group meeting discussions with participants. The participants were selected using a purposive sampling technique, and three groups of participants were identified. The participants were healthcare professionals, potential patients, and healthcare administrators.

Data were gathered through face-to-face interviews, where possible, but mostly, the interviews and the focus group meeting deliberations were conducted virtually because, during the data collection period, there were COVID-19 restrictions that had to be followed on interacting with doctors, nurses, and potential patients, as well as for discussions in a focus group meeting.

Data Analysis

Data collected from the interviews and focus groups were analysed using Thematic Analysis techniques.

Significance of the Study

The study introduces integrating healthcare systems across different healthcare facilities as a strategy that can assist the Ministry of Health in taking full control of the health sector because it supports patient-oriented care instead of facility-oriented care. The study emphasises that at the point of care, the public health information management system must be used to draw a patient's medical records from various healthcare facilities to inform healthcare professionals about the patient's historical medical information.

(a) Significance of the study to the Ministry of Health

The Ministry of Health can use the study findings to restructure its healthcare service delivery system to monitor and control healthcare service delivery nationwide, adding to the efforts to strengthen the health system. For example, the specifications of a public health information management system established through the study can be adopted from the study, and the terms of reference to develop such a system can include the specifications adopted from the study.

(b) Significance to the healthcare administrators

Through the study findings, the healthcare administrators will be aware of the challenges currently encountered by healthcare professionals in their respective healthcare facilities and nationwide. With the study findings, the healthcare administrators will identify their areas of improvement, their role in improving the healthcare service delivery, and provide an advocacy role in developing a public health information management system and policy/legal framework required to enhance the efficiency of the healthcare service delivery.

(c) Significance of the study to the healthcare professionals

The study highlights the challenges healthcare professionals encounter when providing care at different facilities throughout the country, some of which they might not have experienced in their careers. Moreover, the research discusses strategies for addressing the challenges and benefits of implementing suggested approaches, which are suitable for improving the healthcare professionals’ experience at work.

(d) Significance of the study to the potential patients

When the challenges encountered by healthcare professionals during care provision are identified through the study and addressed with the suggested strategies, the quality and safety of care are improved, and patients' lives will be safe instead of being at risk. Therefore, potential patients will receive much-improved healthcare services at the healthcare facilities if the findings and recommendations are implemented.

Research Assumptions and Questions

Alternative to the literature assumptions regarding the integration of Health Information Systems, the following are the research assumptions:-

Assumption 1: Migration of medical records from paper-based to electronic format will improve the quality and safety of care

Migration of medical record management systems in all healthcare facilities, from paper-based to electronic format, and development of ICT infrastructure nationwide, will facilitate the sharing of medical information by healthcare professionals and improve the quality and safety of care.

Migrating from paper-based to electronic format health information systems is a positive action to facilitate quick access to stored medical information and enable sharing of such information by healthcare professionals across healthcare facilities where the need arises.

Transforming paper-based medical records to electronic format in all healthcare facilities, and improving the ICT infrastructure such that the healthcare facilities can be linked digitally, could enable connectivity between healthcare facilities, and address the challenges encountered by healthcare professionals during the provision of care, which compromise the quality and safety of care.

Assumption 2: A detailed patient medical record will support decision-making during future care

An electronic health record containing a detailed patient medical record, as generated at the point of care during the interaction of a healthcare professional with the patient, will contain information that can be useful to any healthcare professional should they attend to the patient at a later stage.

A detailed patient medical record enables the next healthcare professional attending to the patient to make an informed decision regarding the patient’s illness. This can improve the quality and safety of care.

HIS with a detailed record keeping when healthcare professionals provide care, will assist future reference to the saved information, by both the generator of information and another healthcare professional, who attends to the patient at a later stage

Assumption 3: All healthcare professionals understand the need for the quality of information in a patient's medical record

Through their education, healthcare professionals have a common understanding of the information that must be contained in an electronic health record. Therefore, the healthcare professionals know the importance of completeness and correctness of the patient's medical record.

In case of disputes regarding the handling of patients' medical records, the health oversight body will rely on the quality (completeness and accuracy) of medical records to provide a ruling if a need may arise.

Healthcare professionals have a basic understanding of the structure of a useful patient medical record, which does not require the law to enforce it. However, a legal/policy framework may be required to guide/regulate the development and implementation of new HIS.

Consequently, by challenging current research assumptions and providing alternative assumptions, the following research questions were formulated:-

a) To what extent do the challenges encountered by healthcare professionals during the provision of care affect the quality and safety of care?
b) What could be the appropriate and relevant features for the integrated HIS to ensure its efficiency?
c) How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?

CHAPTER 2: LITERATURE REVIEW

Introduction

The purpose of the literature review chapter is to conduct a critical analysis of the literature about the research topic, which is Strengthening the Public Health Information Management System (PHIMS) through the Integration of IT-based Health Information Systems in Lesotho. Moreover, the research problem statement indicates that the healthcare service in Lesotho is risky to the lives of the patients because the healthcare systems are fragmented. Therefore, there is a need to establish techniques and strategies that can be adopted into the design of a system that would address the problem and contribute towards health systems strengthening processes by the Ministry of Health. Therefore, the research contributes to the plans of the Ministry of Health to strengthen the health systems by demonstrating how the integration of healthcare systems mitigates the risk of current healthcare service delivery. The literature review highlights options available for integrating the healthcare services delivery to strengthen the public health information management system. Therefore, appropriate options could be adopted and adapted for the Lesotho public health information management system. Furthermore, the literature contributes towards building the body of knowledge on the subject and also helps the researcher to use the information to formulate the answers to the research questions and provide much-needed solutions to address the research problem. In challenging the current literature assumptions, the researcher addressed the following issues in line with the research questions:-

a) Establish the extent to which the challenges encountered by the healthcare professionals during the provision of care compromise safety and quality of care, and the solutions that have been successful in mitigating such challenges, so that they can be recommended for Lesotho.

b) Establish the success factors that are critical for the integration of IT-based health information systems (HIS) that have been implemented in other countries and recommend relevant factors for the envisaged Lesotho Public Health Information Management System.

c) Establish laws and/or policies that have been used in other countries to regulate the design and implementation of successful IT-based health Information Management systems, then formulate those that can be useful in the Lesotho health systems environment to ensure that health services are integrated to enhance the envisaged digital Public Health Management Information System.

The literature review report asserts that to strengthen the public Health Information Management System, there must be an integrated approach by all healthcare facilities in managing the following, while providing care:-

a) Electronic Patient's Health Record
b) Healthcare services and digital health systems within each facility and
c) IT-based Healthcare information systems across healthcare facilities

For integration to work effectively, the following considerations are critical to be made by the authorities:-

a) Design and development of an electronic Public Health Information Management System
b) Financial support to acquire ICT infrastructure services and continuous maintenance
c) Trained health human resources on the usage of the system
d) Periodic monitoring and evaluation of the integrated health system to identify discrepancies and facilitate continuous improvement

The literature review illustrates the theoretical framework known as OmniPHR, which is about ensuring that one patient has one record, regardless of the number of health facilities they have encountered needing healthcare services (Roehrs, Costa, & Righi, 2017). Furthermore, the literature review analyses the state of patients' medical records systems in Africa in general and then those in Lesotho. It has been found that most patients' medical records systems in Africa are still paper-based, not coordinated, and fragmented. The healthcare facilities are independent of one another, and they operate in silos, without sharing patients' medical records and not providing a platform for collaboration among the healthcare professionals.

Additionally, the literature review critically analyses the critical success factors of the PHIMS that are suitable for the healthcare services delivery environment in Lesotho and provides the highlights and importance of a legal framework, which is required to guide the design and implementation of the PHIMS.

Following the discussion of the critical success factors of the PHIMS, the chapter also discusses the benefits of integrated health information systems, as they assist healthcare professionals in providing care with complete patients' medical information. Moreover, the literature review chapter discusses the legal/policy framework that Lesotho can develop to facilitate the regulation of the implementation of the envisaged Public Health Information Management System. Finally, the issues established under the literature review are summarised.

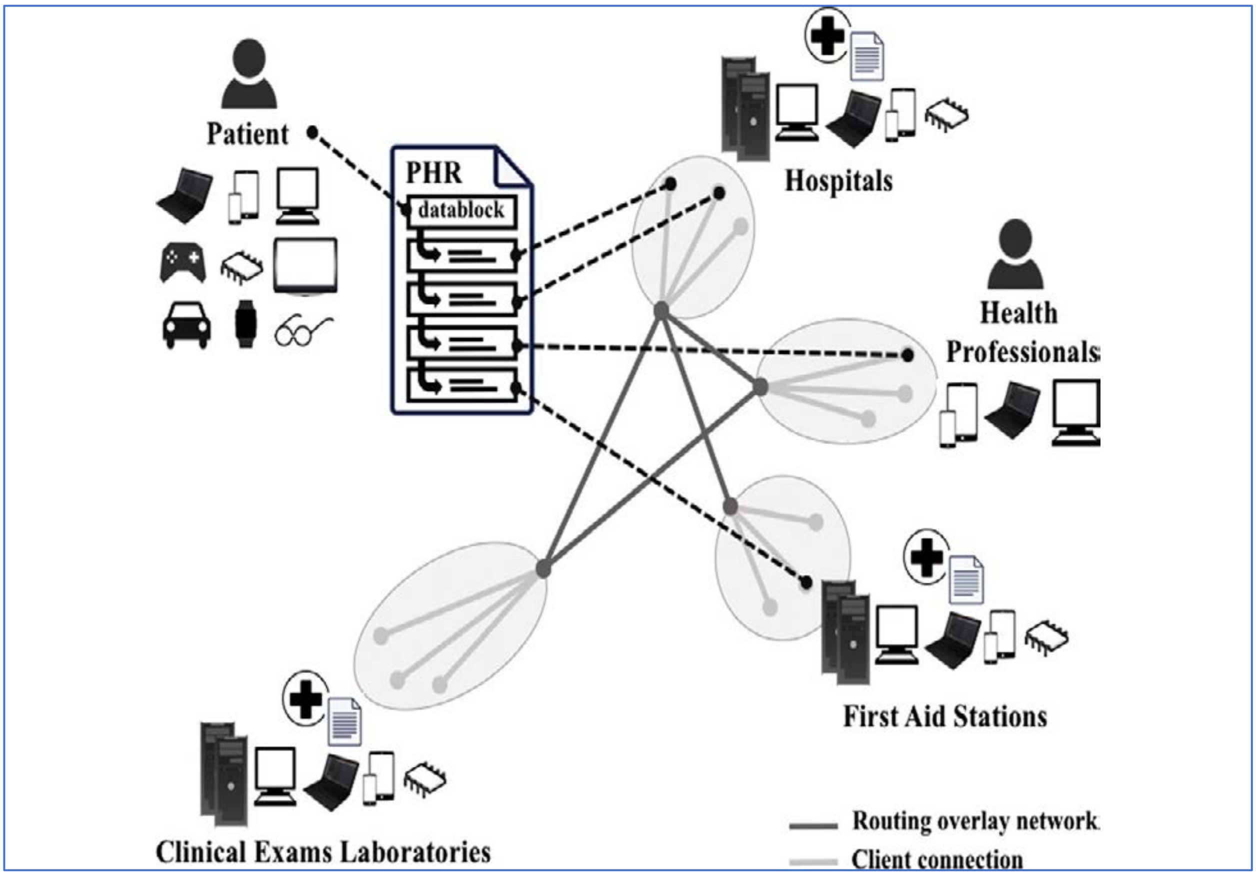
Keywords: Integration, Health Information Systems, National Health System, Fragmentation, Patient Information Confidentiality and Security, Privacy of Patients' Records, Regulatory Framework, Lesotho Health-related Laws, International Health Regulations.

Theoretical Framework

The problem statement indicates that due to the fragmented healthcare systems, the patient's medical records are scattered all over the healthcare facilities that have provided care, which creates a challenge to the provision of care, as the patient's medical information is never complete at the point of care. Therefore, the healthcare services in Lesotho are risky to patients' lives because, according to the literature, for healthcare professionals to provide quality and safe care, they need a full medical history of the patient (Binarti & Fitriyana, 2022; Mirgane, 2021). Otherwise, the provision of care with incomplete patients’ medical information can cause healthcare professionals to commit medication errors that could cause severe adverse drug reactions to the extent of being fatal (Ramesh, Manimegalai, & Priya, 2020; Lubin & Shah, 2022; Mira, 2019; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Mulac, Taxis, Hagesaether, & Granas, 2021). Therefore, it was prudent to adopt a theoretical framework, which would guide the researcher’s efforts and arguments toward resolving the identified problem. Consequently, the researcher adopted the OmniPHR theoretical model, which was developed by a group of experts, Roehrs, Costa, & Righi (2017), who assert that the best way to provide health care is to ensure that a complete patient’s health history is always available and accessible by the healthcare professionals during the provision of care at any healthcare facility within the country. However, Roehrs, Costa, & Righi (2017) assert that it is a challenge to get complete patient medical information because the medical records, known as electronic health records (EHR), are normally scattered at healthcare facilities in different formats and standards. If each patient could have a Personal Health Record (PHR), which, by definition, each patient must have control over, then the information in that record would be available to patients when a need arises (Roehrs, Costa, & Righi, 2017) and would address the problem of risky healthcare service delivery identified for Lesotho. Therefore, the research adopted a theoretical model known as OmniPHR (see Figure 1 below) developed by Roehrs, Costa, & Righi (2017), which has been borrowed from the word omnipresent, meaning always present.

Figure 1

OmniPHR Theoretical Model (Roehrs, Costa, & Righi, 2017)



As illustrated in Figure 1, the theoretical model, OmniPHR, is for ensuring that each patient has one record through the integration of multiple electronic health records for a patient from healthcare information systems across various healthcare providers into one patient medical record that should be available at the point of care and assist the healthcare professionals in making informed decisions. This is made possible by the two modules of OmniPHR, namely, data management and service, while the second deals with data security and privacy (Roehrs, Costa, & Righi, 2017).

The Data Block and Service Module

The module has five components as follows:-

a) *Translator*: translates data from various health information systems to promote interoperability with different standards of health data blocks.
b) Distributor: for distributing data blocks across the network
c) *Validator*: to check the integrity of the data blocks from different health information systems
d) *Nodes Manager*: to manage and control the input and output of routing overlay nodes on the network
e) *Message Router*: provides communication services across the network

The Security and Privacy Module

The Module has four components as follows:-

a) *Encryptor*: establishes the encryption of data blocks that have been transmitted or stored
b) *Digital Signer*: responsible the for digital signing of data blocks
c) *Authenticator*: ensures that only authorised access is granted and proper attribution of profiles
d) *Roles and Privileges*: for registration, concession and maintenance of network access profiles

Relevance of the Theoretical Model to the Research Topic

The OmniPHR is an architectural model promoting a unified PHR view (Roehrs, Costa, & Righi, 2017). The research topic suggests that the IT-based HIS across various healthcare organisations must be integrated to strengthen the Public Health Information Management System (PHIMS). Integrated digital health information systems provide a unified view of the PHR.

Application of the OmniPHR Model

Theoretical Assumptions

The following are the common theoretical assumptions from the literature regarding IT-based health information systems:-

a) Healthcare facilities use information technology to manage their patients' medical records (Roehrs, et al., 2019; Almunawar & Anshari, 2012; Kerrissey, et al., 2022; Azadi & García-Peñalvo, 2023).

b) Standardisation of medical records facilitates interoperability of digital HIS, which leads to successful integration of IT-based HIS (Shahmoradi, et al., 2020; Saripalle, Runyan, & Russell, 2019).
c) Integration of IT-based Health Information Systems leads to accurate decision-making (Roehrs, Costa, & Righi, 2017; Azadi & García-Peñalvo, 2023; Kouroubali & Katehakis, 2019)

Key Variables of OmniPHR

As indicated above, the theoretical framework, OmniPHR, is about the availability of a complete patient's health record at the point of care, regardless of whether the healthcare facility is public or privately owned. Therefore, the key variables for the theoretical framework are a) availability of the patient health record at the point of care, b) completeness of the patient health record at the point of care, and c) the point of care or the healthcare facility where healthcare services are offered.

The Theoretical Framework guides the following aspects of the research:-

a) To the Study Design: *Case Study Design*

The Case Study Design deals with data collection through interview protocols. To verify the theoretical assumptions, the researcher had to conduct research by collecting data through interviews with research participants (patients and care providers).

b) To the Research Methodology: *Induction*

Since evidence is needed for induction methodology to make probable conclusions, data collection through interviews of health services delivery stakeholders would indicate whether electronic health records from various care providers are interconnected so that each patient may have only one record containing data from multiple care providers.

c) To Data Analysis: *Thematic Analysis*

The data analysis must indicate the extent to which the healthcare professionals have access to the patient’s historical medical information during the care provision at any facility to facilitate safe and quality care.

d) To the Interpretation of the Findings

The interpretation of the findings must indicate whether patients’ medical records are complete at the point of care or are scattered in multiple databases of care providers’ health information systems, thereby indicating that the patient’s medical records are fragmented. Therefore, highlighting the risks of fragmentation and the advantages of integration.

The OmniPHR Facilitates the Integration of Health Information Systems

The exchange of data across healthcare facilities, known as integration of health systems, is an important issue in healthcare because, if implemented correctly, it will facilitate integrated care, leading to a better experience for care providers and improved quality and safety of patient care (Shahmoradi, et al., 2020; Kerrissey, et al., 2022). However, for successful health systems integration, the HISs in different organisations must conform to the international data exchange standards, namely, a) Health Level 7 (HL7), b) Integrated Healthcare Enterprise (IHE), and c) Digital Imaging and Communications in Medicine (DICOM) (Shahmoradi, et al., 2020).

The fragmented health systems force organisations to maintain many technological solutions with redundant functions to fill the same data in different interfaces, resulting in double-handling data and causing an increase in healthcare costs (Neto, Andreazza, & Chioro, 2021). The duplication of records reduces the quality of health information, which makes analysis and cross-referencing of health data difficult and the resulting health information unreliable (Neto, Andreazza, & Chioro, 2021).

The OmniPHR theoretical model directs that at the point of care, the healthcare providers should have access to the complete patient medical history to facilitate improved quality of care and avoid medication errors (Ramesh, Manimegalai, & Priya, 2020). For example, if the information regarding allergies for a patient may not be available during the provision of care, healthcare professionals could prescribe medication that could worsen the patient's ailment and threaten his/her life (Roehrs, Costa, & Righi, 2017).

The developers of the OmniPHR model defined above, Roehrs, Costa, & Righi (2017), attest that it should be possible for a health facility providing care to have access to the historical medical information of a patient, which was generated during the provision of care in patient's previous visits to various healthcare facilities in the country. The statement of the problem indicates that one patient has as many records as the number of facilities he/she has visited for medical care. However, according to the OmniPHR model, those fragments of the patient record must be put together into one so that during the next visit to any healthcare facility, the healthcare professional can have access to just one patient record, which is a consolidation of those records generated in many healthcare facilities (Roehrs, Costa, & Righi, 2017).

Moreover, having a medical record provides the patient's historical information to healthcare professionals, such as previous diagnoses, treatments, and prescriptions (Marutha & Ngoepe, 2017). With this information, the healthcare professional will use it to note changes in the health of a patient and decide on any further action. If any of the required information is not available during the provision of care because healthcare facilities are independently handling fragments of patient medical information, it could result in compromised quality of care where improper prescriptions may be offered or repeated clinical tests, which would be costly to the patient and time consuming to the healthcare professional (Mahajan, et al., 2021; Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020; Marutha & Ngoepe, 2017). Therefore, the OmniPHR model is about ensuring that one patient has one record, regardless of the number of facilities he/she has visited, to avoid the identified challenges caused by the fragmented patient record. Furthermore, to clarify the importance of this theoretical framework, the model dictates that if a patient has been hospitalised and then discharged after some time if she/he goes to any healthcare facilities thereafter to seek medical attention, the patient's hospital discharge information must be available as part of the medical history information to facilitate continuity of care (Mahajan, et al., 2021; Roehrs, Costa, & Righi, 2017; Persaud, 2019). Persaud (2019) suggests that where each healthcare facility uses its system independently of others, at the point of care, patients are sometimes expected to remember vaccines or specific medication because there is no record available to the healthcare professionals, resulting in incomplete medical information for patients (Persaud, 2019).

Finally, according to Marutha & Ngoepe (2017), appropriate record-keeping can only be done if healthcare facilities migrate their health information systems from paper-based to electronic patients' medical records. The Electronic Medical Records Systems (EMRs) at the healthcare providers organisations are a good environment for the implementation of the OmniPHR model to enhance the management of patients' medical records such that care providers could share patients' records to facilitate one medical record per patient at all times, especially at the point of care (Roehrs, Costa, & Righi, 2017).

The OmniPHR in Electronic vs Paper-based Records

Figure 1 above, which is the theoretical model adopted by the research, illustrates that there is no limitation in terms of care providers that a patient can visit or the number of devices they use to access the health record because the patient's clinical data generated during the provision of care, at any facility, can be shared across the facilities. Secondly, with the implementation of OmniPHR, a patient record will be updated with medical information from all the healthcare facilities the patient has visited to seek care because the medical information will be shared across the electronic health information systems. Therefore, the patient record will always be complete during the provision of care, resulting in safe and quality care and minimal medication errors (Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017). Therefore, it is prudent for the Ministry of Health to ensure that care providers implement electronic Health Information Management Systems using appropriate data exchange standards to enable the smooth sharing of patients' records across healthcare facilities and facilitate efficient healthcare service delivery. Efficient healthcare services minimise medical errors, but poor patient medical record management systems are the main cause of medical errors (Adane, Gizachew, & Kendie, 2019). Adane, Gizachew, & Kendie (2019) suggest that electronic patient record management systems can enhance the quality of medical data and improve the safety of healthcare services delivery, while paper-based patient records management systems create challenges for healthcare professionals, such as enlarged paper trails, lost, misplaced or illegible paper records due to poor storage facilities or bad handwriting, respectively (Keshta & Odeh, 2021). Moreover, paper-based HISs hinder integration because they don't facilitate the sharing of patient records across healthcare facilities (Adane, Gizachew, & Kendie, 2019; Keshta & Odeh, 2021).

Contrary to the concern by some healthcare professionals that the introduction of the electronic medical record system threatens patient privacy, removes the patient-doctor relationship as the doctor pays too much attention to the computer, and introduces additional administrative work to the doctor and slows his performance in dealing with patients; the literature indicates that in developed countries, electronic medical records systems are understood more than just as digitisation of health chart, but more as vital tools for healthcare services stakeholders to actively interact in dealing with the health of a patient, as it has data fields that facilitate reporting to support communication, processing, and analysis of patient data (Janett & Yeracaris, 2020).

Notwithstanding the importance and the greatness of electronic-based patient records management systems as opposed to the paper-based ones that are not easy to share information across healthcare facilities to facilitate integration, it is worth noting that there are challenges and concerns associated with them, mainly the security aspects of the patient’s medical records (Keshta & Odeh, 2021; Roehrs, et al., 2019; Adane, Gizachew, & Kendie, 2019; Thimmaiah, S, Naya, B, & L, 2019). Keshta and Odeh (2021) caution that for health systems to be successful, developers have to be aware of and address the following key properties of such systems, namely, a) confidentiality (assurance that the patient’s records can only be accessed by authorised users of the system), b) Integrity (assurance that the patient’s data cannot just be changed by anyone who wants to), and c) Availability (the patient’s medical information can be available when it is needed, especially during the provision of care).

However, the literature indicates that technology that assists the safe sharing of information across organisations is available and is already used mainly in financial services and can be utilised to support the sharing of patients’ medical data across healthcare facilities with high-quality, safety and efficiency. Blockchain technology is used to ensure the security of health records that are shared across facilities (Adane, Gizachew, & Kendie, 2019; Roehrs, et al., 2019; Thimmaiah, S, Naya, B, & L, 2019). Therefore, the recommended theoretical model, which is about ensuring that one patient has one record, regardless of the number of facilities he/she has visited to seek medical care, can be supported by blockchain technology to ensure that the patient’s medical information remains secure while being shared across the healthcare facilities networks, to improve quality and safety of care for the lives of patients (Adane, Gizachew, & Kendie, 2019; Ramesh, Manimegalai, & Priya, 2020; Roehrs, et al., 2019).

The Personal Health Record

The Personal Health Record Overview

The research statement of the problem, discussed above, refers to uncoordinated healthcare service delivery caused by the fragmented health information systems used by the healthcare facilities in the country, resulting in scattered pieces of each patient’s medical records in various healthcare facilities from which she/he has received medical care. The problem is further explained as having adverse medical events on patients during the provision of care, resulting in compromised quality and safety of care, as healthcare professionals do not have access to complete patients’ medical information at the point of care, and they commit medication errors. Moreover, some medication errors are said to be severe such that they worsen the patient’s health state or cause fatalities when not corrected sooner. However, the Theoretical Framework that the research has adopted directs that the focus of the study should be towards the always present Personal Health Record (PHR), abbreviated as OmniPHR by Roehrs, Costa, & Righi (2017), to attempt to address the problem. However, due to the nature of the health sector, there are many contributors to the patient’s medical record because physicians have different specialisations in sicknesses or diseases, which creates fragments of patients’ medical information according to their current ailment.

Definition of the Personal Health Record

During the provision of care, when patients come to healthcare facilities, healthcare providers need and use historical information for diagnosis and treatment of patients, and they inform patients how to take care of themselves while they are away from the healthcare facilities (Department of Health and Human Services-USA, 2023). However, at home, away from the healthcare facilities, the patients are expected to use guidance from healthcare professionals to manage their health, and, therefore, need the necessary tools. The appropriate tool is the personal health record, which is defined as an internet-based application that can be used by patients to manage and share their health data according to their views (Andrikopoulou, Scott, Herrera, & Good, 2019; Saripalle, Runyan, & Russell, 2019; Park & Yoon, 2020). The PHR differs from the Electronic Health Record (EHR) in that the EHR is only available and controlled at a healthcare facility as opposed to the PHR, which is information from different healthcare providers and is controlled by the patient (Roehrs, Costa, Righi, & Oliveira, 2017). Moreover, data that could be found in the PHR can include the following (Department of Health and Human Services-USA, 2023, p. 1; Roehrs, Costa, Righi, & Oliveira, 2017):-

a) Contact information for the patient and his or her family members
b) A list of providers involved in the patient’s care
c) Diagnosis list
d) Medications list
e) Allergy list
f) Immunisation history
g) Lab and test findings
h) Family medical history
i) Genetic information
j) Medical advice
k) Patient registration data
l) Insurance plan information
m) Education

n) Demographic data (age, sex)
o) Family social history
p) Lifestyle
q) Food
r) Diet
s) Daily activities

However, the information in PHR and EHR can be integrated so that the information relevant to the patient can be shared (Roehrs, Costa, Righi, & Oliveira, 2017). The picture below illustrates the relationship between PHR and EHR and their interaction using the Internet of Things:-

Figure 2

Relationship and interaction between PHR and EHR through the Internet (Roehrs, Costa, Righi, & Oliveira, 2017)

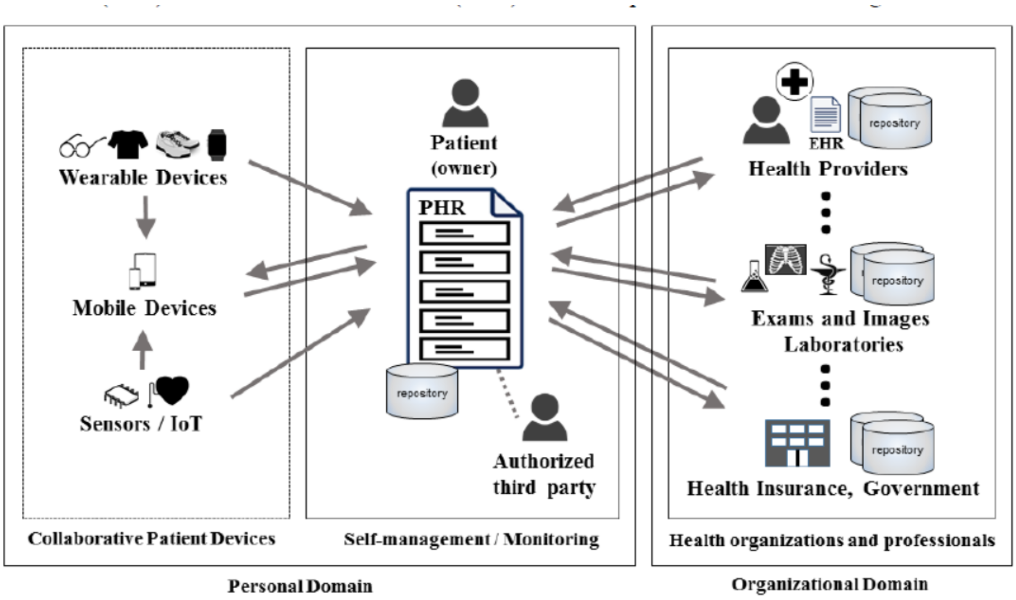


Figure 2 above illustration indicates that the PHR contains health-related information for the patient, which is updated continuously with data from many EHRs owned and controlled by health care providers, health laboratories, health insurers, and the government. The patient shares information with healthcare professionals and organisations, together with any person

the patient may grant access to the medical information. Therefore, the theoretical framework, which is OmniPHR, guides the research in the direction of finding ways to ensure that there is only one PHR per patient, which is always available at the point of care, to avoid medication errors.

Benefits of Using PHR for the Patient

a) In case of emergency, healthcare professionals can use the PHR information to provide necessary care.

b) When a patient has a chronic disease, a PHR monitor may be used to record the test findings, and also the patients can track lab findings.

c) For the reason that PHR has patient health information from sources at one point, then the patient can have coordinated care.

d) When a family member is an authorised third party to the PHR, he/she can help monitor health appointments for the elderly, as indicated in the elderly PHR.

e) PHR can be used as secure communication between the patient and the health care provider, which can be quick. The patient can ask a question related to his/her health and be responded to quickly without having to go to the healthcare facility.

f) PHRs have allowed patients to monitor their health through mobile devices.

Limitations to the PHR

According to Yousefet al. (2021), endorsement of the PHR by the Health Care Providers (HCPs) will facilitate acceptance of the PHR by the patients. Therefore, during the implementation of the PHR, healthcare organisations are encouraged to involve HCPs as they play a key role in engaging and supporting patients through their endorsement of services, which will ensure that PHR is successfully accepted by the patients (Yousef, et al., 2021). As

Figure 2 illustrates, PHR is updated by information from the EHRs that are controlled by the HCPs. Furthermore, Yousefet al. (2021) suggest that the usage of PHRs depends on eight key factors as follows:-

a) Showing the relevance of PHR
b) Focusing on the PHR's unique services to increase the perceived value of PHRs
c) Provide training to the key stakeholders (target groups)
d) Integrate PHR into existing technologies
e) Align the functions of PHR with familiar workflow
f) Offer incentives to the target groups
g) Make information accessible
h) Support necessary communication about PHR

In the studies, which were made around the world, to find out the extent to which the PHR concept was accepted by the HCPs, Table 2 below illustrates examples of countries in which the studies were made and what was therefore established:-

Table 2

The extent to which HCPs accepted PHR in some countries (Yousef, et al., 2021)

Country	**Target groups (HCPs)**	**Findings**	**Effect/Reaction**
USA	Physicians, nurses, and pharmacists	Many HCPs had limited familiarity with PHR features	Underutilisation of the PHR
Finland	Nurses, social workers, dentists, physicians, physical therapists, and psychologists	HCPs support PHR because of a) Expected positive influences on their work b) User friendliness of the PHR c) Benefits to their patients	Only 13% said they had received enough information about the PHR
Sweden	Nurses and Physicians	HCPs working in Outpatient **vs** those working in Primary Health Care a) 50% **vs** 36% believed there were benefits in usage	PHR is being used with different understanding (Yousef, et al., 2021)

Country	Target groups (HCPs)	Findings	Effect/Reaction
		b) 50% **vs** 26% said there is a greater ability to clarify information c) 36% **vs** 20% said there is improved patient communication	

The overall perception of the HCPs on PHRs is that PHRs are needed to promote patient engagement and patient-centred support by the HCPS (Yousef, et al., 2021).

On the other hand, Leeet al.(2020) argue that the PHR concept in the health sector is fairly new and in its prototype stage. Therefore, very few groups are testing it (Lee, et al., 2020). In addition, Lee, et al. (2020) suggest that the hardware architecture must be expanded to ensure that a large number of users will be catered for when they start using the system.

Health Information Systems

The Importance of Health Information Systems (HIS)

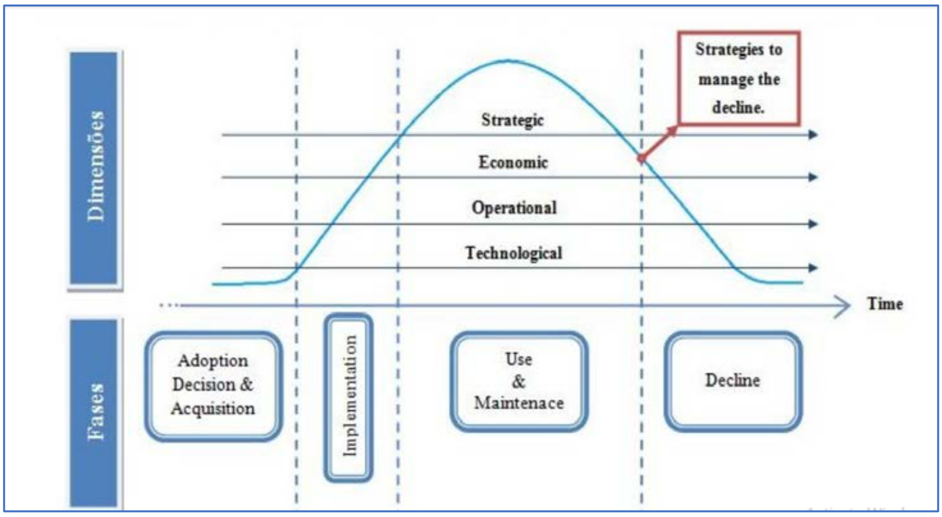
Technically defined, an Information System (IS) is a set of components that are interrelated in collecting and processing data, storing and disseminating information to support decision-making and control for the administration of an establishment (Boell & Cecez-Kecmanov, 2012). The components of the IS are Information and Communication Technology (ICT) infrastructure, computer hardware and software, and people using the technology (Boell & Cecez-Kecmanov, 2012). In addition to the definition of IS, Almunawar & Anshari (2012) suggest that the Health Information System (HIS) is an interaction between health professionals and ICT to support and manage the dissemination of information to improve the quality of healthcare service delivery. Additionally, McCullough, Casey, Moscovice, & Prasad (2010) assert that Health Information Systems (HIS) can improve the quality of care and reduce costs because they are intended to enhance communication among healthcare professionals within and across health facilities. Moreover, HISs provide guidelines for care and tools that support decision-making, facilitating the prevention of medication errors during the execution of care processes (McCullough, Casey, Moscovice, & Prasad, 2010; Persaud, 2019).

More precisely, Wilms, Mbembela, Prytherch, Hellmold, & Kuelker (2014) cite WHO in defining the Health Information System as a system that helps healthcare professionals manage health data effectively such that it improves the quality of healthcare and safe lives. Therefore, it is clear that an HIS has some guidelines and functionality to process patients' medical data into information, i.e. there must be health data input (Wilms, Mbembela, Prytherch, Hellmold, & Kuelker, 2014), followed by data processing to change it into information, and information is distributed through available communication channels to support medical/clinical decision-making for provision of quality healthcare services. It is, therefore, evident that if something goes wrong in the process, the health system may fail, resulting in poor healthcare service delivery and possibly loss of life and/or abandonment of the system. However, the literature highlights the potential for Health Information Systems to reduce medical costs and improve the effectiveness and quality of healthcare when things are done properly, from planning to developing, and implementing a health information system (Granja, Janssen, & Johansen, 2018). Moreover, Granja, Janssen, & Johansen (2018) argue that there is a gap between the potential benefits that the research in health information systems alludes to and the clinical reality. This is evident in the dismal failure of some HISs while others become successful. Moreover, when systems that fail are abandoned, the resources used towards building such systems go to waste.

However, to ensure that public health management systems are successful, a government Ministry, such as the Ministry of Health, which is the custodian of all health systems, must include in its strategies enough support to mitigate inherent risks for financial, technical, and human resources at all stages (Adoption Decision & Acquisition, Implementation, Use & Maintenance, Decline) of the information system life cycle as shown in Figure 3 below (Duarte & Costa, 2012). Further, as indicated in Figure 3 below, during the Use and Maintenance stage, support is required in all the dimensions of the organisational operation (Duarte & Costa, 2012). During this stage, it would be critical to document lessons learned so that strategies that brought success are known, and those that did not work well are also recorded so that they can be avoided in the future to realise continuous improvements going forward.

Figure 3

Information System Life Cycle (Duarte & Costa, 2012)



Practically, implementation of the HIS involves data collection by health staff; data is then processed into information that is used for reporting at different levels of healthcare service to influence informed decision-making by either healthcare professionals or government officials

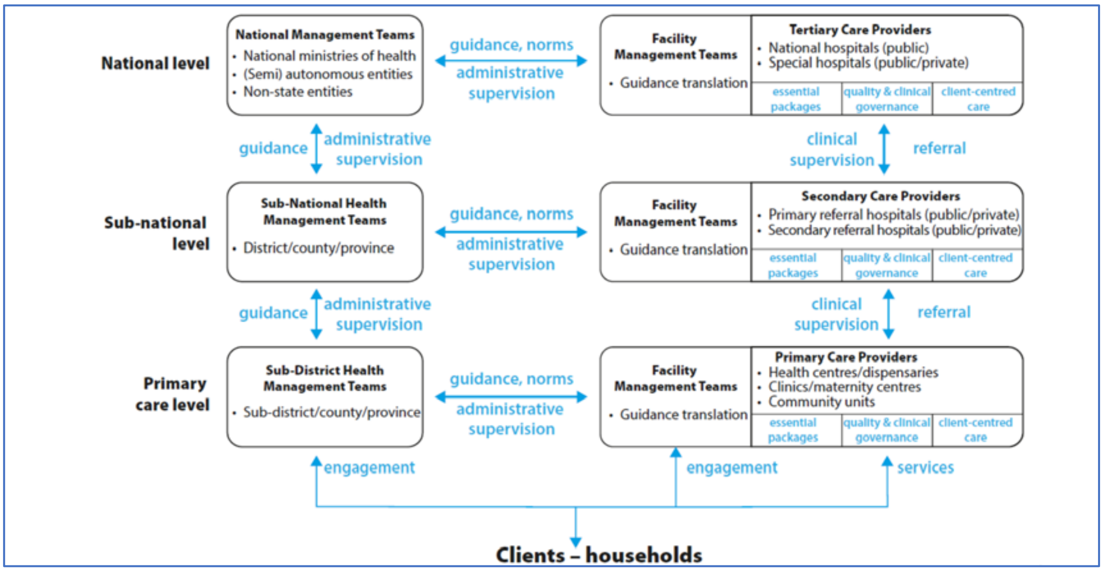
(Kluge, et al., 2018; Wilms, Mbembela, Prytherch, Hellmold, & Kuelker, 2014). Therefore, a public health information system is not just a data collection tool, but it is a coordinated system that, when used properly, can improve the quality of healthcare for the citizens. Furthermore, Klugeet al. (2018) added that having a HIS could assist a country to quickly realise, test and track critical health issues, such as pandemics, and timely inform all key stakeholders locally and globally.

Health Information Systems in Africa

According to the World Health Organisation (WHO, 2018), most African countries understand the concept of a healthcare service delivery that can improve healthcare services for their citizens (see Figure 4 below). However, there is little effort taken, and none in some African countries, to dedicate efforts towards designing, financing or monitoring information systems that can enhance healthcare delivery (WHO, 2018).

Figure 4

Concept for a National Healthcare Service Delivery (WHO, 2018)



To confirm the assertion by WHO (2018) regarding the inadequate desire by African countries to design Health Information Management Systems (HMIS) that can implement an improved healthcare service delivery shown in Figure 4 above, the literature (Mwase, et al., 2010; Chaulagai, et al., 2005; Muhindo, Joloba, & Nakanjako, 2016) suggests that African countries are still using paper-based health information systems, which do not support accurate and timely reporting. To name but a few African countries, in Malawi, patients' medical history is stored in three types of booklets, each indicating the patient's category (children, Women, and Others) (Chaulagaiet al., 2005). The booklets are known as health booklets or passports that patients have to keep and carry to the health facilities, while for recording health indicators, the facilities use wall charts that are filled daily (Chaulagaiet al., 2005). On the other hand, in Lesotho and Uganda, two types of systems are used, paper-based and electronic, depending on the level of advancement in information technology at a particular health facility (Chaulagai, et al., 2005; Mwase, et al., 2010). In both countries, Lesotho and Uganda, there are paper-based registers for specific diseases and client data cards for individual patient records (Chaulagaiet al., 2005; Mwaseet al., 2010). At the health centre/clinic level, there are also Health Information System (HMIS) report forms that are filled daily and compiled at the end of each month for reporting to the district level, which is eventually reported to the Ministry of Health Headquarters in case of Lesotho (Mwaseet al., 2010).

Furthermore, on the paper-based Health Information Systems, Wilms, Mbembela, Prytherch, Hellmold, & Kuelker (2014) suggest that, in Tanzania, several books are used to administer health information. The books cover all data categories prescribed and monitored by WHO, namely, vital registration, surveillance systems, and administrative and routine service reporting (Wilms, Mbembela, Prytherch, Hellmold, & Kuelker, 2014). However, the Ministry of Health in Tanzania has admitted that their public health information system is weak because data collection is extremely weak, and sometimes, some facilities do not fill in the data (Wilms, Mbembela, Prytherch, Hellmold, & Kuelker, 2014).

Management of Patients Medical Records by Care Providers

Patients' medical records are generated through information provided by patients and the healthcare professionals' notes during interaction with patients through diagnosis, provision of care, and treatment (Abiy, et al., 2018). Therefore, documentation of such information from patients and healthcare professionals is critical for a) future reference in support of the continuation of care, b) improvement of patients' outcomes, c) facilitates collaboration among healthcare professionals, and d) supports healthcare professionals' memory of care provided (Akhu-Zaheya, Al-Maaitah, & Hani, 2017; Muinga, Abejirinde, Paton, English, & Zweekhorst, 2020). Therefore, the objectives of documenting the patients' medical records are to a) create records that can be used for future administration processes, b) provide legal documents for future cases, c) create information for education purposes, and d) provide data for research and continuous improvement (Muinga, Abejirinde, Paton, English, & Zweekhorst, 2020). Moreover, authorities can use patients' medical information to plan the budget, allocate resources, and make decisions for health infrastructure development (Abiy, et al., 2018). Therefore, completeness, accuracy, and integrity of the patients' health records are critical to be maintained to enhance the quality of the information and improve the patient's health, government budgeting, and appropriate planning towards allocation of resources (Abiy, et al., 2018; Akhu-Zaheya, Al-Maaitah, & Hani, 2017).

Each facility may decide how the patient's health records are managed. The records may be managed using paper-based health information systems or electronic-based health information systems. In Table 3 below, the pros and cons of both the paper-based and electronic health information systems, respectively, are highlighted.

Paper-based versus Electronic Health Information Systems

Table 3

Paper-based versus Electronic-based HIS (Abiy, et al., 2018; Fröhlich, et al., 2020; Akhu-Zaheya, Al-Maaitah, & Hani, 2017)

HIS	Pros	Cons
Paper-Based HIS	a) Affordable as the paper is easy to find b) Every health professional can use a pen to write	a) Needs big space for storage, which may be costly to maintain b) Records fade over time c) The records are not easily retrievable as the system is not searchable d) Sometimes the handwriting may be illegible e) Paper can easily be misplaced. For example, a) if the healthcare facility uses files and arranges them sequentially, a staff member can misplace them, which may cause delays when the patient arrives. Consequently, a new file would be opened, b) In cases where a health booklet is used, the patient can leave it at home, and then a new one would be required

HIS	Pros	Cons
		by the healthcare professionals to have the clinical notes for the day f) The records kept are not reliable, as paper can easily be misplaced or torn out
Electronic-based HIS	a) Enhances collaboration among the healthcare professionals b) Clinical notes are legible c) Reports can easily be generated and shared over electronic networks d) The database is searchable e) The system can be designed to be agile to accommodate future requirements of the Ministry of Health f) Data can be shared across healthcare facilities g) Facilitate systems integration within and across the healthcare facilities h) Retrieving records for financial or legal purposes is at the click of a button i) Patients' medical information could be completed at the point of care due to the integration of systems. This can improve the quality and safety of care. j) Provide reliable data	a) Security and confidentiality of the records is always a concern, especially when data can easily flow from one facility to the other i.e. the system can be hacked and records be compromised if the security is not up-to-date b) Interoperability between different systems can be a challenge and needs to be addressed c) Lack of financial support by the principals can compromise the functionality of the system. For example, if a system update or upgrade is required, which supports information sharing, and funding that is needed to address the upgrade or update then the system would not be updated resulting in fragmentation of the healthcare systems

From Table 3 above, it is clear that there are more disadvantages of paper-based systems than advantages due to the kind of challenges they pose to healthcare services delivery. On the other hand, the advantages of using electronic health information systems are more than the disadvantages, as they simplify the coordination and management of patients' medical records.

Following from the assertions and the understanding that a well-designed HIS can contribute towards improved quality of care (Kluge, et al., 2018), African governments that have not yet started should deliberately develop plans to support efforts that are aimed at strengthening their countries' Health Information Management Systems, such as the current research towards the conceptualisation of a concept for an efficient Public Health Information Management System (PHIMS), for Lesotho, to establish better ways to manage health services delivery and improve the quality of life for the citizens (Amazigo, et al., 2012). For example, countries must deliberately consider plans that would facilitate moving away from paper-based patients' medical records to electronic-based ones as it is clear that holding on to paper creates countless challenges for healthcare professionals and, as a result, lowers the quality of care, which puts patients' lives at risk (Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020). For example, in South Africa, poor management of patients' records, such as misplacing a paper-based patient file, caused serious health problems for patients, such as delaying treatment. First, in Limpopo a hospital failed to provide medical history regarding the patient's chronic disease, which was needed by a private doctor to provide care, and unfortunately the doctor could not continue with treatment for fear of committing medication errors (Marutha & Ngoepe, 2017). Secondly, in another incident at a different hospital, because of the missing file containing the patient's medical history, an operation could not be carried out, as there was no information on what caused partial paralysis in the patient's leg (Marutha & Ngoepe, 2017). In both cases, the risk of committing medication errors was very high, and therefore, the patient's life continued to be in danger as they could not be given the required care. The death of any of those patients could cause expensive and very unnecessary litigation for the government of South Africa because patients could not be assisted due to the unavailability of information at the point of care (Marutha & Ngoepe, 2017; Ramesh, Manimegalai, & Priya, 2020). Therefore, paper-based medical record systems provide challenges of incomplete or unavailability of medical history, which is needed during the provision of care, because there is a risk of committing medication errors if care is provided with incomplete patient medical history (Marutha & Ngoepe, 2017; Ramesh, Manimegalai, & Priya, 2020).

Integrated Public Health Information Management Systems

Definition of Health Information Systems Integration

A Health Information System (HIS), by definition, is an intersection of healthcare processes and information technology for improving healthcare service delivery (Almunawar & Anshari, 2012; Elhauge, 2010). Therefore, Health Information Systems (HISs) integration is the coordination of HISs within the facility or across healthcare organisations or facilities to ensure that patients' information always remains complete when accessed at any point of care. Contrarily, if the systems are not integrated, they are said to be fragmented (Bourgeois, Olson, & Mandl, 2010; Cebul, Rebitzer, Taylor, & Votruba, 2008; Elhauge, 2010). Fragmentation places patients at risk of medical flaws and increased medical costs due to repeated tests because medical information is never complete at the point of care (Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017). Moreover, fragmented HISs lack clinical linkages, which results in unsustainable healthcare expenses as there are no coordinated efforts in healthcare services (Enthoven, 2009).

According to Kodner (2009), governments can continuously provide quality healthcare, that is affordable only if they restructure their health systems to improve efficiency and reduce fragmentation by introducing health systems integration. Healthcare system integration creates coherence among various specialised health services within and across healthcare facilities, thereby enhancing the capability of healthcare professionals to provide effective and safe treatment, as integration promotes collaboration and communication among healthcare professionals (Kodner, 2009; Protti, 2009).

For healthcare professionals to provide much-needed care in the current era when pandemics threaten the world, integration within and across the care facilities is more than just an ethical act but goodwill (Smyth, 2009). If each hospital service department has full access to patient's medical information when providing care, better care can be provided, and medical errors could be avoided (Bourgeois, Olson, & Mandl, 2010; Scott, Seidel, Browen, & Gall, 2009; Suter, Oelke, Adair, & Armitage, 2009; Armitage, Suter, Oelke, & Adair, 2009; Persaud, 2019). For example, if a patient's current ailment is an aching tooth and medical history from within the facility or from another facility indicates that the patient is diabetic, the health professional providing care would prescribe medication suitable for a diabetic patient. However, without such knowledge or access to medical history, the patient's ailment could be worsened by the deterioration of the patient's health status (Stange, 2009; Tensen, Heijden, Jaspers, & Witkamp, 2016). Therefore, integration of HISs can assist healthcare professionals to cross jurisdictions, geographical and healthcare facility boundaries while the focus is on providing a patient-centred approach to fighting diseases (Protti, 2009; Smyth, 2009; Armitage, Suter, Oelke, & Adair, 2009). In as much as integration is a good strategy to improve healthcare service delivery, Armitage, Suter, Oelke, & Adair (2009) caution that integration does not automatically bring success. Instead, organisations or healthcare facilities that want to implement integration must be ready to monitor and evaluate the integration processes to track the integration performance. Table 4 below shows an example of principles that monitor and evaluate the implemented healthcare systems integration strategy so that appropriate measures can be taken to improve the integration processes where the need arises.

Table 4

Principles of Successful Healthcare Systems Integration (Suter, Oelke, Adair, & Armitage, 2009)

PRINCIPLES FOR SUCCESSFUL HEALTH SYSTEMS INTEGRATION	
Principle	Description
1. Comprehensive services across the care continuum	1.1 Cooperation between health and social care organizations 1.2 Access to care continuum with multiple points of access 1.3 Emphasis on wellness, health promotion and primary care
2. Patient focus	2.1 Patient-centred philosophy; focusing on patients' needs 2.2 Patient engagement and participation 2.3 Population-based needs assessment; focus on a defined population
3. Geographic coverage and rostering	3.1 Maximize patient accessibility and minimize duplication of services 3.2 Roster: responsibility for identified population; right of the patient to choose and exit
4. Standardized care delivery through inter-professional teams	4.1 Inter-professional teams across the continuum of care 4.2 Provider-developed, evidence-based care guidelines and protocols to enforce one standard of care regardless of where patients are treated
5. Performance management	5.1 Committed to quality of services, evaluation and continuous care improvement 5.2 Diagnosis, treatment and care interventions linked to clinical outcomes
6. Information systems	6.1 State-of-the-art information systems to collect, track and report activities 6.2 Efficient information systems that enhance communication and information flow across the continuum of care
7. Organizational culture and leadership	7.1 Organizational support with a demonstration of commitment 7.2 Leaders with vision who can instil a strong, cohesive culture
8. Physician integration	8.1 Physicians are the gateway to integrated healthcare delivery systems 8.2 Pivotal in the creation and maintenance of the single-point-of-entry or universal electronic patient record 8.3 Engage physicians in the leading roles, and participation on Board to promote buy-in

PRINCIPLES FOR SUCCESSFUL HEALTH SYSTEMS INTEGRATION	
Principle	Description
9. Governance structure	9.1 Strong, focused, diverse governance represented by a comprehensive membership from all stakeholder groups 9.2 Organizational structure that promotes coordination across settings and levels of care
10. Financial management	10.1 Aligning service funding to ensure equitable funding distribution for different services or levels of services 10.2 Funding mechanisms must promote inter-professional teamwork and health promotion

Therefore, in summary of the contents of Table 4 above, the objective for integration of care services is to ensure that the patients get coordinated, safe and more cost-effective care throughout their journey in a healthcare facility (Lee, 2008). Moreover, integrated healthcare services within a healthcare facility ensure that patient information is always complete at any point of care within that facility. Furthermore, the integration of healthcare services across healthcare facilities improves the quality of healthcare services delivery in the country because the healthcare facilities would share patients' medical information for access by healthcare professionals during the provision of care (Roehrs, Costa, & Righi, 2017; Adane, Gizachew, & Kendie, 2019; Persaud, 2019).

HIS Integration for Personal Health Record

Personal Health Record (PHR) is defined as an electronic lifelong record of health-related information of a person, which is owned and managed by the person and is accessible from anywhere and anytime (Park & Yoon, 2020). The PHR contains information about allergies, operations, vaccinations, treatment, surgeries, ailments, and insurers of a patient (Puustjärvi & Puustjärvi, 2016). Having this information when required is a challenge in Health Sectors that have not implemented the integration of patient health records. For example, where there are no restrictions for patients to seek healthcare services at any facility, the patient can have as many records as the facilities he/she has visited because each facility keeps the patients' records independently, especially when there is no integration of health information systems across facilities. Therefore, it is a challenge for the patient record to be complete, especially during an ailment and when the patient gets to the healthcare facility. To address the challenge, in Lesotho, the authorities resorted to the concept of having the record with the patient through the usage of a paper-based healthcare record in the form of a booklet (PWC, 2013), while Ramanayake, Perera, De-Silva, & Sumanasekara (2013) suggest that the record should be in the form of a file containing patient information. However, there are inherent risks in keeping patients' medical records in paper-based formats, such as a booklet kept by a patient or a file kept by the healthcare facility. For example, that booklet or file can be misplaced, stolen or destroyed by water or fire. Secondly, the text written on paper fades over time until it cannot be readable, or the handwriting may not be legible, which would be a challenge for the next healthcare professional to provide care. Therefore, since in Lesotho, the patient's medical records are still kept in paper-based format, but with plans to strengthen the health systems such as developing electronic health information systems (GoL, 2013; Ministry of Health, 2016), there is a need to establish, by research, an electronic health information system that will facilitate access to the PHRs for all citizens, so that during the provision of care the healthcare professionals could have access to full patients' medical information, and, the Ministry of Health can have the overall health data that includes patients' medical information from all the healthcare facilities in the country, regardless of whether they are private or public facilities.

Otherwise, if the PHR is fragmented, the healthcare providers will not have access to the complete patients' medical information because the patient's medical information would have been stored as pieces of information at various healthcare facilities' health information systems, which have provided the patient with care over time (Adane, Gizachew, & Kendie, 2019; Persaud, 2019; Park & Yoon, 2020). Therefore, integrating patients' Personal Health Records through the health information systems within and across healthcare facilities nationwide will ensure that medical information for the patients is always complete during the provision of care and at any point of care, which will assist the healthcare providers in providing integrated care (Roehrs, Costa, Righi, & Oliveira, 2017; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Fylan, Caveney, Cartwright, & Fylan, 2018; Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020). With the integration of personal health records, patients' medical test results would be shared across healthcare facilities, thereby saving patients' medical costs (Buntin, Jain, & Blumenthal, 2010; Mendis & Purves, 2019). Therefore, when integrated care is practised, healthcare service delivery will be affordable, safe and of high quality (Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; Department of Health and Human Services-USA, 2023; Mahajan, et al., 2021).

HIS Integration within a Healthcare Facility or Institution

Healthcare Facilities provide health services targeted to address the current ailments of patients and also to manage chronic diseases that have already been identified on previous visits. A healthcare facility with many specialised care services, such as a) dental section, b) mental observation unit, c) maternal health care, and many others, needs coordination and interoperability between systems managing such services when providing care to facilitate effective and safe care (Protti, 2009; Kodner, 2009). Through the integration of healthcare services or systems, medical information for the patients is shared easily to improve safety and quality of care within a facility (Hetrick, et al., 2017; Darney, et al., 2018) contrarily, fragmentation leads to the following factors (Ramagemet al., 2011): -

a) Inaccessibility to patient’s medical information,
b) Low quality of care services delivery
c) Inadequate use of resources
d) Increase in costs as procedures and medical tests can be repeated
e) Risk of medication errors by healthcare professionals

In addressing the issues of health systems integration within government institutions’ health systems, in Brazil, between 2013 and 2018, the Ministry of Health administered 54 HISs belonging to the Government, managing, among others, patient registration, disease and medical conditions notification, electronic medical records, management of logistics for supplies and medicines, laboratory management, accounting and many others (Neto, Andreazza, & Chioro, 2021). However, the HISs were operated independently because of various challenges, such as duplicate system users and conflicting official data sources from policy documents, such as the National Policy on Health Information and Informatics and the Information Technology Master Plan (Neto, Andreazza, & Chioro, 2021). Moreover, the Contract for a software company giving software support services to the government had to be studied to get proper guidance on how integration has to be implemented (Neto, Andreazza, & Chioro, 2021). Therefore, by 2018, 31 Primary Health Care Systems were worked on, and only 12 were fully integrated, four were incomplete, and 15 were still standalone, as the rest of the systems in other health departments (Neto, Andreazza, & Chioro, 2021). The challenges encountered, such as conflicting official data, could mean that some policy statements contradict some or all provisions of the approved contract, but the integration of health systems would need the contradiction to be cleared. This shows that in as much as health systems integration is important, its implementation needs proper consultations from all stakeholders to ensure smooth implementation.

Another example where integration was recognised as an issue of national concern in Indonesia, around 2018, there was a study carried out concerning the integration of health systems using software known as District Health Information Software 2 (DHIS2) because various fragmented health systems were used to manage health data resulting in work repetition. Even though some challenges were encountered in integrating data, they were more human-resource-based than the system because most programs targeted, such as a) Maternal and Child Health (MCH), b) Immunization, c) Nutrition, d) Tuberculosis, e) HIV/AIDS, and f) Malaria were already electronic-based and managed separately through different systems (Hanifah, et al., 2022). For example, some health systems that could not be integrated using DHIS2 were under the health programs for which managers didn’t know the right health information to display (Hanifah, et al., 2022). Moreover, Hanifahet al. (2022) assert that there are many types of challenges that hinder health systems integration, such as political, cultural, social and structural infrastructure.

As elaborated above, in Brazil and Indonesia, the health systems integration is based on integrating health programs that the Ministries of Health focus on. However, patients could have ailments that do not fall under those programs, meaning that the integration in both cases is not patient-oriented and also dealing with government institutions, which is contrary to what the OmniPHR theoretical model intends to deal with, being patient-oriented. However, the underlying risks associated with the modalities of ensuring successful integration of health systems are noted and still apply to integration as guided by the OmniPHR Theoretical Model. For example, Hanifahet al. (2022) and Neto, Andreazza, & Chioro (2021) suggest that when dealing with health systems integration, issues about politics, culture, social, and structural infrastructure must be considered.

Without the integration of healthcare services within a facility or the health systems administered by the Ministry of Health, each care provider would not have the opportunity to use the full medical history of the patient being treated, which could result in high medical costs for the patient due to repeated tests, adverse results or medical errors that could lead to loss of life (Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Mulac, Taxis, Hagesaether, & Granas, 2021; Säfholm, Bondesson, & Modig, 2019). Furthermore, with the adoption and implementation of integrated healthcare systems, some or all of the following issues could be avoided (Barr, Garrett, Marten, & Kadandale, 2019; Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020):-

a) Lack of coordination of care services
b) Loss of patients' lives
c) High and unsustainable medical costs
d) Conflicting incentives
e) Medication errors
f) Delayed response to the pandemic

Moreover, Enthoven (2009) suggest that due to the fragmentation or absence of integration, in 2005, avoidable medical errors caused more lives than breast cancer in the United States. Therefore, the need for integration has become a global need, and as indicated above, integration can break global boundaries, thereby facilitating the collaboration of healthcare professionals in the provision of care and enhancing safety and quality of care (Enthoven, 2009; Persaud, 2019).

However, in Lesotho, where the study has been carried out, there is only one healthcare facility that has installed an integrated healthcare system that coordinates care services within the facility (PWC, 2013). It would improve healthcare services' performance in the country if more healthcare facilities could adopt integrated healthcare within their services to reduce the costs and time that the patients take at the healthcare facilities for healthcare services (Azevedo, 2017; Abiy, et al., 2018; Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; Mounier-Jack, Mayhew, & Mays, 2017).

HIS Integration across Different Healthcare Facilities

The World Health Organisation defines the integration of health services as follows:-

“Health services that are managed and delivered so that people receive a continuum of health promotion, disease prevention, diagnosis, treatment, disease-management, rehabilitation and palliative care services, coordinated across the different levels and sites of care within and beyond the health sector, and according to their needs throughout the life course” (Lepeleire, 2022).

The integration of patient medical records across different care provider organisations or facilities ensures that if a patient receives care from various healthcare facilities and arrives in one facility with a current ailment, the facility providing care will have access to the patient’s medical information through coordinated systems that store and allow retrieval of information as required easily in a manner that has been agreed between the facilities, with the assistance of some legal framework to ensure consistency and enforce compliance. Moreover, if the facility providing care needs more information from other facilities that have seen the patient, the healthcare professionals can collaborate and deliberate on clinical linkages to get the best solution for the patient’s ailment.

Without health systems integration, each healthcare facility will carry out tests from scratch that have already been performed in other facilities and increase patient costs unnecessarily (Bourgeois, Olson, & Mandl, 2010; Puustjärvi & Puustjärvi, 2016; Mwaseet al., 2010; Armitage, Suter, Oelke, & Adair, 2009). Moreover, lessons learned by previous healthcare professionals will not be shared with the current providers, and medical errors could be caused to the patient to the detriment and deterioration of his/her health (Bourgeois, Olson, & Mandl, 2010; Elhauge, 2010; Letourneau, 2009; Persaud, 2019).

In Lesotho, an American Corporation known as The Millennium Challenge Corporation (MCC) contributed to health systems strengthening (Mwaseet al., 2010) through the following:-

a) Rehabilitation of 17 Hospitals by the construction of outpatient departments
b) Construction of 155 health centres and
c) Installation of Health Information Management Systems, which were only installed in hospitals

Notwithstanding the assistance to the Lesotho government by the MCC, there has not been the integration of healthcare systems across the facilities, i.e. each facility keeps and manages its records independently. Therefore, patients' medical information is fragmented across the facilities, such that each patient has as many records as the number of facilities he/she has received care. Integrating healthcare systems across the healthcare facilities will enhance Lesotho's health sector, thereby ensuring safety and quality of care because patient medical information would be complete at any point of care (Roehrs, Costa, & Righi, 2017; Hetrick, et al., 2017).

The effects of fragmentation were realised during the COVID-19 pandemic, when countries with advanced global health security capabilities, such as the United States of America and the United Kingdom, responded late in the fight against the pandemic due to the fragmented governance of the health services (Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Hetrick, et al., 2017). The delay affected testing and contact tracing, which was a risk for healthcare professionals because they were left vulnerable to being infected as they were unprotected (Lal, Erondu, Heymann, Gitahi, & Yates, 2021). Therefore, fragmentation of healthcare services provided by different facilities or at different levels of care results in duplication of services, increased costs to patients as medical tests or procedures are repeated, unnecessary pressure on healthcare professionals, and lack of coordination between different levels of the provision of care, and this is because of the siloed approach of facilities or care providers (Barr, Garrett, Marten, & Kadandale, 2019).

HIS Integration by Function

The summary of benefits of implementing the Health Information Systems Integration are illustrated in Table 5 below:-

Table 5

Summary of the benefits of the HIS Integration (Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017)

ELECTRONIC HIS INTEGRATION	**BENEFITS**
1. Personal Health Record	a) The personal health record is always complete at the point of care b) Improved documentation of the personal health record
2. Within a Healthcare Facility	a) The facilities' healthcare services are coordinated such that at each service point the healthcare professionals have full details of what is happening with the patient, without having to stop work and ask if required health services from the previous service point have been fully offered. b) Omissions during the provision of care can quickly be realised by healthcare professionals before the patient leaves the healthcare facility
3. Across the Healthcare Facilities	a) The healthcare service delivery will be coordinated b) The patient will have one medical record c) The patient's medical record will be complete at any point of care d) Integration facilitates smooth collaboration among the healthcare professionals e) Quality and safety of care can be maintained due to full medical information for each patient at the points of care f) Medical tests performed in one facility may not be repeated in the other, thereby reducing medical costs for the patient and time saving for the healthcare professionals g) Reduced medical errors, which are normally caused fragmented and incomplete patients' medical information.

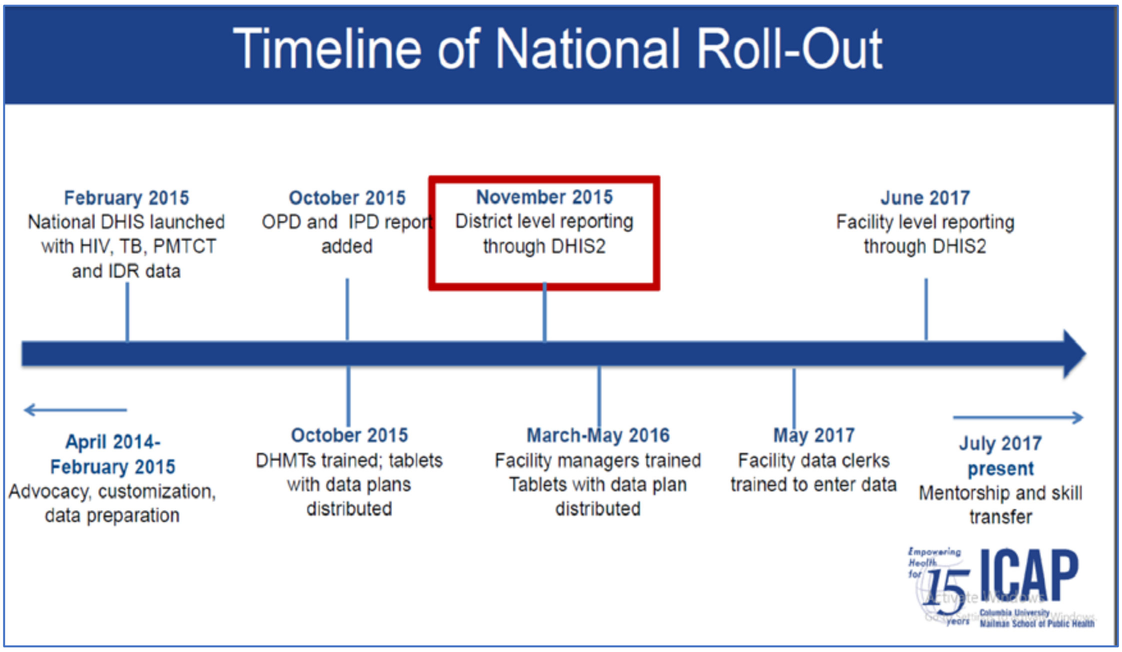
The Status of Health Information Management System in Lesotho

In Lesotho, where the empirical research is focusing, there are many international donor agencies which are willing to support programs that are aimed at improving the health systems to ensure that the lives of the Basotho Nation are protected from the danger of diseases (IPPF, UNFPA, WHO, UNAIDS, 2012; Mwase, et al., 2010). For example, the Millennium Challenge Corporation (MCC) of the United States of America conducted a five (5) year development program from the year 2008 to 2013. The program aimed to reduce poverty by improving economic growth (Downs, Montagu, da Rita, Brashers, & Feachem, 2013). One of its key components was Health Systems Strengthening, where investment for the design and development of an Electronic Medical Records (EMR) System was given to the Lesotho Government as a grant (PWC, 2013; MCC, 2013). The EMR system was intended to collect health data only at the Outpatient Departments (OPDs) of some hospitals owned by the Government of Lesotho and also by the Christian Health Association of Lesotho (CHAL) respectively, nationwide. For this initiative, private hospitals and Government health centres/clinics were excluded (MCC, 2013). The limitations of the EMR system, which was sponsored by the MCC, is that it focussed on the smallest point of contact with patients, at the outpatients department (OPD), which is only available in Hospitals but not in health centres/clinics country-wide. Therefore, this system needed to be improved to increase coverage for the country to achieve its objective of strengthening the Lesotho public health system. Therefore, a considerable effort to encourage and support research intended to establish the design for a suitable national health system, supporting infrastructure to accommodate other points of contact (health centres and/or clinics) with patients nationwide, empowering the health human resources and other relevant support functions is necessary.

Two years following the MCC's 5-year health systems strengthening project that ended in 2013, the Government of Lesotho got into another partnership with other donors under the health systems strengthening concept (Gadisa & Saito, 2018), and the EMR system was later discontinued. In the new partnership, a project intended to increase points of contact with the patient and expand the collection of primary health data nationwide was agreed upon (Gadisa & Saito, 2018). The project was for the design and development of a public health database known as District Health Information System 2 (DHIS2) and was supported financially and professionally by ICAP (Gadisa & Saito, 2018). The project timeline is illustrated in Figure 5 below:-

Figure 5

DHIS 2 Project Timeline (Gadisa & Saito, 2018)



The project is aimed at monitoring and reporting on health programs, such as a) Mental Health, Epidemiology, & Family Planning, b) Communicable & non-communicable diseases, c) Tuberculosis (TB), d) HIV Care & Treatment, e) HIV Testing and Counselling, f) Notifiable diseases (Gadisa & Saito, 2018). International Centre for AIDS Care and Treatment Programs (ICAP) and its partners are providing Tablets at health centres for health staff to collect data, which require telecommunication coverage and the following are challenges:-

a) In some healthcare sites, there is no telecommunication coverage
b) The tablets can easily be misplaced or stolen
c) The tablets can easily be misused such that when data is required for data input, airtime is finished.

The above-mentioned challenges can be mitigated through a different infrastructure or a different design of HIS that may not necessarily depend only on Tablets because they have a high risk of disappearing as they are portable. Moreover, a Policy Framework is needed to regulate the design and implementation of an efficient public health Information Management system that an African country, Lesotho in particular, can be able to manage and sustain over time, with professional and financial assistance from the donor community; a system through which health data can be collected easily from all healthcare facilities nationwide, be processed and produce information, through the reports that would assist healthcare services delivery.

Different from the two projects above, in 2011, another attempt by the Government of Lesotho to strengthen health systems was initiated under a Public Private Partnership arrangement, where a new referral hospital was built in the capital city, Maseru, and was equipped with an advanced Healthcare Information System, but which is only serving the hospital and it is not integrated through the DHIS2 because it is a private healthcare facility (Downs, Montagu, da Rita, Brashers, & Feachem, 2013). The referring healthcare facilities nationwide send patients to the referral hospital, some patients come with health booklets, while some just get referred with a doctor’s letter indicating their current ailment with no previous medical history (Mwaseet al., 2010).

Notwithstanding the efforts taken by the Government of Lesotho and its development partners to strengthen Lesotho's health systems, the Ministry of Health still refers patients outside the country, mostly in neighbouring South Africa, because there are patients whose medical conditions are beyond the capabilities of local hospitals (Mwase, et al., 2010; Ministry of Health, 2018). Therefore, supporting a study that is intended to conceptualise the design of a public health Information Management system to improve healthcare service delivery should be considered a worthy course because the findings from the study could be used as the groundwork for the design of an efficient Public Health Information Management System.

The Desired HISs Integration in Lesotho as influenced by OmniPHR

A patient with many chronic conditions may be required to seek medical attention from various doctors within the same healthcare facility or from healthcare facilities in different locations in the country. However, during the provision of care, any healthcare professional needs the patient's full medical history to make informed decisions and avoid medication errors to ensure the quality and safety of care (Singer, et al., 2020). Therefore, the integration of healthcare services within or across healthcare facilities can facilitate the availability of full patient medical information at the point of care (Lepeleire, 2022; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017; Singer, et al., 2020). **Figure 6** below illustrates the integration of healthcare services across healthcare facilities in Lesotho. The Patients' Health Records (PHR), also known as Electronic Health Records (EHR), are medical records of patient information which are used as a basis for the integration of healthcare services (Luz, Mussi, Dutra, & Chaves, 2021). Moreover, the PHR and EHR are also known generally as the Health Information Systems (Lal, Erondu, Heymann, Gitahi, & Yates, 2021).

Figure 6

Health Information Systems Integration

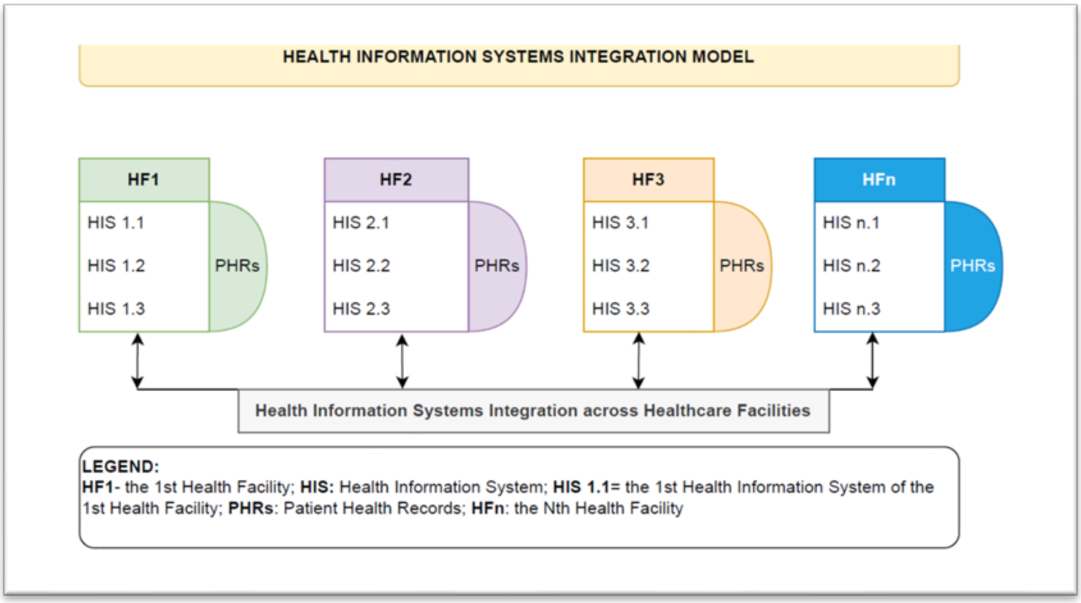


Figure 6 above is the illustration of the health information system integration recommended by the research. For the first healthcare facility, HF1, there are 3 HISs, namely, HIS 1.1 to HIS 1.3. HISs for HF1 are integrated. Therefore, the integration of health information systems is within the healthcare facility. Furthermore, the systems for the health facilities from the 1st facility to the nth facility are integrated. When the HISs in HF1 are executed, particularly when the patient visits the facility, the HISs create or update data in the Patient Health Record (PHR) for HF1. Moreover, the other integration happens as HISs within any facility are executed during the provision of care for a patient who has been to other facilities, and all the information from PHR in the other facilities is consolidated and appears at the point of care. Therefore, each health facility has Patients' Health Records (PHRs), which are updated with medical information from the Integrated Health Information Systems within and across the health facilities.

The Benefits of Health Information Systems Integration (Lubin & Shah, 2022; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017; Singer, et al., 2020)

a) Patients' Medical Records will have complete information at any point of service within the healthcare facilities.
b) Healthcare facilities will be able to share Patients' Medical Records
c) During the provision of care at any facility nationwide, a patient health record will be complete and will help health professionals avoid medication errors
d) The healthcare professionals will easily collaborate when systems across their facilities are sharable.
e) When healthcare facilities share medical records through HIS and healthcare professionals collaborate on patients' clinical issues, the quality and safety of care are expected to improve.

According to the literature, any country that has implemented HIS in the form of electronic health records EHR or Electronic Medical Records system expects to get the following benefits (Luz, Mussi, Dutra, & Chaves, 2021):-

a) Efficient and safe healthcare service delivery
b) Integrated health information systems
c) Reduced medical costs as there would be no medical errors or duplicate medical tests because healthcare facilities would be sharing patients' medical records during the provision of care

The Requirements for the Integration Across Healthcare Facilities

Since health information systems consist of, according to WHO, organisations, people, and actions primarily intended to improve, restore, and sustain people's health (Toskin, et al., 2020), the successful integration of such systems requires specific considerations. Therefore, to ensure the successful integration of health information systems, the following must be critically considered as they may hinder the coordination of healthcare systems intended to support the integration:-

a) Security of medical records, especially when medical records are shared across the healthcare facilities

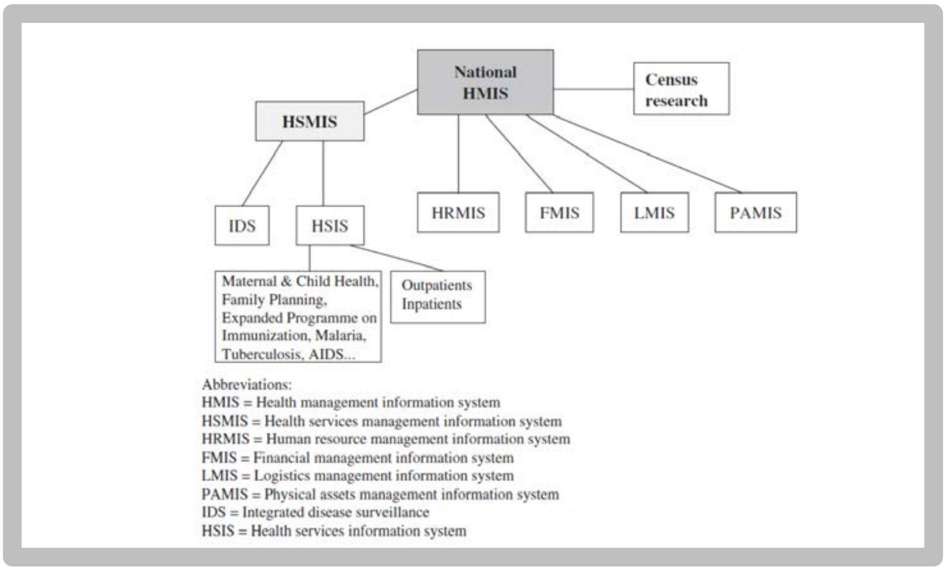
b) Confidentiality, Integrity and Availability of patients' medical information during the provision of care
c) Financial support by the government for addressing the functionality issues
d) Legal/Policy framework to regulate the implementation of the health information system integration process

The integration of health information systems is defined as the coordination of health systems such that any useful information from one system can be used as input to the other to improve timely decision-making during the provision of care (Armitage, Suter, Oelke, & Adair, 2009; Atun, Jongh, Secci, Ohiri, & Adeyi, 2010; Ohannessian, Duong, & Odone, 2020; Conseil, Mounier-Jack, & Coker, 2010; Mounier-Jack, Mayhew, & Mays, 2017; Trankle, et al., 2019). Therefore, healthcare systems integration can improve the quality of care to the patients, resulting in cost savings in the long term and improved health outcomes (Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; Buntin, Jain, & Blumenthal, 2010). Cost savings and improved health outcomes are critical factors for most African countries because they are poor and depend on grants or investments from international donor agencies (WHO, 2018; Buntin, Jain, & Blumenthal, 2010). Contrarily, Armitage et al. (2009) caution that, though the integration is said to bring very important positive health improvements, there is no clear tested evidence that healthcare systems integration improves health outcomes. On the other hand, the latest literature, which may still require further research, suggests that the COVID-19 pandemic exposed the gaps in health systems, mostly indicating that fragmentation of the health systems made most countries' health systems crumble (Lal, Erondu, Heymann, Gitahi, & Yates, 2021). Therefore, in anticipation of future pandemics, countries are cautioned to consider integration as one of the key considerations for better health and a sustainable future (Lal, Erondu, Heymann, Gitahi, & Yates, 2021).

On the other hand, Lesotho’s healthcare delivery systems are highly fragmented (Ministry of Health Lesotho, 2014). However, data within the facilities for some health services, such as oral health, delivery, out-patient, maternal health, inpatient and Antenatal Care, are integrated, while for HIV and TB control programs, immunisation, notifiable diseases, together with human resources and social welfare data are not integrated, the programs are stand-alone (Mwaseet al., 2010). Chaulagaiet al. (2005) argue that only health information systems with interdependent components can be integrated, meaning that health systems may not be fully integrated. But in the Lesotho health sector, where some systems are standalone (e.g. Health Financial Data, a system managing human resources for health, and the system managing health logistics) yet they have interdependent components, they could be integrated, as illustrated by Chaulagai et al. (2005) integration model in Figure 7 below:-

Figure 7

Public Health Information Management System Integration Model (Chaulagaiet al., 2005)



Furthermore, Hope, Kendall, Langer, & Bärnighausen (2014) suggest that in most countries of Africa, integration of Sexual and Reproductive Health (SRH) with HIV services happens to a certain extent, but countries which are serious about integration have ensured that integration is available in their HIV Strategic Plan. Such countries are Ethiopia, Kenya, Botswana and South Africa (Hope, Kendall, Langer, & Bärnighausen, 2014).

Notwithstanding the suggestion by Hope, Kendall, Langer, & Bärnighausen (2014) that there are three models of integration, namely, single provider, referral-based within one healthcare facility and referral-based across many healthcare facilities, the literature focuses on referral-based within one facility. For example, IPPF, UNFPA, WHO, UNAIDS (2012), Conseil, Mounier-Jack, & Coker (2010), Hope et al. (2014), and Atun, Jongh, Secci, Ohiri, & Adeyi (2010) discuss the integration of specific health interventions, such as HIV and TB programs within the healthcare system of each healthcare facility. On the other hand, even though there is no empirical evidence of research that deals with the integration of health information systems across healthcare facilities, where healthcare facilities can exchange patients’ medical records seamlessly, Electronic Health Records have been explored by many, with suggestions that integration is possible across healthcare organisations (Luz, Mussi, Dutra, & Chaves, 2021). However, without disregarding the importance of integration, according to Singeret al. (2020), the extent to which integration within and across the healthcare facilities is achieved by the health information systems in a national healthcare setting needs empirical research.

To highlight the importance of health information systems integration, Ohannessian, Duong, & Odone (2020) suggest that with pandemics like COVID-19, countries without integration of telemedicine in their healthcare systems must consider a policy framework to guide the adoption and implementation of telemedicine to facilitate the managing of the current and future pandemics. Moreover, if countries around the world had telemedicine integrated into their healthcare systems, healthcare professionals would easily collaborate regardless of the country they are operating from (Ohannessian, Duong, & Odone, 2020).

It is also worth noting that implementation of PHIMS integration needs full commitment by all stakeholders and government support so that proper regulatory framework and infrastructure can be put in place; monitoring and evaluation systems must also be designed so that performance indicators for integrated healthcare systems can be monitored (Hope, Kendall, Langer, & Bärnighausen, 2014; Kluge, et al., 2018; Grigorov, 2009).

Critical Success Factors of an Efficient PHIMS

The report notes that the envisaged Public Health Information Management System is electronic-based instead of paper-based. Paper-based Health Information Management Systems are inefficient and produce a lot of paper that becomes difficult and expensive to store, as paper takes up lots of space, paper records fade over time, and are vulnerable to distraction by water or fire (Janett & Yeracaris, 2020; GoL, 2013). Therefore, electronic medical records are known to solve multiple challenges brought about by paper-based medical records systems (Janett & Yeracaris, 2020). On the other hand, though the electronic-based records are more reliable and efficient to manage medical records, Keshta & Odeh (2021) caution that for the electronic system to be efficient, there are three properties that the system must possess, namely, a) **C**onfidentiality of the medical records, such that they can only be assessed by authorised personnel, b) **I**ntegrity of the medical records, such that the records cannot just be altered without authorisation, and c) **A**vailability of the patient's medical records when needed, especially during the provision of care when healthcare professionals need patient's medical history to inform the decision-making process during the provision of care, regarding the current ailment (Janett & Yeracaris, 2020). The patient's medical history that is critical during the provision of care could include, for example, ongoing medical treatment, prescriptions and previous diagnoses, which will assist the healthcare professional in making informed clinical decisions (Marutha & Ngoepe, 2017).

Availability and Completeness of Patient Information During Care

In Malawi, while the paper-based PHIMS is implemented, Chaulagaiet al. (2005) suggest that there were gaps in the appreciation and usage of existing data by health professionals. The gaps resulted in incorrect diagnoses and the entry of wrong files. Furthermore, Chaulagaiet al. (2005) and Muhindo, Joloba, & Nakanjako (2016) assert that the completeness of data is very poor. For example, only 50% of the facilities in Malawi conduct the compilation of data daily (Chaulagai, et al., 2005). In Uganda, district health status reporting is very poor and makes the completeness of data unreliable (Muhindo, Joloba, & Nakanjako, 2016).

Alternative to the collection of data in some African countries being problematic, as indicated above, there could be a challenge with the health system, which needs careful monitoring (Coyne & Hilsenrath, 2002). For example, South Africa is considered the most advanced African country in health systems, however, in 2002, when many adults were contracting the HIV epidemic, health professionals could not rule out the possibility that the health system could be flawed among many possibilities, such as inappropriate social conduct by citizens (Coyne & Hilsenrath, 2002).

On the other hand, in Lesotho, where the research will be conducted, the Ministry of Health keeps on changing healthcare systems because the data collected is either not enough, incomplete, or sometimes non-existent during care (Mwaseet al., 2010). Many different types of PHIMS have been implemented and some were later discontinued and replaced, to strengthen the country's health systems. For example, the EMR system sponsored by the Millennium Challenge Corporation (MCC) from America, was discontinued when the DHIS2 was introduced because DHIS2 was considered much easier to use and modify, as it uses open-source technology (MCC, 2013; Downs, Montagu, da Rita, Brashers, & Feachem, 2013; Gadisa & Saito, 2018). Data collection required for DHIS2 has challenges because of the input tool that is portable and sometimes taken home and forgotten and has a risk of being stolen or lost. Along with DHIS2 being used to collect data where tablets exist, in some facilities data is still only available in health cards or booklets that are carried by the patient. This type of storage (health cards or booklets) for health records has the risk of being lost, forgotten at home or damaged by water or fire. Finally, another initiative to strengthen the health systems in Lesotho was the introduction of the national referral hospital, which prides itself on the latest health Information Management systems technology (Downs, Montagu, da Rita, Brashers, & Feachem, 2013). For this initiative, the country is engaged in a Public Private Partnership (PPP) relationship with a private operator, where the challenge is that the facility's Health Information Management System is not integrated with other health facilities. Therefore, the arrangement does not facilitate easy collaboration among health professionals as patients are referred from the hospitals in the districts to the referral hospital in the capital City to the extent that a patient can be attended to without any known medical history. Therefore, in Lesotho, the availability and completeness of patients' medical information during care is still a challenge. In summary, there is a need to study the Lesotho health systems situation to determine the extent to which a design for a Public Health Information Management System can be conceptualised to integrate all healthcare facilities to facilitate collaboration among health professionals and improve the quality of care (Ohannessian, Duong, & Odone, 2020; Tensen, Heijden, Jaspers, & Witkamp, 2016).

Reliability and Security of the Health Information Systems

As has been indicated above, in most African countries, health information systems are still paper-based, and the security of such systems is difficult to guarantee. From the literature, there are at least four types of paper-based tools used to collect or store health data, namely, a) booklets, b) registers, c) data aggregation workbooks, and d) yearly review books (Chaulagai, et al., 2005; Grigorov, 2009; Muhindo, Joloba, & Nakanjako, 2016). For example, where health booklets are utilised (e.g. in Lesotho, Uganda, and Malawi), it is possible that the following risks could materialise: -

a) Health booklets can be forgotten at home
b) The health booklets can be lost
c) The health booklets can easily be destroyed by water or fire when kept at home.

d) Some parts of the clinical notes or medical information in the booklets could be illegible.

e) Some booklets could be blank as they could be new. They could be new because the owner was forced to buy them at the facility, as the old one was left at home intentionally or by mistake, lost or misplaced.

Moreover, where registers are used as a means of collection of healthcare data from primary to secondary healthcare for reporting to the tertiary level, the reliability and security of data can be compromised. From the natural disaster’s point of view, this kind of data storage and transporting of registers from health facilities is not safe because health booklets and registers can be lost, stolen or destroyed by fire or water. For example, if the mode of transport can experience any kind of problems/accident, there is a risk of registers falling into the wrong hands.

If any of the above-mentioned disasters regarding the paper-based records could happen, and the patient goes to receive care at the health facility, a new health booklet would have to be used to record the patient’s clinical information for the day and continuity of care will be compromised due to lost medical history. Alternatively, if the security risks mentioned above regarding health data registers materialise, healthcare provision for the concerned patients at higher levels of care will be compromised, delayed, or possibly result in a life-threatening situation. Therefore, the reliability of such records is highly questionable and needs serious consideration by countries to strengthen the capabilities of their health records management.

Considering the above security challenges and intending to encourage efforts towards efficient healthcare services delivery, the WHO insists that countries must invest in health information systems that will help them respond to future disease threats (Klugeet al., 2018). In addition, Kluge et al. (2018) posit that to ensure the capacity to respond to emergencies, countries must invest in resilient health information systems, and this would result in a very strong global health threats response framework. Furthermore, Kluge et al. assert that countries’ upfront investment in Health information systems mitigates the risk of public health crises, which threaten the economy, countries’ development and citizens’ social well-being.

Finally, for countries to be better prepared to deal with future global health threats, they must enhance the security of their health systems by embedding International Health Regulations (IHR) into their National Health Strategies because IHR is a framework for managing health disasters and outbreaks (Klugeet al., 2018; WHO, 2018). Having adopted the IHR, countries will be able to plan for the prevention of health risks, detection and responses to health outbreaks (WHO, 2018).

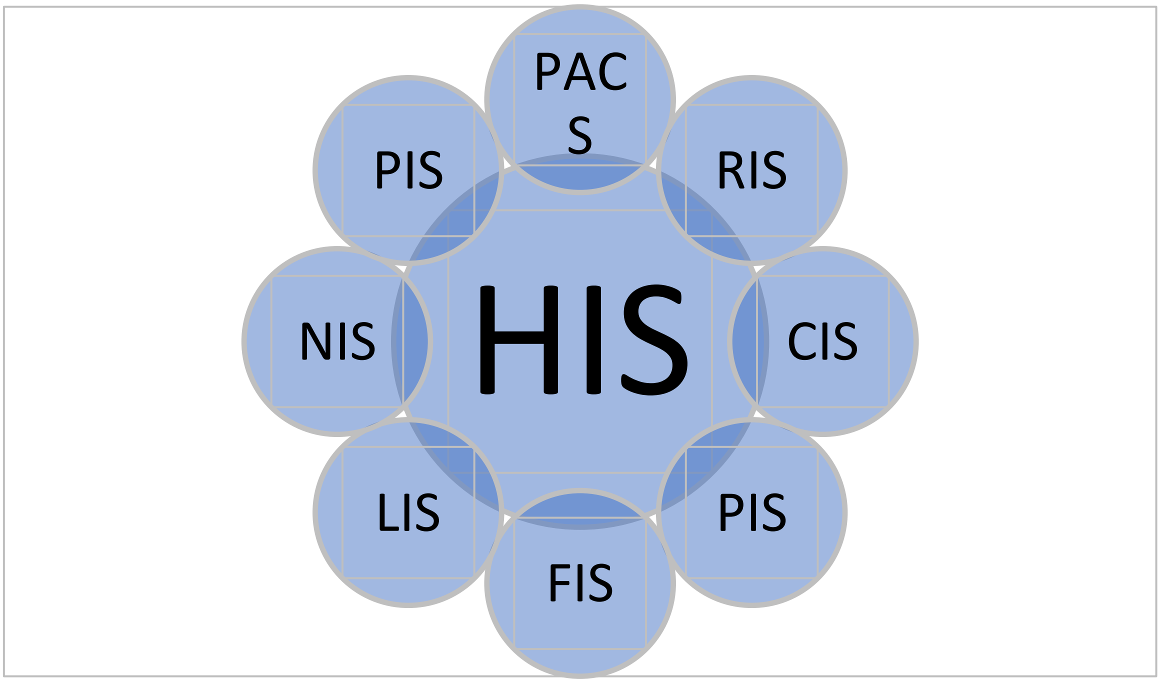
Towards Electronic Public Health Information Management System

Health Information System (HIS), by definition, is a collection of processes and resources organised to manage clinical, administrative and financial aspects of a healthcare facility to enhance patient experience and health outcomes while still minimising medical bills (Mehdipour & Zerehkafi, 2013; Baker & Axler, 2015).

Illustrated by **Figure 8** below, HIS could integrate and coordinate all or some of the following information resources or sub-systems, dependent on the size of a healthcare facility or services they have the capacity and/or capabilities to offer (Mehdipour & Zerehkafi, 2013, pp. 56-57). The resources or sub-systems could be:[PACS: Picture Archiving Communication System; RIS: Radiology Information System; CIS: Clinical Information System; PIS: Physician Information Systems; FIS: Financial Information System; LIS: Laboratory Information System; NIS: Nursing Information Systems; PIS: Pharmacy Information System] (see Figure 8 below)

Figure 8

HIS and its Sub-Systems (Mehdipour & Zerehkafi, 2013)



The above-mentioned sub-systems of the HIS would be contributing towards the five main components of the HIS, namely, a) Registration of patients, b) clinical orders and electronic alerts, c) online documentation of clinical encounters, d) appointment scheduling for patients, and e) billing (Mehdipour & Zerehkafi, 2013).

On the same token, in efforts by the global health community to manage information generated during the provision of healthcare, there is also something known as a Health Information Management System (HMIS), which is a system used in some healthcare facilities to record, store, retrieve and process data to produce information that enhances decision-making relative to healthcare (Endriyas, et al., 2019).

On the other hand, the National Health System (NHS) or the Public Health Information Management System (PHIMS) is defined as a government initiative to systematically put together private and public healthcare facilities to enhance, manage and restore citizens' health. The initiative ensures that national activities or services play an advocacy role in all sectors to manage factors of health politically, socially, economically and environmentally (Schmets, Rajan, & Kadandale, 2016).

Therefore, consolidating the concepts of HIS, HMIS and NHS, an efficient NHIS (which will be sometimes referred to as PHIMS) can be conceptualised. The PHIMS will be aimed at ensuring that the government takes control of the healthcare services offered at both public and private healthcare facilities and facilitates timely decision-making on factors of national health by authorities at all times. The suggested combination that forms a public asset known as PHIMS would be beneficial to Lesotho to minimise fragmented management of healthcare services or the silo mentality by healthcare facilities in managing health issues, such that private and public healthcare facilities do not share information across sectors and/or facilities.

The efforts by the Lesotho Government, assisted by donor agencies, to strengthen health systems to improve the performance of existing health systems have not yet produced the desired findings by the Ministry of Health, possibly because the attitude towards national health services is not correct or the concept is not known by the key stakeholders in the provision of healthcare. The research aims to highlight the importance of PHIMS, which would immediately bring the issue of healthcare services and systems integration to facilitate the sharing of information and avoid fragmentation of medical information. Integration of healthcare services and information systems would ensure that the healthcare system in Lesotho is resilient enough to be able to respond to future changes or challenges (Schmets, Rajan, & Kadandale, 2016).

Therefore, it would be easy for the Ministry of Health in Lesotho to control healthcare service delivery because the national health information would be received from one source, which carries national health data that is informative and conforms to World Health Organisation Standards.

Relevant HIS Elements to the Lesotho Health Sector

Lesotho, like other African countries, is not making much progress in trying to improve the healthcare service delivery nationwide because of the concept of Health Systems Strengthening (HSS), which focuses on efforts to improve the performance of existing health systems (Schmets, Rajan, & Kadandale, 2016). Therefore, if the basis or foundation for existing health systems was not efficient or had inherent flaws that were not identified during their design, then there will always be a need to fix something. For example, when Lesotho started with the HSS initiative in 2008, assisted by the Millennium Challenge Corporation (MCC), the Electronic Medical Record (EMR) System was developed for the Government under the Ministry of Health (MCC, 2013). The system did not last long beyond the 5-year MCC project timeline because the focus was on one aspect of health processes, the outpatient department (OPD) of the hospital and many other factors of health were not covered. But Lesotho needs a fresh start to conceptualise and then develop an NHIS, which will address the current health sector requirements within the confines of the WHO standards. For example, Stead, Kelly, & Kolodner (2005) suggest that a framework for building an efficient NHIS that can improve the health outcomes and patient experience has five components as indicated below:-

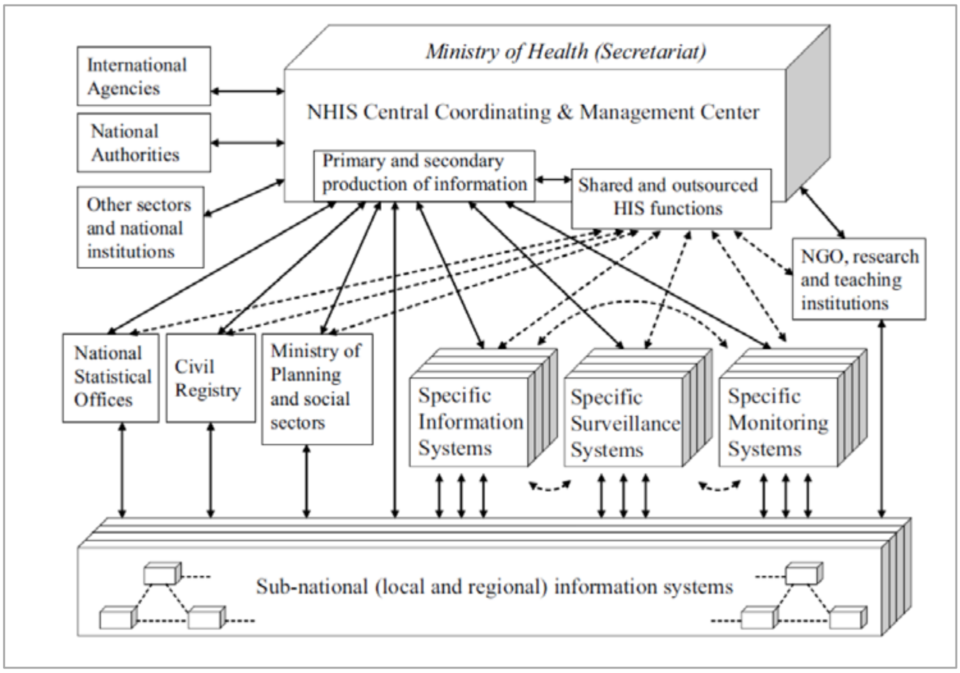
a) EMR System, which is intended to improve healthcare quality and safety by managing healthcare info
b) Electronic Health Record (EHR), which is patient electronic information required for managing personal health or the health of the community. EHR can collect information from different EMRs.
c) Personal Health Record (PHR), which is the collection of a complete patient health record

d) Standards, which include guidance on the management of medical records
e) Data interchange capabilities define the level of integration with other health systems within or across healthcare facilities.

One of the attempts for Lesotho HSS only focused on one component, EMR (MCC, 2013), possibly because health professionals from other countries suggested to their Lesotho counterparts or donor agencies that particular component. The other attempts include developing the HMIS where data was manually collected from the healthcare facilities; building an expensive national referral hospital through a Public Private Partnership, which is not integrated with other healthcare facilities; and development of open source DHIS2, which requires facilities to have a tablet as input device; still were not capable of assisting the Ministry of Health to take control of the health sector to facilitate timely decision-making at national level (Downs, Montagu, da Rita, Brashers, & Feachem, 2013; Gadisa & Saito, 2018; WHO, 2018). Therefore, Lesotho needs to adopt this approach to ensure that the HIS interacts with systems that support all factors of healthcare service delivery, which would result in an efficient health information management system. In addition, Stansfield et al. (2008) assert that NHIS must be efficient enough to support day-to-day management, long-term planning, and policy development for the National Health Sector. Moreover, PHIMS must be user-oriented and focus on decision-makers so that timely action can be instituted. It must also deliberately target issues of effectiveness, availability, and timeliness of information to support decision-makers (Gattini, 2009). Gattini (2009) suggests an approach that can be adopted by governments for implementing an effective NHIS (see **Figure 9** below). As illustrated in **Figure 9**, for an NHIS to be efficient, the Ministry of Health must coordinate all health management issues throughout the Health Sector so that healthcare professionals and leaders of supporting institutions can make decisions based on evidence.

Figure 9

Operational Approach for National Health Information System (Gattini, 2009)



To improve the management of health data, Lesotho, like other African countries like Kenya, adopted a system called District Health Information System2 (DHIS2), which is used to collect data at the point of care (Kyalo & Odhiambo-Otieno, 2019; Gadisa & Saito, 2018; MoH, 2016; WHO, 2018). However, DHIS2 is criticised for having limited reporting, which does not have an analysis of the health data (Kyalo & Odhiambo-Otieno, 2019). As a country, Lesotho would have to develop DHIS2 further to prepare it for interoperability with other systems, such as the Lab Information System (Gadisa & Saito, 2018). Therefore, the PHIMS for Lesotho would incorporate such specific information systems as DHIS2 to ensure that data collected in that system gets included in the main national health system, as indicated in the operational approach of the NHIS by Gattini (2009) in Figure 9 above.

The above-mentioned approach will ensure that health professionals, who are expected to collect health data, are not overburdened by a repetitive collection of data because the approach demonstrates the integration of information across key stakeholders in the health sector (Gattini, 2009; Stansfieldet al., 2008). Lesotho or any other country can achieve a similar approach suggested by Gattini (2009) through the development of a National Health Information Systems Architecture, which ensures that the following benefits are realised (Stansfield, et al., 2008):-

a) Avoid fragmented data collection and use
b) The system will be built with consistent data collection standards, management and use
c) Components of the architecture will be consistent with global disease programs, which is critical for affirmation by donor agencies such as WHO
d) Alignment of HIS investments to support healthcare services management and Health Policy, which can result in very strong health systems.

According to Stansfieldet al. (2008), NHIS Architecture will assist in identifying the important interrelations among the components of NHIS so that information can get where it is required at the right time during implementation (Global Fund, 2019). Therefore, this would reduce the risks associated with data collection, such as redundancy in data collection and reporting by health front-line staff, as data can be collected once and be shared with key stakeholders over integrated systems (Stansfieldet al., 2008). To achieve this approach, telecommunication coverage nationwide has to be improved to enable swift communication and connectivity across healthcare facilities (Tang, 2002; Stead, Kelly, & Kolodner, 2005). Moreover, many times, poor quality in healthcare service delivery is caused by the inaccessibility of data or information (Detmer, 2003; Trankle, et al., 2019). For example, when a physician does not have access to a patient’s medical history, he/she can worsen the ailment by providing allergic medication to the patient. Therefore, because the Lesotho NHIS is an improvement from the earlier attempts made by the country to strengthen health systems, NHIS will have to be aligned with the six aims for healthcare improvement as prescribed by the Committee on Quality of Healthcare for the Institute of Medicine in the United States of America (Ahluwalia, Damberg, Silverman, Motala, & Shekelle, 2017), namely, a) patient-centeredness, b) effectiveness, c) safety, d) timely access, e) efficiency, and f) equity. Therefore, a clear policy or legal framework that ensures collaboration among key healthcare service delivery stakeholders will be required to ensure the successful implementation of PHIMS.

Patient Identification Methods

When patients' medical records are successfully shared across healthcare facilities under the integrated Public Health Information Management System using the OmniPHR Model, one of the critical success factors of such a system is to match the patients to their medical records (Riplinger, Piera-Jiménez, & Dooling, 2020). Otherwise, that system would hurt care and safety, financial resources, and inappropriate sharing of medical information of patients (Riplinger, Piera-Jiménez, & Dooling, 2020; Paul, Laurence, Antoine, Philippe, & Vincent, 2021). Therefore, the integrated public health information management system requires proper identification of patients by care providers.

Overview of Patient Identification Methods

When any country intends to adopt a specific system which is applicable in the running of public operations, or specifically in the health sector, the following become important considerations to ensure that no one will be harmed by the existence of such a system:-

a) The benefits of the system to the public have to be identified,

b) Issues of security have to be clarified to ensure the safety of the lives of the citizens and

c) The legal/policy framework, which must regulate the usage of such a system, has to be determined to ensure that users and beneficiaries of the system are guided and protected by law, respectively.

Therefore, when a public health information management system is considered for adoption and implementation, one of the key questions would be: When patients' medical information is stored in the system, what measures could be put in place to accurately identify patients, such that the patient is who he/she says he/she is (Riplinger, Piera-Jiménez, & Dooling, 2020), or in the case of emergency and the patient is incapacitated, how will the patient be matched to the stored information in the system if he/she is already in the system? Or simpler asked: How will a patient be identified such that he/she is accurately matched with the data in the system if already in the system?

The above-mentioned question regarding the identification of a patient, with or without the ability to talk on arrival at the healthcare facility, brings about the need for any country to decide on the type of Patient Identification Method that would be adopted for integration with the Public Health Information Management System.

Selection of Appropriate Patient Identification Technique

According to Riplinger, Piera-Jiménez, & Dooling (2020), five methods can be used for patient identification, and these methods are controlled by the levels of technologies available, especially with considerations of healthcare systems integration where patients' medical records are shared across the health information systems of different organisations. The methods are namely:-

a) Unique Patient Identifiers (UPIs)

In many developed countries, except the United States of America, UPIs have been used for the identification of patients in interaction with health information systems (Riplinger, Piera-Jiménez, & Dooling, 2020). The countries that have adopted the UPI are using the national identification number as a UPI for patients. However, the USA has concerns regarding the privacy of patients' information. As a result, they have adopted other methods.

In a study that intends to establish progress towards the usage of UPIs and Case-Based Surveillance in Africa, specifically in the Southern Africa Development Community (SADC), challenges have been identified that hinder progress (Govender, Long, & Miot, 2020). For example, in most of the countries of SADC, the healthcare systems are still paper-based, and in healthcare facilities where UPIs have been implemented, they are facility-based and cannot be used across the facilities as healthcare systems are not integrated (Govender, Long, & Miot, 2020). Govender, Long, & Miot (2020) assert that there is a need for consideration of policy change to improve the management of healthcare systems.

b) Algorithm Approaches,

In this approach, patients are matched to their health information using, for example, demographic information (Riplinger, Piera-Jiménez, & Dooling, 2020). The USA has adopted this method with the addition of the social security number to the demographic information (first name, surname, date of birth, and gender) (Riplinger, Piera-Jiménez, & Dooling, 2020). Riplingeret al. (2020) suggest that there are different types of algorithm approaches with different levels of complexity as may be required by the country or organisation.

c) Referential Matching Software,

According to Riplinger, Piera-Jiménez, & Dooling (2020), the referential matching software method adopts the algorithm approach and adds additional demographic information, such as information from credit management or utility companies. These additions aim to improve the matching accuracy of the patient with the information in the health information system (Riplinger, Piera-Jiménez, & Dooling, 2020). Riplinger, Piera-Jiménez, & Dooling (2020) suggest that the referral matching software has an accuracy matching level of up to 100%.

d) Biometric Identification System

Biometrics is defined as the measurement of a person using physiological characteristics (physical and behavioural) (Mason, et al., 2020). The limitation in algorithms and UPIs leads to the adoption of biometric identification methods (Riplinger, Piera-Jiménez, & Dooling, 2020). Riplingeret al. (2020) assert that biometric data is mainly used in the USA, possibly because of its strength or accuracy in matching the patient with his/her records in the health system. Since biometric data can be fingerprints, facial recognition, iris scanning or palm vein scanning, and voice data, it cannot be stolen, misplaced or forgotten (Riplinger, Piera-Jiménez, & Dooling, 2020; Mason, et al., 2020). Riplinger et al. (2020) caution that the biometric method of patient identification has some limitations in that they are not as effective in infants as they are in adults.

e) Radio Frequency Identification

Riplinger, Piera-Jiménez, & Dooling (2020) suggest that though Radio Frequency Identification (RFI) is considered much more secure than the application of a barcode system, they are not used by many organisations as they are expensive and do not have standards and guidelines for their usage. The security in the transmission of patient data across facilities raises concerns to most users because there is no opportunity for a patient to authorise such data transmission (Riplinger, Piera-Jiménez, & Dooling, 2020).

Risks Associated with the Misidentification of a Patient

The first risk is medication errors, where a patient is given the wrong medication or incorrect procedure due to the wrong identification of the patient. This mistake can cause serious patient harm if there is a mistaken identity (Riplinger, Piera-Jiménez, & Dooling, 2020).

Secondly, misidentification of a patient can cause unnecessary financial strain on the patient, especially if the current matched records do not indicate that certain tests or treatments have already been made on the patient, while the data is for another patient and wrongly matched (Riplinger, Piera-Jiménez, & Dooling, 2020).

Finally, misidentification of patients leads to limitations in the sharing of data across healthcare facilities, which can lead to clinical decisions being made on incomplete patients' medical information during the provision of care (Riplinger, Piera-Jiménez, & Dooling, 2020).

Medication Errors Related to the Healthcare Services Delivery

Causes of Medication Errors

Every healthcare facility has a primary goal to ensure patient safety. However, due to various reasons and conditions at healthcare facilities, medication errors can occur in the process of providing care because humans are not perfect, sometimes the resources are not adequate, or the healthcare systems in place are not appropriate for the healthcare services delivery. For example, a paper-based system does not allow the integration of the patient's medical information or the sharing of information across the facilities. Therefore, during the provision of care, patients' medical history may not be easily accessible or exist, which then calls for new and current medical information or worse, the healthcare professionals would have to depend on the patient to get the patient's medical history. Unfortunately, the patient who is not a medical professional may not accurately relate medical history, and the information they provide would be unreliable. Moreover, if medical tests had been done on the patient, and such information is not available because of poor record keeping, they would have to be repeated at the expense of time and also repeated costs for the patient. Using information provided by the patient may result in medication errors, as the basis would not be reliable.

A medication error is defined as a failure in the medical treatment process that leads to or has the potential to harm the patient, such as causing undesirable drug reactions (Säfholm, Bondesson, & Modig, 2019). Alternatively, some definitions of medical error are more elaborative and clearer as it is defined popularly as "any preventable event that may cause or lead to an inappropriate medication use or patient harm, while the medication is in the control of the healthcare professional, patient or consumer" (Assiri, et al., 2018; Mira, 2019; Mulac, Taxis, Hagesaether, & Granas, 2021; Shitu, Aung, Kamauzaman, & Rahman, 2020; Khan & Tidman, 2022).

According to available literature, medication errors are an inherent risk to the lives of patients and are prevalent in many countries worldwide (Musharyanti, Claramita, Haryanti, & Dwiprahasto, 2019). Musharyanti, Claramita, Haryanti, & Dwiprahasto (2019) assert that medication errors are commonly caused by a lack of concerted communication between healthcare professionals, such as doctors, nurses and pharmacists, regarding the healthcare services that they provide to patients daily. There is a need for healthcare professionals to provide clear clinical management notes for the next healthcare professionals to be able to provide necessary healthcare services with complete information. The clinical notes can indicate current treatment with medication and requirements for the next visit to the healthcare facility, allergies to any medication and anything that can help to ensure continuity of care

(Musharyanti, Claramita, Haryanti, & Dwiprahasto, 2019; Mulac, Taxis, Hagesaether, & Granas, 2021). Consequently, the clinical notes inform the next healthcare professional of the patient's full medical information to facilitate quality and safe provision of care (Assiri, et al., 2018). Furthermore, in a study that was conducted in Norway in 2021, where the researcher wanted to determine at what point of the provision of care in a hospital severe and fatal medication errors occur, the findings indicate that most medication errors occur during the administration of medication and prescription, so the leading types of errors were namely, a) dosing at 38%, b) omissions at 23%, and c) wrong medication at 15% (Mulac, Taxis, Hagesaether, & Granas, 2021).

Mitigation Measures Against the Medication Errors

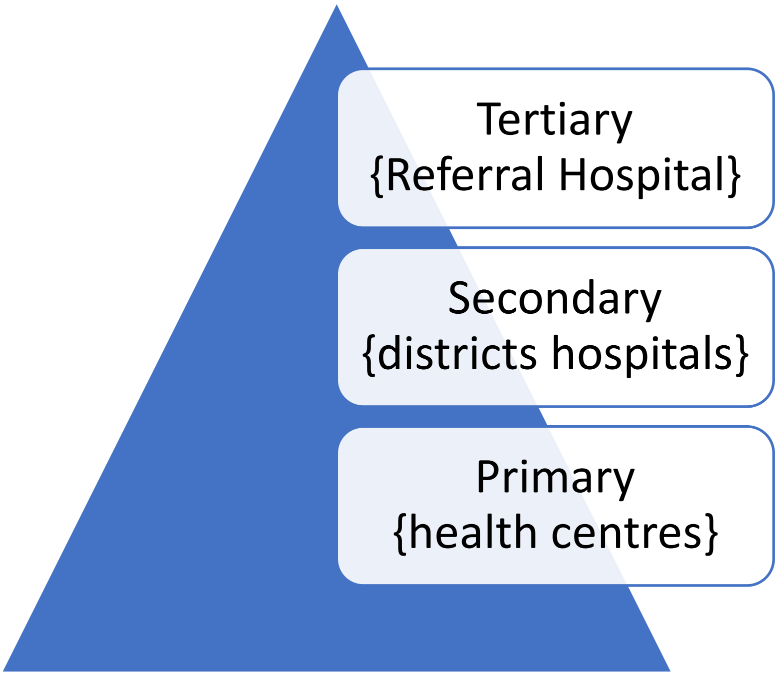
Suggested mitigations for medication errors in some cases have been the decision to train new nurses and continuously train nurses on new medication safety procedures, especially for critical patients, as their medication may not be common to many nurses as they are not regularly used in a hospital's day-to-day activities (Mulac, Taxis, Hagesaether, & Granas, 2021). Alternatively, in Norway, the challenge is approached technically, i.e. the Norwegian Incident Reporting System was developed that can identify medication errors, such as wrong dosage errors and those that provide allergy alerts to avoid prescribing or administering the drugs to which the patient has allergic reactions that can harm the patient or have the potential to harm a patient (Mulac, Taxis, Hagesaether, & Granas, 2021; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021). Secondly, medication error incident reporting systems are developed mainly because of severe medical errors, which are errors that lead to or have the potential to harm patients or, in some cases, become the cause of death (Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Mulac, Taxis, Hagesaether, & Granas, 2021). When incidents of medication errors are documented in a system, they can be used as lessons learned to inform future handling of medical activities so that the same errors may not be repeated. Thirdly, as most severe medication errors are attributed to the administration of drugs for patients, such as dosing, medication reconciliation between the doctor’s and patient’s medication lists must be frequently practised to ensure appropriate dosages are adhered to and avoid adverse medical events (Säfholm, Bondesson, & Modig, 2019; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Mulac, Taxis, Hagesaether, & Granas, 2021). However, when patients’ medical records are not complete or not available, such as when they are in small pieces at different healthcare facilities, which is the case in fragmented health information systems, reconciliations of medical records may not be possible. Therefore, a consideration to integrate the health systems within and across the healthcare facilities could make it possible for healthcare professionals to reconcile medication lists as a mitigation measure against possible medication errors, to be implemented to avoid harm to the patients and save lives (Säfholm, Bondesson, & Modig, 2019).

The Healthcare Services Delivery Infrastructure in Lesotho

The healthcare services delivery in Lesotho is provided at three different levels, namely, the primary, secondary and tertiary levels respectively (GoL, 2013) [see Figure 10 below]. In this regard, the country aims to reach patients in every part of the country and make healthcare services accessible to all citizens, wherever they live in the country, at affordable cost (GoL, 2013). When a country can offer healthcare services to all its citizens at an affordable cost, the World Health Organisation refers to that as having reached Universal Health Coverage (UHC). Moreover, the primary level is where the communities have the first contact with the healthcare services of the country, and that is known as Primary Health Care (Lim, Pathmanathan, & Jaafar, 2021).

Figure 10

The three levels of healthcare services delivery in Lesotho (GoL, 2013)

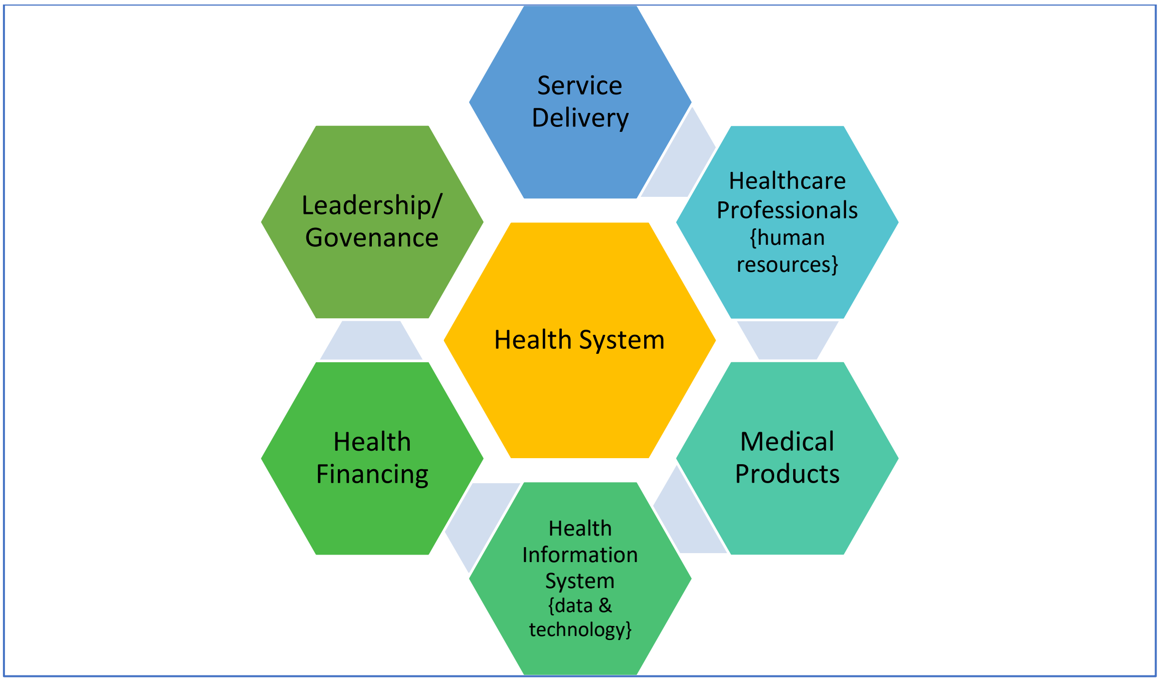


Healthcare Facilities are constructed and set up to provide healthcare services that are safe and of good quality to save patients' lives. For example, they are equipped with the resources that can help to achieve their objective of saving lives, such as healthcare professionals, medical supplies, medical equipment, and a clean, habitable environment. However, sometimes things do not turn out as planned for either healthcare professionals in the way they provide care or patients' actions after they receive care. For example, healthcare professionals conduct their business differently, such as having an unwelcoming attitude or prescribing or providing patients with the wrong drugs that may cause severe adverse events to the patients, which may result in harm or fatalities; alternatively, patients or consumers of the drugs may miss the doses and be harmed by the drugs. These mishaps are known as medication errors. However, it is still possible for the healthcare sector to create and maintain safe and good quality healthcare service delivery. Furthermore, the World Health Organisation (WHO), World Bank and the Organisation for Economic Co-operation and Development (OECD), in their report which they assess the quality of healthcare services (WHO, OECD, World Bank Group, 2018), suggest that while the healthcare service delivery in all countries is nurse-driven, especially in the provision of the services through the primary healthcare system, the availability of healthcare professionals does not necessarily mean safe and quality healthcare services will be provided (WHO, OECD, World Bank Group, 2018). However, the report cautions that healthcare professionals can still make medication errors, such as wrong diagnoses or faulty prescriptions. Therefore, the report (WHO, OECD, World Bank Group, 2018, p. 43) suggests that the quality of the healthcare service delivery is not just about the healthcare professionals' skills in the provision of care but also the result of many factors, namely, a) **Accessibility**: how easy is it for the patients to get a chance to speak with a healthcare professional, physically at the health facility or by video or voice call; b) **Acceptability**: Do the healthcare professionals at the facility make patients feel accepted, listened to or are patients’ opinion regarding their health being considered or taken seriously i.e. do the patients feel respected?; c) **Quality**: is the healthcare professional knowledgeable? Is their work and attitude ethical enough to be considered normal as viewed by the patients? d) **Skills Mix and Teamwork**: are the healthcare professionals capable of working as a team to handle healthcare services issues, such as patients’ mortality and/or morbidity incidents; e) **Enabling environments**: does the healthcare facility infrastructure make it easy for the disabled patients to move about within the premises of the healthcare facility to get the required services. If there are specific patient requirements or disputes (financial, legal, political, or cultural) between a patient and healthcare professionals, are the facility administration and staff willing to cooperate with or assist the patient to resolve the issues that cause disputes?

Therefore, beyond the existence of the healthcare staff that provides healthcare services, other factors as indicated above of accessibility, acceptability, quality, skills mix, and teamwork, enabling environments would require some kind of leadership to support healthcare professionals that deliver the healthcare services, because to strengthen the quality of healthcare services, effective leadership is required to provide guidance, coaching and support to the healthcare professionals that deliver the healthcare services (Sfantou, et al., 2017). In accord, Govender, Proches, & Kader (2018) assert that weak healthcare leadership leads to or contributes to poor healthcare service delivery. Moreover, to ensure that the healthcare leadership has the continuous capacity to lead effectively, an organisation or proprietor for the healthcare facilities must deliberately have capacity-building initiatives, such as training healthcare professionals for continuous improvement, introducing the performance management system for healthcare professionals, implementing monitoring and evaluation of the healthcare systems to ensure that the goals, which are set for the healthcare services delivery, are achieved (Govender, Proches, & Kader, 2018). Furthermore, one aspect of effective healthcare service delivery is based on the theoretical framework of the research, which is about implementing a healthcare system that will ensure that each patient has one complete medical record at the point of care. Therefore, this means data generated for the patient at a healthcare facility during the provision of care is essential for future visits of the patient to any healthcare facility as it will inform the healthcare professionals about the previous medical information. Moreover, with complete patient information, healthcare professionals can provide care that is safe and of good quality and avoid medication errors (Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020). Consequently, to provide healthcare services to the patients, the application of the research theoretical framework will require a health information management system, which will make it possible for each patient to have one medical record, regardless of the number of healthcare facilities he/she has visited. According to the World Health Organisation, there are six important building blocks, as illustrated in **Figure 11** below, for a functional healthcare system, namely, the healthcare service delivery, healthcare professionals, medical products, health information systems, health financing, and Leadership (Sacks, et al., 2019). For the scope of the research, the report will focus on healthcare service delivery, human resources (healthcare professionals) and health information systems (management of medical information). Healthcare service delivery requires a health information system to collect and manage patients’ medical information and make it accessible to healthcare professionals during the provision of care at a healthcare facility that the patient has visited for the current ailment. Furthermore, the research project conceptualises a design for the public health Information Management system that will help healthcare professionals generate, store, and manage the patients’ medical information such that each patient has one complete medical record at the point of care.

Figure 11

Six Building Blocks for a Health System (Sacks, et al., 2019)



Legal Framework for Lesotho Public Health Information Management System

As far as the medical records management or health information systems design, each care provider uses the design that best suits their way of operation. For example, the following are true and happening in Lesotho:-

a) There is no national or public health management system. Each healthcare facility collects, records, stores and manages patient data in a manner that is comfortable or suitable for their independent operations (Mwaseet al., 2010; Mwaseet al., 2010).
b) There is no national database for health records which contains medical records for all the citizens of Lesotho.
c) Public and Private healthcare providers keep their records independently and in the format of their choice.
d) Medical information is not shared across care providers. However, for public healthcare facilities and those of CHAL, healthcare data are manually shared between the health centres of the district and the district Hospital (MoH, 2016).
e) On a very low scale, in Public and CHAL facilities where one government's development partner, ICAP, has donated iPad devices and Laptops, health centres use District Health Information System2 (DHIS2) to record their health data (Gadisa & Saito, 2018). The system depends on telecommunication coverage to operate, which unfortunately is not available in some centres or is not stable when available (PWC, 2013).

The researcher understands that the efficiency of any government tool, such as a public health Information Management system, needs strong policy guidance and support, especially the legal framework, to regulate its implementation so that those at fault can be sanctioned accordingly. Once the regulatory/policy framework is formulated, it must be shared with all stakeholders to ensure transparency by all stakeholders, as all key stakeholders will be made aware of the boundaries set for its operation. Therefore, the legal framework is intended to ensure that the envisaged information system is designed and implemented successfully and efficiently. Moreover, for the envisaged system to be successful, it is therefore vital for the developers of the legal/policy framework to understand the following factors:-

a) The environment within which the envisaged system is intended to be implemented
b) The objectives of the envisaged public health Information Management system
c) The existing National Health Policy
d) The current National Strategic Development Plan
e) The International Health Regulations

f) The constitution of Lesotho

Understanding these factors would ensure that an appropriate legal/policy framework that regulates the implementation of the envisaged system is developed in line with the laws and policies of Lesotho without ignoring the international laws set by organisations that Lesotho is affiliated with through bilateral agreements or membership.

However, in Lesotho, there is no national policy or regulatory framework that directs healthcare facilities to integrate their healthcare management systems so that the sharing of information and collaboration among healthcare professionals can be simplified. Therefore, the Lesotho healthcare system allows fragmentation of the personal health record because a) patients' records in all healthcare facilities are paper-based. In public facilities, the medical records are kept in the health booklets, which are in the custody of the patients or physical files for the inpatients; b) each healthcare facility keeps patients' medical information in a manner that satisfies their independent operations, and this minimises the possibility of sharing health data across the health sector to improve healthcare service delivery (Kouroubali & Katehakis, 2019; Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017). Due to the fragmentation of patients' medical records, each patient has various and different medical records at the healthcare facilities that she/he has visited over time, resulting in the provision of care having inherent risks of medical errors by the healthcare professionals, repeated medical tests, and unsafe and low-quality healthcare service delivery (WHO, 2018; Ramesh, Manimegalai, & Priya, 2020; Barr, Garrett, Marten, & Kadandale, 2019; Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Persaud, 2019; Roehrs, Costa, & Righi, 2017).

Moreover, in healthcare facilities that use healthcare booklets, which are intended to record and keep a complete medical record for the patient, there is a risk of illegible handwriting, the booklet being left intentionally by the patient because of personal reasons, destroyed by water or fire; or being lost; or forgotten at home when care is required (PWC, 2013). Therefore, the next healthcare professional may be forced to provide care with incomplete or no patient medical information and put the life of a patient in danger as critical information such as medication that the patient is allergic to or current treatment (Mirgane, 2021; Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020). For example, information regarding allergies that the patient may have forgotten about may lead to the prescription of allergic medicines, which could worsen the patient's ailment and threaten their life.

Lesotho's Current Laws and Policies on Health-related Matters

The design of the envisaged efficient Public Health Information Management System (PHIMS) must be guided by the current laws and policies of Lesotho, with special interest and adherence to the health-related protocols.

Adherence to the health-related protocols would ensure that the PHIMS is aligned with the country's strategic direction to facilitate smooth implementation due to high chances of buy-in and ownership by key stakeholders.

Any planned modification to the enacted laws or approved policies and regulations of health-related matters must be communicated to the Minister of Health for clearance. If modifications are cleared, then the Minister may recommend such changes to the Cabinet of Ministers of Lesotho for approval (MoH, 2017). Table 6 below shows current regulations, policies and laws of Lesotho related to the National Health Systems:-

Table 6

Lesotho Health-Related Laws and Regulations

Health-related Laws/ Plans/ Policies/ Regulations	**Emphasis on Health matters that could regulate the Design and implementation of a National Health Information Systems**
The Lesotho Public Health Order 1970	The order emphasises the need for the country to adhere to International Health Regulations and all its future amendments (Government of Lesotho, 1970).
Lesotho National Health Strategic Plan 2017-2022	The plan gives focus to design and development of resilient Health Systems, which require a coordinated effort of all health stakeholders locally and globally to create a workforce that is dedicated to national and international health initiatives (MoH, 2016). According to the plan, the PHIMS should focus on five areas, namely, a) generation of data, b) data compilation, c) data synthesis and analysis, d) information dissemination and usage for decision-making (MoH, 2016).
Lesotho Public Health Bill 2018	Directs that the Health Information Management System must be designed to monitor and evaluate healthcare service delivery for the integrated healthcare delivery network.
Policy - National Multi-Sectoral Integrated Strategic Plan for the Prevention and Control of Non-Communicable Diseases (NCDS): 2014-2020	Stresses that the health systems must be strengthened and Health Information Management System is one of the key support services for the Lesotho Essential Services Package, which focuses on provision of services for the Primary Health Care strategy (MoH, 2017). The Health Information System should be able to provide disaggregated data reports on NCDS, inherent risks and their determinants. HMIS should assist in, a) monitoring trends, magnitudes and impact of NCDs nationally; and b) information dissemination through Information and Communications Technology(ICT) means (MoH, 2017).
International Health Regulations (IHR)	Among many important issues the IHR suggest that each country must have strong surveillance systems, which will result in dissemination of information to assist prompt decision-making (WHO, 2016). In the IHR, WHO (2016) defines surveillance as continuous collection, collation and analysis of public health data for timely dissemination of information to aid public health response as appropriate.

Other Laws that Affect the Design of Lesotho PHIMS

Notwithstanding having its regulatory framework, Lesotho is a member of some international bodies and organisations, such as The World Health Organisation, The

Commonwealth, and the African Union, just to name a few. Therefore, Lesotho is bound by many regulations and conventions that are sanctioned by these institutions. For example, in the 61st sitting of the World Health Assembly, WHO urged member states to establish Health Information Systems that will assist member states in the assessment and analysis of trends for migrants' health and disaggregate health information by appropriate categories (WHO, 2008).

Having a system that tracks migrants' health would assist countries in making a deliberate effort to implement strict measures to record the health status of migrants while moving in and out of the country and provide necessary reports to the authorities (WHO, 2008).

Legal/Policy Framework's Goals and Objectives

a) Ensure that the Lesotho Public Health Information Management System is used within the confines of the existing laws of the country and also in alignment with the international laws and conventions that govern universal health matters.

b) To guide the health sector towards achieving Universal Health Coverage (UHC) advocated by the World Health Organisation (WHO). UHC is regarded as a solution for managing healthcare needs at both national and global levels for developing countries, which insists on affordable delivery of healthcare services for all people regardless of financial status (Barr, Garrett, Marten, & Kadandale, 2019; Lal, Erondu, Heymann, Gitahi, & Yates, 2021).

c) To ensure that the Lesotho Health Sector adheres to national and international health-related legislation, regulations and policies, such as the International Health Regulations (IHR) governed by the WHO (WHO, n.d.).

d) Ensure that the system is used by authorised healthcare professionals only to ensure the integrity of the system.

e) Improve the quality of the healthcare services in Lesotho through the following:-

(i) Ensure that the healthcare services in Lesotho are patient-centred for much-improved healthcare service delivery all the time.
(ii) Ensure that healthcare facilities provide integrated care for their patients for better health outcomes (Kupeli, et al., 2018).
(iii) Ensure healthcare services' systems are integrated so that the patient's medical information is always available at any point of care nationwide (Barr, Garrett, Marten, & Kadandale, 2019; Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Roehrs, Costa, & Righi, 2017).

f) Reduce the healthcare costs for the patients

g) Improve patients' access to healthcare services

The Proposed Legal Framework Provisions

For the envisaged system to operate smoothly, specific provisions have to be added to the current legal framework to ensure that those affected by the systems are protected by law against any wrongdoing or wrongful accusations. The proposed provisions need to be added as the envisaged Public Health Information Management System has never been implemented before and, therefore, needs to be regulated to ensure that all the stakeholders abide by the laws and that their actions are also protected by the law. If provisions of the law as regards usage and management of the envisaged system may not be added, the new system would just fail before it starts.

The legal framework is important to regulate the implementation of the PHIMS because the system will be handling people's private and confidential information, which, if it falls into the wrong hands, the information could be misused. It is common that when systems implemented to deal with people's information are critically regulated to ensure that all affected by the systems have an equal advantage in interacting with it. For example, in developed countries such as the USA and the UK, the usage of devices to monitor patients' health is regulated to ensure compliance with the set national standards for data handling, sharing and interoperability where applicable (Michie, Yardley, West, Patrick, & Greaves, 2017).

Moreover, in the USA, the relevant legislation for health monitoring devices is the Health Insurance Portability and Accountability Act, while in the UK, it is the Data Protection Act (Michie, Yardley, West, Patrick, & Greaves, 2017). These acts or regulations within the acts are intended to protect confidential information for the patients when the devices are used for managing and sharing such information across care provider networks (Michie, Yardley, West, Patrick, & Greaves, 2017). Therefore, on the same token, the PHIMS for Lesotho would have to be regulated using relevant legislation in the country to enforce specific restrictions on the usage and sharing of patients' medical information by authorised users.

Public Health Information Management System IT Standards

a) Electronic Health Record structure must be agreed upon by all healthcare facilities (private and public) under the guidance of the Ministry of Health to facilitate the integration of healthcare systems for the Lesotho Health Sector.

b) Health data formats for all new systems must be approved by the Ministry of Health to ensure the smooth sharing of health information across and among healthcare facilities.

c) The system must have the following characteristics (MEASURE Evaluation, 2018):-

(i) Clear documentation with simple definitions
(ii) Inclusive to cover all the health information system needs as identified by health stakeholders and captured by the developers.
(iii) Well-designed with infrastructure that will facilitate ease of use by health professionals once trained to use the system.
(iv) Easily adaptable to all health service levels and gradually rolled out from one level to the next without compromising any health standards.

d) Its planned coordination should help it to operate under all kinds of human perspectives and different types of challenges, such as political, environmental or social challenges.

National Health Database

a) The Ministry of Health will become the custodian of the national health database, which will be centrally stored using the Lesotho Government ICT Systems Guidelines.

b) Data from all the healthcare facilities registered in Lesotho will continuously update the national health database to facilitate consolidated national reporting on health matters as required by the Government of international organisations such as the World Health Organization.

c) A system to perform a periodic backup of the National Health database must be developed and documented to ensure consistency in the backup procedures and business continuity in case of disaster, respectively.

Access and Administration of the System

a) The system must be accessible to authorised users who have access to the World Wide Web (Internet)
b) The MoH ICT Department staff must be the administrators of the system
c) All legally registered doctors, private and public, must be given access to the system
d) All healthcare professionals who are in charge of legally registered healthcare facilities must be given access to the system
e) All users must have unique login credentials to ensure ownership of activities performed on the system
f) For a healthcare professional who has been fired or is no longer considered authorised to carry out any healthcare activities, access to the system must be withheld.
g) Access to the system by MoH Head Quarters employees will be authorised by the Honourable Minister of Health.

Usage of the System

a) Healthcare professionals providing care must update patient records with relevant information as it is generated during the provision of care.
b) Authorised users must use the system as mandated by the authorities
c) No one should use the system for personal reasons
d) The system must be used only for the intended and authorised use

Reporting

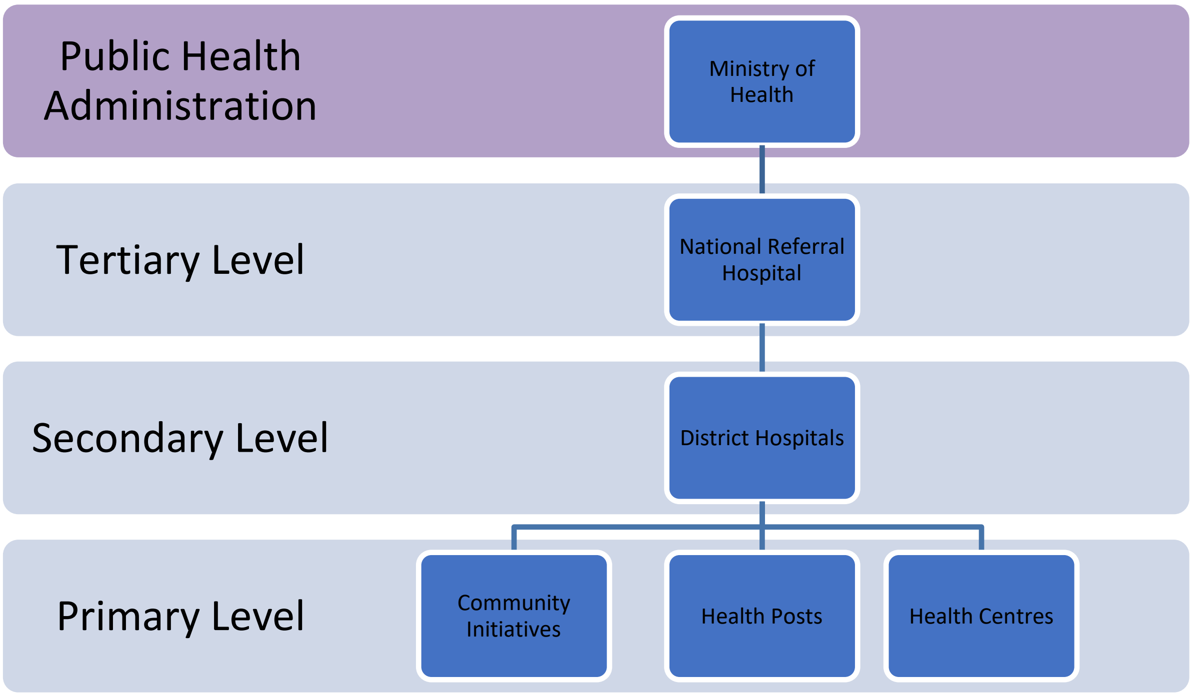
a) The system must allow reporting as defined in the International Health Regulations.
b) Authorised users must adhere to the standard health reporting regulations
c) National and International health reports will be generated from the national health database

The Organisation of Lesotho Public Health Information

Healthcare services delivery in Lesotho is divided into three levels, namely, Primary, Secondary and Tertiary healthcare levels (MoH, 2016), as illustrated by **Figure 12** below. The first level of service delivery is the Primary level, which is at the community level being provided by Village Health workers, the Health Posts and the Health Centres, whichever the patient chooses or can access easily or quickly (MoH, 2016). According to the MoH (2016), the health posts and village health workers often take patients to the health centres for further observation, from where the health centres provide care or pass them further to the district hospitals, but they can still take them straight to the district hospitals.

Figure 12

The Lesotho Health Sector Healthcare Service Delivery Levels (MoH, 2016)



Implementation of the PHIMS for Lesotho

a) Testing the system with the user and handing the system over to the Ministry of Health must be conducted under the guidance of the Principal Secretary of the Ministry of Health, who is also the chief accounting officer for the Ministry.

b) User training for all system users must be mandatory to avoid unnecessary problems caused by a lack of system understanding.

c) After training, induction into the live system must be conducted to confirm understanding of the user roles while operating the system.

d) All registered doctors must be given credentials to access the system, and all registered healthcare facilities must be added to the system to facilitate data input, health records integration and consolidated reporting as appropriate.

e) System Change Management procedures must be developed and practised to ensure that the Director General authorises all changes at the Ministry of Health Headquarters.

f) Change of healthcare facility by a registered user should formally be communicated to the system administrator to ensure continued access.

Health Information Security

Public health information should be stored in the Government of Lesotho's computers (servers) that are administered by assigned Health ICT personnel. The servers should be accessed through login name and password, strictly known to the server administrators. Access to the health information database on the Government Wide Area Network (WAN) should only be provided to the registered and authorised doctors and their assistants (nurses) during healthcare provision. Understanding and meeting the technical requirements as set out and being aware of the inherent risks associated with the storage and use of the information will ensure information security and integrity, as well as timely communication with other systems when required because the designers will manage to determine suitable software necessary to manage storage and security of information (Farzandipour, Meidani, Nabovati, Jabali, & Banadaki, 2020). Additionally, to ensure that information is secure, healthcare organisations must adhere or align their security policies to international security standards such as the Information Security Controls to Personal Data Protection as found in ISO/IEC 27001:2013 and ISO/IEC 27002:2013 (Diamantopoulou, Tsohou, & Karyda, 2020).

Furthermore, the country, through the Ministry of Health, must develop a policy that will guide how issues of confidentiality and security for the Public Health Information Management System should be treated. The Policy should indicate clear procedures to be followed and punitive measures that would be taken should offenders be identified.

Privacy of Patient Information

Notwithstanding the importance of the envisaged public health Information Management system and the benefits it will have towards assisting the country to be in control of the national health data, that information will be accessible by many users from different healthcare organisations who may develop certain behaviour to the extent of using the information for personal gain. Therefore, it has become a global interest to protect patient information through security controls to avoid unauthorised misuse due to negative behaviour by those entrusted to use the information for the improvement of healthcare services (Beck, Gill, & Lay, 2016).

Moreover, as integrated health information is required to assist the country in managing national health status to reach the required standards for Universal Health Courage (UHC) in Lesotho, health data reports are not for individual patients but are disaggregated by certain health elements that would facilitate national reporting. Therefore, national reporting on health data should not show any patient names, but it should be by health components that can facilitate timely decision-making by healthcare professionals or government officials. For example, reporting elements could be disease concentration per living area, gender, age, education, etc. If these requirements are understood by health organisations, patient information will be kept private and confidential.

Health Systems Integration and Interoperability

According to the literature, the absence of health systems integration is a source of all challenges to the management of the health sector, as each system will be independent of others, systems will be operating in silos and without any coordination, which can create life-threatening situations in the provision of care (Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017). Implementation of a Lesotho public health Information Management system requires an integrated approach in the design of information systems so that unnecessary complications in the provision of care can be avoided (Lepeleire, 2022). For example, all health information systems architecture must have the same structure for a patient health record, which would facilitate interoperability between systems. Therefore, the Ministry of Health must provide an approved patient health record structure and approved technology standards to healthcare organisations to facilitate common designs and compatibility of health information systems both for private and public healthcare institutions. These approved structures and standards of health information systems must also be aligned with the latest International Health Regulations and World Health Organisation requirements.

Moreover, for the Ministry of Health to ensure an efficient Public Health Information Management System, a periodic health information systems audit must be carried out, either half yearly or annually, as the MoH may choose, the audit should be carried out by an independent systems audit firm to ensure impartiality. This would ensure that all new systems comply with the latest requirements for designs of healthcare information systems in all registered healthcare organisations.

Physical/Digital Migration

Migration of the system from a fragmented system to an integrated health information system requires a deliberate and systematic engagement with key stakeholders of the PHIMS, from administrative to technical professionals in both health and information technology. To achieve successful stakeholder engagement, the firm in charge of the system development process must develop a migration plan that should be agreed upon among key stakeholders before the migration process commencement. The plan must cover inputs and outputs, which are expected for the PHIMS.

Following stakeholder engagement, a team to take stock of the old system's functionality must be selected. This could be followed by a joint planning session to determine the latest requirements and match them with the old functionality to determine the gaps. The two lists must be merged to fill the gaps and identify the duplicates to establish one final list. The final list can be provided to the developers for reference as the latest requirements that can form part of the terms of reference for the functionality of the PHIMS.

Security Aspects of the Health Information System

It is important to note that there are risks associated with Health Information Systems (HISs), though health information systems are important to organise the healthcare services delivery. The HISs are known for identifying and involving complex interconnected processes for data collection in the information society and converting it into information that supports decision-making in public health (D'Agostino, et al., 2021). Health Information Systems are known for providing economic benefits through efficient processes, managing health data effectively, and efficiently administering care, especially when medical information is used for improving diagnosis, educating patients, and promoting self-care (Fatima & Colomo-Palacios, 2018).

HIS Security Risks and Mitigation Measures

The inherent risks in implementing health information systems are available throughout the processes involved with healthcare service delivery. Therefore, organisations need to identify them so that measures for mitigating their impact should the risks materialise, can be put in place.

First, it is common knowledge that the fastest way to share information across organisational networks is through the Internet. Therefore, having an internet presence or using Electronic Devices on the Internet has Risks for an organisation: When healthcare systems are integrated to provide efficient care across the healthcare organisations, they use the internet (Fatima & Colomo-Palacios, 2018). Therefore, there is a risk of unauthorised access to the patient's medical information through hacking or as a security breach where an outsider uses an electronic device to gain access to confidential information or data is damaged through an electricity power outage (Fatima & Colomo-Palacios, 2018; WHO, 2021).

Mitigation measures: to mitigate the impact of exposure should the risk materialise; a certain level of access control must be deliberately set. For example, devise a certain policy for the change of passwords and ensure the change is mandatory, or develop an authentication procedure for accessing the HIS or make a rule that passwords must be treated safely and not shared among employees or friends (Fatima & Colomo-Palacios, 2018). Moreover, identify suitable IT standards, specifically those related to Health Systems, such as developing ICT policy that defines IT security requirements, such as performing penetration tests regularly to ensure that network protection systems are up-to-date (Fatima & Colomo-Palacios, 2018; Sittig, et al., 2020; WHO, 2021).

Second, Internal Risks: There is a risk of data theft by internal employees of the healthcare facility, Accidental sharing of data to the wrong email address, and Accidental deletion of medical records by an employee (Fatima & Colomo-Palacios, 2018).

Mitigation of internal risks: encrypt all email messages to ensure that if the email is sent to the wrong addressee, it cannot be read, or encrypt data on removable devices (Fatima & Colomo-Palacios, 2018). From the daily mistakes that staff perform, develop specific training cause outlines that target areas of improvement (Fatima & Colomo-Palacios, 2018).

Third, third-party software installed in the HIS of a healthcare facility: There is a risk of system failure due to outdated third-party software intended to enhance the performance of HIS or add security features such as antivirus software, system errors, or technical errors (Fatima & Colomo-Palacios, 2018; Sittig, Belmont, & Singh, 2018).

Mitigation: Identify the suitable IT Standards for the software requirements and request the method statement, which will provide details of how the solution would be carried out. Ensure that IT development companies follow the IT standards that are suitable for the requirements (Sittig, et al., 2020).

Fourth, Network Risks: Unavailability of the HIS or patients’ medical information due to breakdown of the network within which the HIS is supported, non-adherence to ICT network configuration standards or failure to ensure security to the critical places of the networks, such as the server room, which houses the network drivers and controllers (Fatima & Colomo-Palacios, 2018; Sittig, Belmont, & Singh, 2018; WHO, 2021; Sittig, et al., 2020).

Mitigation: Develop and implement ICT Policy to emphasise adherence to general ICT Standards and also ICT standards for Health ICT systems. The standards should include, for example, continuous monitoring of ICT systems to determine Health Information Systems safety hazards, ensuring that ICT standards for HIS are strictly adhered to, and implementing security audit strategies such as penetration testing (Smith, 2018; Sittig, et al., 2020; WHO, 2021).

Fifth, Natural Disaster Risks: unavailability of HIS services on the network due to natural disasters such as fire, cyclones or floods (Fatima & Colomo-Palacios, 2018).

Mitigation: Include in the ICT Policy the setup and development of a disaster recovery plan, which will ensure that when a natural disaster strikes, there will be a plan to recover from such a disaster (WHO, 2021).

Sixth, Medication Errors Risks: Sittiget al. (2020) suggest that due to the complexity of the HIS, the users can select the wrong medication from the list displayed by the system, or if the correct option is selected, the user can choose incorrect dosing because the options are not clear.

Mitigation: Develop periodic training programs for HIS users and Implement appropriate guidelines, procedures and security controls (Fatima & Colomo-Palacios, 2018; Sittig, et al., 2020).

Seventh, Data input risks: if the HIS is not user-friendly, the system users may fail to input data or commit errors during data input correctly due to the poorly designed user interface (Sittig, et al., 2020).

Mitigation: To avoid poor designs, software-developing organisations must follow well-established software development standards (Sittig, et al., 2020).

Eighth, Patient Identification Risk: When working in an integrated healthcare services environment, where a patient's medical information is shared across the healthcare facilities, there is a risk of being unable to match a patient with his/her information that is contained in the system, when the patient arrives at the point of care (Sittig, et al., 2020).

Mitigation for Patient Identification Risk: There are many options to deal with the risk of not being able to match the patient with the stored patient information in the HIS, the choice may depend on availability or resources. The options are as follows:-

a) Improvement of the HIS interoperability capabilities (Sittig, Belmont, & Singh, 2018).

b) Formulation of a unique patient identifier that can be agreed upon nationally and enacted into law (Sittig, Belmont, & Singh, 2018; Sittig, et al., 2020).

c) Using algorithms to combine some patient information (Mason, et al., 2020; Sittig, et al., 2020). For example, combine a passport number with a national identification number or date of birth for a patient with a village identification number or constituency number.

d) Select a biometric identification from either fingerprints, facial recognition, iris or palm vein scanning, and voice data (Mason, et al., 2020; Sittig, et al., 2020; Sittig, Belmont, & Singh, 2018; Riplinger, Piera-Jiménez, & Dooling, 2020).

On the other hand, beyond the risks discussed above that must be managed when sharing patients' medical records across healthcare facilities networks, for Lesotho two critical issues need to be addressed to ensure a smooth integration of healthcare services across healthcare facilities as guided by the theoretical framework, OmniPHR. To ensure that healthcare professionals have access to complete patient's medical information continuously and consistently, telecommunication infrastructure must improve greatly. This will facilitate the sharing of patients' medical information, comprising clinical notes text and high-quality pictures, across healthcare facilities without the slightest disturbance that might distort patients' information. Otherwise, there is a risk of medication errors that healthcare professionals can make at the point of care. Moreover, Table 7 below illustrates the global digital and connectivity indicators projections for 2025, indicating that Lesotho's digital infrastructure needs tremendous improvement so that the communication required to achieve OmniPHR requirements can be reached (Alda, 2024):-

Table 7

Digital Infrastructure and Connectivity Indicators (Alda, 2024)

Digital Infrastructure and Connectivity Indicators	Lesotho Projections for 2025	South Africa Projections for 2025	United Kingdom Projections for 2025
The 4G network coverage	88.94%	99.98%	100.00%
The average broadband connection speed	13.98k kbit/s	45.89k kbit/s	116.10k kbit/s
The 3G network coverage	96.29%	100.00%	100.00%
The export in ICT services per capita	US$0.02	US$24.26	US$0.74k
The total consumer spending in ICT equipment	US$8.31m	US$4.64bn	US$15.92 bn
The Internet penetration	51.76%	83.58%	87.05%
The number of households with internet access at home	14.59k	13.35m	28.09m

The table above shows that internet penetration in 2025 will only be at about 52%. However, OmniPHR requires full coverage so that there will be no shortcomings in patient medical information access, to ensure that complete patient's medical information is accessed at any point of care. Furthermore, the projected number of households with internet access at home is only about 15 thousand, which is approximately 54 thousand people out of a population of 2 million, making it about 2.7% of Basotho with internet access (Esri, 2023). This status of connectivity needs a serious improvement for the OmniPHR to be effective in supporting or driving the efficiency of the envisaged PHIMS.

Secondly, the legislation governing the sharing of medical information across healthcare facilities must be enacted and put in force when a PHIMS is implemented, otherwise, some healthcare facilities will not participate in the patient's medical information integration, which is supposed to be for all healthcare facilities nationwide, regardless of whether the facility is public or privately owned. This is critical because sharing medical records between public and private healthcare entities is not usual in Lesotho, as each entity has its own acquired way of managing medical records for its patients because the entities are governed differently. Therefore, to address leadership and governance for proper implementation of the envisaged PHIMS, a legal/policy framework must be formulated. It is evident that, in Lesotho, both leadership and governance in information and communications technology are major challenges to the implementation of the electronic health systems because risks associated with implementation of these systems are not identified promptly to facilitate appropriate mitigation plans (Maoeng, et al., 2024), which in most cases results in the electronic health systems being abandoned or replaced if funds permit.

Summary of the Chapter

The research topic is about strengthening the Public Health Information Management System (PHIMS) through the integration of Healthcare Information Management Systems from various healthcare facilities in Lesotho. The PHIMS needs strengthening because, currently, the healthcare services offered through PHIMS are risky to the lives of the patients because they are fragmented and prone to medication errors. Therefore, there was a need to research and establish measures that could mitigate the risks that are associated with the current healthcare service delivery systems to the lives of patients.

To conceptualise the design of an efficient Public Healthcare Information Management System for Lesotho through the integration of health systems of care providers, the researcher has adopted a theoretical model known as OmniPHR to guide the research process. The OmniPHR theoretical framework is about the patient having one medical record at the point of care. The framework has three important variables, that guide research design, data collection and analysis. The variables are a) Availability of the patient record when needed, b) A complete patient record at the point of care, and c) A point of care, which is a public or privately owned healthcare facility in Lesotho. These are needed to ensure that healthcare professionals make informed decisions at the point of care to avoid medication errors and maintain safe and quality care to the patients (Roehrs, Costa, & Righi, 2017).

For OmniPHR to be implemented successfully, each healthcare facility must have an electronic Health Information Management System, which manages patients' medical records such that each patient has an Electronic Health Record (EHR) at that facility. Therefore, each patient must have one EHR that contains the medical information generated at the healthcare facility through the interaction of the patient and the healthcare professionals during the provision of care. The OmniPHR integrates EHRs from various healthcare facilities that the patient has visited to seek care into one personal health record (PHR) per patient because the

OmniPHR technology facilitates the sharing of medical information across healthcare providers, thereby giving the healthcare professionals the full medical history of the patient when providing care, and avoid medication errors.

Sharing medical information across health information systems of care providers may have challenges that should not be overlooked, such as the security and privacy of such sensitive data (Hakim & Vaze, 2021; Jin, Luo, Li, & Mathew, 2019). However, blockchain technology is used to mitigate the risks inherent in sharing data across healthcare facilities to make medical data secure and only accessible to authorised users (Hakim & Vaze, 2021; Miller, 2021; Vora, et al., 2018; Jin, Luo, Li, & Mathew, 2019).

Health information systems are designed to capture patients' medical information during the provision of care at a healthcare facility and improve collaboration among healthcare professionals. Moreover, Health Information Systems (HIS) help healthcare professionals manage health data effectively to improve the quality of healthcare and safe lives (Wilms, Mbembela, Prytherch, Hellmold, & Kuelker, 2014). Notwithstanding the importance of HISs, some countries are still not doing enough to support the implementation, control and management of HISs. For example, in most African countries, medical records are still paper-based as opposed to electronic format, and this hinders the integration of health records because paper-based records cannot easily be shared across healthcare facilities (Roehrs, Costa, & Righi, 2017). Therefore, paper-based medical records are the source of fragmentation of patients' medical information because when records are not shared across care providers during the provision of care, patient medical information will not be complete as the electronic health records of one patient would be scattered at the healthcare facilities that provided care, resulting in risky healthcare service delivery and possible medication errors (Roehrs, Costa, & Righi, 2017; Mathews & Pronovost, 2011; Abiy, et al., 2018).

Notwithstanding the importance of the integration of health programs that a country may prioritise, it is critical to begin with the integration of healthcare systems from various care providers to ensure that the integration is patient-based as opposed to health-program-based because clinical data regarding other patients’ ailments may be omitted resulting in incomplete national health status, as required by the OmniPHR theoretical model.

The management, control and monitoring of the HIS in Lesotho need improvement because, in most healthcare facilities, patients’ medical records are still paper-based and therefore fragmented and available as pieces of information within care provider healthcare information systems where the patient received care over time (Ministry of Health, 2018). This situation poses risks during the provision of care because healthcare professionals do not have access to the complete medical history of a patient, which can cause healthcare professionals to commit medication errors (Assiri, et al., 2018). Therefore, to strengthen healthcare systems in Lesotho, the health sector must migrate from paper-based medical records and adopt electronic health information systems in all healthcare facilities to facilitate the integration of healthcare systems across care facilities, as sharing of medical records will be possible with electronic systems in place (Roehrs, Costa, Righi, & Oliveira, 2017; Persaud, 2019). After the adoption of the electronic healthcare systems, then it will be possible to integrate the systems into a Public Health Information Management System for the Ministry of Health to control, manage and monitor healthcare service delivery nationwide and be aware of the performance of various health programs, as they would be having a full medical history of all patients (Persaud, 2019; Ramesh, Manimegalai, & Priya, 2020).

However, it is important to highlight the critical success factors for an efficient Public Health Information Management System as established through the literature review. The following, though not the only ones, are considered crucial elements for the PHIMS to be efficient:-

a) The system must be electronic to facilitate medical records sharing and enable IT-based health information systems integration for healthcare providers. Otherwise, with paper-based medical records, patients' medical information remains fragmented, medical records are not easy to share, and are unreliable. For example, clinical notes written on paper may fade over time, or the handwriting may be illegible.
b) The system must be reliable and secure to ensure that it is always available when needed and accessible only to authorised users to maintain the privacy and integrity of patients' records.
c) Proper patient identification methods must be in place to ensure that care providers can accurately match patients to the correct records stored in the system, thereby avoiding medication errors during care provision.

The research findings must refute or confirm the theoretical assumptions made by the researcher that a) For Lesotho, migration of medical records from paper-based to electronic format will improve the quality and safety of care, b) A detailed patient medical record will support decision-making during future care, and c) All healthcare professionals understand the need for the quality of information in a patient's medical record.

Finally, according to the literature review, for the OmniPHR theoretical framework to be successfully implemented in Lesotho, the digital infrastructure must be improved, and a legal/policy framework that binds healthcare facilities to share patients' medical records must be enacted.

CHAPTER 3: RESEARCH METHODS

Introduction

The study is about strengthening the public health information management system (PHIMS) through the integration of healthcare systems of various healthcare facilities in Lesotho, regardless of whether they are for public or private proprietors, to address the problem identified in the country. The problem is that healthcare services delivery in my country, Lesotho, is fragmented and, therefore risky to the lives of the patients. The healthcare facilities in Lesotho do not share patients' medical records, instead, they work independently of each other in providing care, such that one patient has as many records as the number of healthcare facilities that have provided him/her with care. Therefore, fragmentation is caused by the various independent healthcare systems of the care providers in Lesotho, some of which are paper-based and not easy to share, while others are electronic-based but still working independently.

The purpose of this qualitative study is to show that integration of healthcare services delivery within and across healthcare facilities can be used as one of the strategies to strengthen the Public Health Information Management System to ensure its efficiency. Strengthening the public health information management system through the integration of healthcare services within and across healthcare facilities has been established by the application of the theoretical model of the research adopted in Chapter 2 above, which guides the research. The theoretical model illustrates how healthcare providers can share the electronic health records of a patient to facilitate the integration of the medical records to ensure that there is only one medical record for a patient during the provision of care. Having one complete medical record at the point of care facilitates improved health outcomes because the healthcare professionals will make informed decisions, which minimises the risk of medication errors (Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020).

The research approach and design under which the research questions, objectives, philosophy, methodology, design, and methods are described. The Chapter reiterates the research questions that the research findings must address to resolve the research problem, as guided by the theoretical framework. There are three research questions, which are briefly discussed below:-

a) To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?
   Managing to establish the existing challenges during the provision of care could assist in identifying possible solutions that could improve the quality and safety of care.

b) What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?
   The critical success factors of a PHIMS established through the research process could make the PHMIMS efficient and assist in resolving the research problem, if applicable for Lesotho.

c) How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?
   The research may establish appropriate policy/legal framework elements that could be used to regulate some of the critical success factors as incorporated in the design of the PHIMS to ensure its efficiency.

The research objectives are related to the research questions and will be achieved when the questions are addressed. Furthermore, the philosophy adopted, interpretivism, is based on the understanding that there could be different perspectives to viewing reality (Alharahsheh & Pius, 2010; Ryan, 2018; Isaeva, Bachmann, Bristow, & Saunders, 2015). Therefore, participants' views are collected and analysed to assist the researcher in determining his views.

The research methodology adopted is induction because unlike deduction, whose inferences do not require evidence, and the abduction approach, which is about speculation with acceptable assumptions about the phenomenon being studied, induction needs empirical evidence to make probable conclusions, which this qualitative research provides (Folger & Stein, 2017).

The research design applied for the research is a case study design because unlike the other two research design approaches, namely, ethnographic, which requires the researcher to be an active participant such as being an employee where the research is conducted, and grounded theory, which requires the researcher to develop a theory that could later be tested using a hypothesis, case study design assists the researcher to use a small sample of participants to study complex life matters (Crowe, et al., 2011; Heath & Cowley, 2004; Kothari, 2004; Savage, 2000).

Furthermore, the research population is defined. After that, the population sampling techniques and methods are critically analysed, and the researcher selected purposive sampling to facilitate the participants' selection directed to a specific group of participants knowledgeable about the phenomenon to be studied as opposed to random sampling, which would require more research time and more resources such as a high number of participants and many researcher representatives, which would have to be paid.

Moreover, the research tools, procedures and ethical assurances are highlighted to clarify that the participants were allowed to decide whether they wanted to be involved during the research process. The researcher explained the research and its importance and requested a signed consent form for each participant. Therefore, participants got involved at free will and were made aware they could withdraw their participation at any point in the research process. Finally, data collection using the instruments influenced by the theoretical framework, such as interviews and a focus group meeting, and the data analysis technique known as thematic analysis are critically discussed.

In summary, the chapter illustrates the qualitative research methods which were used in conducting the study, provides reasons for selecting the methods applied, and emphasises that the research subjects participated of free will without being harmed.

Research Approach and Design

The researcher established three research questions, through which data collection tools were formulated to facilitate the acquisition of responses from research participants to resolve the identified research problem. The approach was for the researcher to establish the views of the research participants through data collection tools, interview questions and focus group meeting deliberations, regarding the research questions. After data collection, participants' responses were analysed to obtain the findings, which were interpreted against the research assumptions to respond to the research questions and determine whether the objectives of the research were achieved. The purpose of this qualitative study is to show that integration of healthcare services delivery within and across healthcare facilities can be used as one of the strategies to strengthen the Public Health Information Management System for Lesotho, to ensure its efficiency, was met. The research questions are as follows below: -

a) To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?

With this question, the researcher intends to establish all types of challenges that can hinder the provision of care, such as unavailability and lack of reliability of the patient's historical medical information, accessibility issues and reliability of storage of historical patients' medical information. These issues are investigated from the perspectives of the participant, i.e. are the hindrances caused by lack of administrative capacity in providing resources, such as a store room containing patients' medical records being very difficult to access. Or lack of access by the healthcare professionals to the current system of storing records during the provision of care or when information is required for any other purpose, such as when there are legal issues relating to a specific patient incident.

b) What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?

These factors should help address the challenges that would have been established.

The question is intended to get the participant's opinion of how the system should be built so that it may be considered efficient in their experience or their opinions. What are the specific functions that the participants would like a public health Information Management system to have so that they may consider it comprehensive or all-inclusive of the services that the healthcare facilities may offer to their patients?

c) How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency? *The framework would ensure that the conceptualised system is efficiently regulated so that its stakeholders get the maximum benefit from the system and are protected while interacting with the system.*

The researcher wanted to find out from the participants their views on suitable laws, policies or standards that can assist in the regulation of the implementation of the envisaged system to ensure that the system benefits all its stakeholders within the health sector.

The research questions are aligned with the theoretical framework, which is intended to improve the healthcare service delivery for the patient, such that each patient has only one medical record regardless of the number of facilities that have provided care to the patient over time. For example, the first research question seeks to find challenges that hinder the provision of care by healthcare professionals daily, which could compromise the safety and quality of care to the patients. The participants' responses provided insight into the daily challenges that healthcare professionals face while providing care. Concerning the second research question, the researcher needs to establish the critical success factors that would make it possible for the patient to have only one medical record. Finally, the third research question seeks to determine the appropriate regulatory/policy framework suitable for implementing a Public Health Information Management System that can make it efficient.

Research Objectives

The process of answering the above-mentioned research questions, through conducting interviews and focus group meeting deliberations with research participants, has assisted the researcher in achieving the following objectives of the research: -

a) To understand why the healthcare service delivery in Lesotho is not coordinated and, therefore, risky to patients' lives.
b) To establish why the healthcare facilities in Lesotho do not share patients' medical information to facilitate collaboration and improve the quality and safety of care.
c) To determine why there is no Policy/Legal Framework in Lesotho that binds and regulates the sharing of patients' medical information by healthcare facilities to facilitate efficiency in healthcare service delivery and avoid poor management of medical records.

Research Philosophy

Interpretivism, also known as constructivism, is the philosophy underpinning the research. It is founded on the understanding that there is no singular reality. The researcher postulates that individuals may perceive things differently and, therefore, contribute distinct perspectives to an issue. Table 8 below illustrates the relationships among various research philosophical paradigms (Ryan, 2018).

Table 8

Philosophical Paradigms (Ryan, 2018)

	Positivism	**Constructivism/ Interpretivism**	**Critical Theory (CT)**
Ontology What is Reality?	**Empiricism Naive Realism Logical Realism**	**Relativism**	**Historical Realism (Historical Social Structures)**
Epistemology What is truth?	**Objectivity**	**Subjectivity**	**Modified Subjectivity**

In agreement with Ryan (2018), as illustrated in Table 8 above, Alharahsheh & Pius (2010) add that researchers will thoroughly understand phenomena or behaviour by looking for perceptions and experiences of certain groups of people because knowledge and truth are subjective. Moreover, Isaeva, Bachmann, Bristow, & Saunders (2015) suggest that the diversity of experiences, stories, perceptions, and historical context factors brought about by interpretivism create new knowledge more than just theories and concepts found in other paradigms. In addition, Ryan asserts that the researcher's beliefs will influence their methods of data collection, analysis and interpretation because a person cannot be divorced from his/her beliefs.

Therefore, the research about conceptualising the design of a public health Information Management system for Lesotho is based on the philosophy of interpretivism, also known as constructivism, where the study was carried out by seeking ideas, perceptions and experiences of the key stakeholders of healthcare services in Lesotho (i.e., healthcare professionals, administrators and patients) as research participants.

About the research questions, through the interviews, questionnaires and focus groups meetings of the key stakeholders, the researcher gathered information regarding the following aspects:-

a) the challenges that healthcare professionals encounter while performing their duties and their impact on the quality and safety of care;
b) critical success factors for The Public Health Information Management System, which can make it efficient and
c) the policy/legal framework that would regulate the implementation of the PHIMS for improved efficiency.

Other philosophical paradigms that could have been considered if they were relevant to the research are (a) Positivism, which insists that objective knowledge is determined through observations and measurement, which means that objective knowledge can be established only through an experiment. However, for the current research, participants' perspectives, not an experiment, are needed to determine answers; and (b) Critical Theory, which relies on analysis of historical data. Even though Ryan (2018) in Table 7 above suggests that there are three philosophical paradigms, other researchers also add the fourth, known as postmodernism, which is about analysing the role of dominant political ideologies in finding truth, knowledge and facts, which is irrelevant for the current research as it does not deal with politics (Alharahsheh & Pius, 2010; Isaeva, Bachmann, Bristow, & Saunders, 2015; Ryan, 2018).

Research Methodology

Research literature indicates that there are three types of approaches to theory development, also referred to as research methodologies, namely induction, deduction and abduction (Åsvoll, 2013; Folger & Stein, 2017; Minnameier, 2010; Liszka, 2010; Reichertz, 2007). According to Folger & Stein (2017), deductive inference does not require evidence because it is a matter of logical necessity, while the abduction approach is about speculation with acceptable assumptions about the phenomenon being studied, whereas inductive inferences use evidence to support conclusions made about a phenomenon. The limitation of inductive inferences is that the conclusions are not true but just probable (Folger & Stein, 2017). Clarifying the differences between these research methodologies, Åsvoll (2013) applies them in an interpretive case study and suggests that adduction would speculate and suggest a hypothesis, while the deduction approach would evaluate the hypotheses to provide deductive certainty, and inductive inference would justify the hypotheses with empirical data and provide a probable conclusion, which if refuted may require further research (Liszka, 2010). Resulting from the above analysis of the research methodologies by various authors, Table 9 below provides a comparison of the three research methodologies.

Table 9

Comparing the Research Methodologies (Mitchell, 2018)

	Deduction	**Induction**	**Abduction**
Logic	For the deductive inference, the conclusion will be true, if the premises are true.	For the inductive inference, conclusions that are not tested, are generated from known premises.	For the abductive inference, testable conclusions are generated from known premises.
From /To	Generalise from the general to the specific.	Generalise from the specific to the general.	Generalise from the interactions between the specific and the general.
Use of Data	The collection of data is used to assess propositions or hypotheses regarding an existing theory.	The collection of data is used to study a phenomenon, identify patterns and themes and create conceptual framework.	The collection of data is used to study a phenomenon, identify patterns and themes and locate them in a conceptual framework. The result of the study is then tested through more collection of data.
Theory	Theory is tested for confirmation or refute.	The theory is generated and built.	The theory is either generated or modified to create a new theory.

The researcher has adopted the induction methodology because, as illustrated in Table 9 above, inductive inferences are made from something known, like a phenomenon being studied, which was tested through the collection and analysis of data (Woiceshyn & Daellenbach, 2018; Mitchell, 2018). The research problem suggests that the healthcare services delivery in Lesotho is not integrated and, therefore, risky to the lives of patients. Therefore, evidence, which can only be generated through research, was used to evaluate this idea. Furthermore, as illustrated in Table 8 above, Mitchell (2018) confirms that under the induction research methodology, evidence to explore the phenomenon is found through the collection of data, identification of themes and creation of a conceptual framework.

Research Design

The main reason the research is undertaken is to establish how to resolve a problem of unintegrated healthcare service delivery in Lesotho that is risky to the lives of patients. Moreover, where each healthcare facility independently manages the patients' records in the way it suits their operations. In this study, where the researcher wants to establish what hinders the healthcare service performance, the qualitative research design options could be for the researcher to learn the culture of the entire health sector, which is known as the ethnographic approach, which requires the researcher to be an active participant (Savage, 2000). It would not be possible for the intended study because that would require a lot of time, and the researcher should be a health professional; the second option would be to use the grounded theory approach, which is an approach where the researcher intends to build a theory that could later be tested through hypothesis but this would not address the research problems stated because the researcher intents to determine why the current healthcare service delivery is risky to the lives of the patients (Heath & Cowley, 2004; Khan S. N., 2014). Therefore, the research design that will be appropriate for this study is a case study, which allows the study to be carried out through the use of interviews and focus group meetings (Kothari, 2004; Crowe, et al., 2011). Case study research design is considered a very detailed study, which assists researchers in understanding complex issues in real-life situations using a small sample of research participants (Croweet al., 2011; Kothari, 2004). According to Croweet al. (2011), there are three types of case study design, namely: a) intrinsic, which is used to learn about a unique phenomenon, b) instrumental, which utilises a specific case, or c) the collective case study design, which uses many cases at the same time or one after the other, to gain an in-depth understanding of a phenomenon (Crowe, et al., 2011). The researcher has adopted the collective case study design, which assists in the collection of data through different channels or cases at the same time (Croweet al., 2011). The research has three different channels from which data is collected because there are three different groups of stakeholders in healthcare service delivery from which participants will be selected. Namely, a) healthcare professionals who provide healthcare services, b) healthcare administrators who provide tools and resources that support healthcare professionals, and c) the patients who are the beneficiaries of the healthcare services.

Consequently, interacting with research participants through one-on-one interviews and focus group discussions brought the same issues in different words. Therefore, a systematic analysis such as coding, where issues are grouped using a thematic analysis (Fereday & Muir-Cochrane, 2006), was used to facilitate the interpretation of findings.

Validity of the Research

Limitations of the study are that the research sample may be too small, and the findings may be perceived to be less representative and hence biased. However, if the research aims and objectives are explained clearly to the participants, and the benefits that the participants will realise if objectives are met; the findings of the research will be a true picture that can be generalised for the Lesotho population. The findings may not be good if the participants are not genuine and have hidden motives. This is because some questions may require individual opinions, which in most cases will be subjective. Notwithstanding, the limitations of the research that may be thought of, the research is intended to reveal the obstacles that hinder the performance of the health service delivery and solutions thereof as envisaged by the key stakeholders in the health sector i.e., doctors, nurses, administrators and patients who seek healthcare services at the facilities. This is done without imposing the thoughts of a consultant on what problems exist within the Lesotho healthcare services delivery and how they should be resolved.

Maxwell (2012) asserts that the researcher must be mindful of the ethical conduct of the participants when administering interviews, questionnaires or conducting focus group meetings, such that participants get involved with a clear understanding of their involvement, which should be voluntary and without prejudice. This was the case when interacting with the participants, as full information regarding the research was provided, and the participants signed the “Informed Consent Form” before taking part in the research. Moreover, both the interviews and a focus group meeting used for data collection regarding the research were audio-recorded and later transcribed to ensure that good data were collected and could be referred to at a later stage to ensure the research’s validity (Coleman, 2021).

Population and Sample of the Research Study

Research Population

The research population is a group of subjects that meet a certain criterion and are targeted by the researcher for a study (Alvi, 2016; Datta, 2018; Martínez-Mesa & González-Chica, 2016; Taherdoost, 2016; Umar & Madugu, 2015). A population can be either homogeneous or heterogeneous (Datta, 2018). A homogeneous population contains subjects with the same characteristics while subjects of a heterogeneous population have different characteristics (Datta, 2018).

Moreover, to conduct research, the researcher has to choose a sample frame from which the research sample will be selected (Sharma, 2017; Jawale, 2012; Martínez-Mesa & González-Chica, 2016; Umar & Madugu, 2015). The sample frame is a set of subjects within a population that the researcher believes that, if included, the objectives of the research will be achieved (Martínez-Mesa & González-Chica, 2016). For example, in the current study, the research population consist of key stakeholders in healthcare services, and the sample frame includes four categories of the population, namely, doctors, nurses, administrators, and patients. Therefore, the population for the current research is heterogeneous as the population contains participants with varying characteristics.

Population Sampling Methods

As indicated above, sampling is the process of selecting subjects for the research that will help the researcher to study the phenomenon and meet the objectives of the research (Marshall M. N., 1996; Umar & Madugu, 2015; Martínez-Mesa & González-Chica, 2016). There are two types of sampling methods, namely, probability and non-probability sampling (Etikan & Bala, 2017; Vehovar, Toepoel, & Steinmetz, 2016; Datta, 2018). The sampling methods are discussed below to clarify how the research sample was selected.

Probability Sampling

In probability sampling, all the subjects in a sample frame have equal chances of being selected for the research (Sharma, 2017; Datta, 2018; Alvi, 2016). Therefore, there is no bias in selecting the subjects, which strengthens the validity of the findings (Sharma, 2017). However, in some research where knowledge of the subject being studied is required, using probability sampling, which is sometimes referred to as random sampling, may exclude very important subjects for the research because participants are randomly selected (Lamm & Lamm, 2019; Tansey, 2007). The probability sampling techniques are the following (Alvi, 2016; Sharma, 2017; Datta, 2018; Martínez-Mesa & González-Chica, 2016; Taherdoost, 2016):-

a) Stratified sampling
b) Quota sampling
c) Systematic sampling
d) Cluster sampling
e) Multistage sampling

Non-probability Sampling

Contrary to probability sampling, in non-probability sampling, when the sample frame has been selected, the choice of the research participants is not random, but it is deliberate (Tansey, 2007; Lamm & Lamm, 2019; Vehovar, Toepoel, & Steinmetz, 2016). The participants selected are those that the researcher believes have special characteristics that assist the researcher in meeting the objectives of the study (Tansey, 2007; Taherdoost, 2016). For example, if the researcher wants to establish the reliability of a specific machine when used for a long time without a break, the researcher would have to select a sample of people who have experience in using the machine for extended periods.

On examining types of non-probability sampling techniques, some authors argue that there are only two types of non-probability sampling techniques, namely, convenience or purposive sampling (Etikan, Musa, & Alkassim, 2016). The argument is based on the premise that if sampling is not probabilistic where subjects have the same chance of participation, then it must be for convenience or a specific purpose (Etikan, Musa, & Alkassim, 2016). On the other hand, other authors (Alvi, 2016; Taherdoost, 2016; Tansey, 2007) suggest that there are many distinct non-probability techniques different from the two as seen above. Therefore, other non-probability techniques different from convenience and purposive sampling, as declared by other authors are as follows: -

a) Quota sampling
b) Expert sampling
c) Volunteer sampling
d) Snowball sampling
e) Matched sampling
f) Genealogy based sampling

The arguments of how these non-probability techniques differ are beyond the scope of this report. The report will focus on purposive sampling, as it is the one relevant for the research to be conducted.

Purposive Sampling

Different from convenience sampling, where the researcher recruits participants that are within easy access and willing to participate, purposive sampling seeks to find the participants that have knowledge and experience of the phenomenon under study and the researcher believes can help provide answers to the research questions and address the objectives of the research (Etikan, Musa, & Alkassim, 2016; Tongco, 2007). Furthermore, even though using purposive sampling, which is sometimes referred to as judgemental sampling, the researcher chooses participants that are believed to be appropriate for the study and are willing to participate in the research, the researcher is still required ethically to get consent from the participants that shows they are willing to participate (Vehovar, Toepoel, & Steinmetz, 2016).

Moreover, since purposive sampling is about selecting participants because of specific qualities, it is a non-random choice, there is no specific number of participants required to satisfy, only that the researcher decides who to include (Umar & Madugu, 2015; Etikan, Musa, & Alkassim, 2016). Under this sampling method, the selection of participants is subjective, which may be considered biased and, as a result, difficult for the researcher to generalise the findings to the target population (Sharma, 2017). However, the current research requires this judgemental or subjective sampling method because of the phenomenon being studied, which needs research participants who are familiar with and knowledgeable about the subject under study. Engaging participants who have insights into the healthcare services in Lesotho will improve the validity of the findings (Datta, 2018; Sharma, 2017; Etikan & Bala, Sampling and sampling methods, 2017). On the other hand, a random selection of participants would jeopardise the study as participants with knowledge and experience of the phenomenon being studied could be missed by chance because the selection of participants would be random (Etikan & Bala, Sampling and sampling methods, 2017; Lamm & Lamm, 2019; Sharma, 2017).

The current study uses purposive sampling because it is the most suitable sampling method, as it will assist the researcher in addressing the research questions and achieving the study's objectives. As indicated above, using purposive sampling will assist the researcher in acquiring information from specifically selected participants, which other sampling methods cannot provide (Datta, 2018; Etikan & Bala, Sampling and sampling methods, 2017). Etikan & Bala (2017) suggest that purposive sampling is based on the judgement of the researcher as to who will give the best information so that the objectives of the research can be achieved. Therefore, after the sample frame of the population has been decided, the researcher will decide on the sample or participants that should be included as participants of the research. The researcher will then administer interview questions to the participants and discuss topics related to the research objectives with focus groups that will be established to get detailed data about the research objectives (Etikan & Bala, Sampling and sampling methods, 2017; Lamm & Lamm, 2019; Sharma, 2017).

Additionally, the type of purposive sampling that has been adopted by the current research is known as heterogeneous, heterogeneity or maximum variation sampling, which facilitates in-depth comprehension of the subject being studied because participants selected are across a wider variety of people knowledgeable about the subject under study (*the healthcare services delivery in Lesotho*) (Datta, 2018; Etikan & Bala, Sampling and sampling methods, 2017; Lamm & Lamm, 2019). Participants are doctors, nurses, health services administrators and patients, who are beneficiaries of the services.

Sample of the Research

The sample of the research is the participants who have been selected from the population to take part in the research (Datta, 2018). Concerning the purposive sampling that is used for the current research, a suitable sample will be participants who have experience in the healthcare service delivery in Lesotho, either by offering healthcare services, administering those who offer the services or have been the beneficiaries of the healthcare services. Therefore, the current research sample frame constitutes healthcare professionals (doctors and nurses), healthcare administrators, and patients. Furthermore, the inherent bias of this non-probability sampling method, known as purposive sampling, makes it very efficient because the researcher chooses participants with relevant experience and who are knowledgeable on the subject under study and are willing to share their knowledge otherwise, selecting participants randomly could result in having to interview participants with no knowledge of the subject being studied (Pace, 2021; Etikan & Bala, Sampling and sampling methods, 2017). However, the researcher must be cautious that it is vital to ensure that the participants are both reliable and competent on the topic that is being researched (Etikan & Bala, Sampling and sampling methods, 2017). Therefore, to recruit suitable participants, the researcher requested approval from people in charge of the healthcare institutions or the healthcare facilities because they would know who is more knowledgeable or experienced than others at their establishment. On the other hand, to recruit potential patients, the researcher provided full information regarding the research, such as the purpose, intentions and objectives. Thereafter, I informed the potential participants of the benefits that the intended product of the research could bring to them, as individuals and to the nation at large if implemented. The participants were also informed of their rights to participate or withdraw at any point of the research, as they were not forced to participate. Furthermore, the researcher also informed the potential participants that their identities would not be revealed to anyone, so their responses would be kept anonymous. This facilitated the signing of an informed consent form as confirmation that the participant was willing to participate in the research and would share their experience in the best way possible.

Following the research sample frame of the current research, which indicates that participants will be selected from doctors, nurses, administrators and patients, purposive sampling was used to recruit research participants as follows: -

i) The following were interviewed and/or were invited to focus group discussions:-
  a) Four doctors
  b) Five nurses
  c) Seven healthcare administrators
  d) Thirty potential patients
ii) A Focus Group meeting was held with three doctors

Materials/Instrumentation of Research Tools

As indicated above, the methodology adopted for the research is induction, which is concerned with gaining a close understanding of the research phenomenon being studied (Ragab & Arisha, 2018). According to the literature, inductive qualitative content analysis is used when there is a lack of theory regarding a phenomenon being studied, and therefore, the researcher has some research questions, aims and objectives of the research, and some pertinent assumptions, which would be confirmed or refuted by the research (Armat, Assarroudi, Rad, Sharifi, & Heydari, 2018; Ragab & Arisha, 2018). Contrarily, deductive qualitative content analysis is used when theories, conceptual frameworks or findings regarding the phenomenon being studied are already available, and the analyst or the researcher needs more facts to confirm or determine alternatives (Armat, Assarroudi, Rad, Sharifi, & Heydari, 2018).

Furthermore, the research design, as already indicated earlier, is a case study design. A case study is a research methodology that allows the researcher to conduct an in-depth investigation of a phenomenon within some specific context, relying on several sources of evidence to generalise the findings to a bigger population (Ragab & Arisha, 2018; Rashid, Rashid, Warraich, Sabir, & Waseem, 2019; Heale & Twycross, 2018). Therefore, to conduct an in-depth investigation to resolve the identified problem that the healthcare services delivery in Lesotho is not coordinated and therefore risky to the life of the patients, the data collection for the research was conducted through interview questions and focus group meeting discussions with the research participants. However, before the researcher could start conducting the research, specific protocols had to be followed. The researcher had to get approvals from three different authorities as follows:-

a) The Unicaf University Research Ethics Committee, after they were convinced that the research would be conducted ethically and with no harm to the participants

b) The Ministry of Health Research Ethics Committee, which is the body in charge of Health research in Lesotho, ensures that research conducted in health is safe for the participants and could be useful for the Ministry of Health.

c) Approval letter from the Christian Health Association of Lesotho (CHAL), which owns some of the hospital and healthcare facilities

Moreover, for the research data collection, three sets of interview questions were developed as the data collection tools to collect data from the research participants. The research participants were divided into three key groups of the healthcare services delivery stakeholders as follows:-

a) The potential patients, who are the beneficiaries of the healthcare services delivery offered at the healthcare facilities

b) The healthcare professionals (doctors and nurses) that deliver the healthcare services at the healthcare facilities and

c) The healthcare administrators, who manage and administer the healthcare services delivery that are offered at the healthcare facilities according to the policies from the Ministry of Health

The research data collection tools used were interview questions and focus group deliberation points. A specific tool is developed for a specific group of participants because the population sample is heterogeneous and involves three groups of participants, namely, potential patients, healthcare professionals (doctors and nurses), and healthcare administrators.

The process of collecting data depended on the population group in the sample, as indicated below:-

a) **Group 1**: Potential Patients

A research introduction letter was used to inform the participant about the research and request the participant to sign and return an Informed Consent Form attached to the letter to confirm their participation if they agree to take part in the research. Therefore, there were two documents sent or given to the participant (the research introduction letter and the informed consent form – Attached for reference as **Annexes 9** and **2** respectively). Moreover, to conduct the interview, a tool for the interview questions for potential patients was developed and is attached for reference as **Annex 5**.

b) **Group 2**: Healthcare professionals (Doctors & Nurses) working at public, CHAL and Private Healthcare Facilities

To interview both healthcare professionals under the Ministry of Health and the CHAL group, an approval process had to be followed as advised by the two institutions. While for Private facilities, the Researcher's introductory letter sufficed.

Ministry of Health

First, the Ministry of Health, through their Research Ethics Committee, demanded the submission of the following documents to the Ministry's Research Ethics Committee: i) the researcher's request letter to interview the participants under the Ministry of Health; ii) the research proposal, iii) approval of the research by the university concerned. Second, The Research Ethics Committee for the Ministry of Health sat to discuss the submitted documents and provided a formal approval letter to the researcher (Attached as **Annex 8** for reference).

Christian Health Association of Lesotho (CHAL)

The CHAL Chief Executive demanded a letter from the researcher requesting to interview the healthcare professionals answerable to the CHAL group. Thereafter, an approval letter was issued to the researcher, which was also by the researcher as proof that the CHAL Chief Executive had agreed that the researcher could interview the healthcare professionals working in CHAL healthcare facilities. The approval letter from CHAL is attached as **Annex 10** for reference**.**

Consequently, to conduct the interviews, a tool containing a set of interview questions for healthcare professionals was developed, and it is attached as **Annex 1** for reference. While conducting the focus group meeting deliberations, a tool containing a set of talking points was developed, and it is attached for reference as **Annex 6**.

c) **Group 3**: Healthcare Administrators working for CHAL, Public or Private Healthcare Facilities

The CHAL principals also requested an application letter and approval of the research by the concerned university from the researcher, requesting to interview healthcare professionals and administrators under the CHAL administration. After review of the letter and the research approval from UNICAF University, CHAL provided a formal approval letter to the researcher as indicated above (Attached as **Annex 10** for reference). To conduct interviews for the healthcare administrators in the healthcare facilities managed by the government, CHAL or privately, a tool containing a set of interview questions was developed and is attached as **Annex 4** for reference.

The three data collection tools, which are the interview questions for each of the three research participation groups, provided a consistent guide to asking questions. Moreover, the tool for focus group discussions assisted the researcher in leading the discussions on issues relevant to the research questions. Very few interviews were conducted in a face-to-face fashion, most of the interviews were virtual because of COVID-19 restrictions. The participants were informed that the interviews, or the focus group meeting, would be recorded to facilitate transcription of the recorded voices at a later stage, and they agreed to the request that their interviews be recorded for later retrieval. For the virtual interviews and focus group meeting discussions, zoom collaboration software was used to record the interviews and focus group deliberations, while for the physical interviews, a voice recorder was used to capture the interviews. The recorded interviews and focus group discussions were transcribed using Microsoft Word. Transcribed interview responses and focus group discussions were analysed using a web-based software known as Taguette. The findings of the analysis from Taguette were exported to Microsoft Excel for further analysis and production of the findings in a clear and presentable manner, which were thoroughly explained in the evaluation of the findings.

Interview questions, which were asked to the three research participants groups, were aligned to the three research questions. Furthermore, the focus group meeting deliberations were guided by the discussion points that are also aligned with the three research questions as illustrated below:-

a) The first research question: “To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?”

Each group is asked the interview questions relevant to themselves, which helps them to freely share their experiences in what they believe are the challenges that hinder the smooth provision of care from their perspective, and in the process, they assist the researcher in determining the answers to the research question. The healthcare professionals discuss challenges caused by patients, healthcare administrators or their superiors. The patients discuss challenges that hinder the provision of healthcare services to themselves by the healthcare professionals or challenges caused by the healthcare administrators.

b) The second question: “What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?”

Each group is asked interview questions that make them share their experiences or opinions on the preferred elements of the functionality of a PHIMS, which the researcher can determine the response to the research question. Their responses emanate from their experiences, preferences or observations of health information systems at different places of care. Therefore, the researcher can be able to put together their responses, compare them with what the literature review suggests and come up with recommendations for critical success factors for the Lesotho PHIMS.

c) The third research question: “How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?”

The interview questions were designed for specific research participants’ groups. Therefore, there were three sets of interview questions. For this third research question, the researcher planned to gather from the participants’ experiences or knowledge of what they believe needs to be regulated during the provision of care when PHIMS is being implemented to ensure that it is efficient, safe and secure. Each group responds to the interview question from their perspective, which assists the researcher in gathering multiple views and aligning the responses to the research question.

On the same token, for the focus group meeting discussions, the focus group comprised of doctors was led to the debate concerning the research questions. For example, they were asked to debate or provide their opinions regarding the extent to which the challenges that healthcare professionals encounter during the provision of care affect the quality and safety of care, while the researcher recorded the discussions and asked clarification questions where the need arose. The focus group members also debated on issues of importance as it comes to the critical success factors of a public health Information Management system that could make it efficient. Finally, the focus group meeting deliberated on the possible regulatory/policy framework that could be used to regulate the implementation of the envisaged public health information management system, such that all people affected by it are protected by law, to ensure that the system is efficient. In the discussions, the healthcare professionals provided their experiences, insights into current and previous issues of concern and the possible legislation that is required to address some irregularities concerning the health activities in the country. For example, one healthcare professional indicated there have been incidents in some healthcare facilities where pictures were taken in the theatre without the consent of either the facilities or the patient. Therefore, this irregularity could be addressed by a clause that deals with the sharing of medical information so that proper procedures or guidelines could be provided and followed by those who would like to share health information, but sanctions for those who do not follow the available legislation be punishable by law.

Table 9 below provides a summary of the instrumentation that was used by the researcher to perform the activities of the research from the beginning to the end of the research. The activities entailed approvals by the relevant research ethics committees or administrative arms of institutions, data collection, and data analysis and reporting.

Table 10

Tools/Materials/Instrumentation used for research Data Collection or Analysis

Tools/Materials/Instrumentation	Purpose
1. An Approval from Research Ethics Committee of the Unicaf University	To examine the research proposal and provide approval to the student to begin the research if it meets the requirements
2. An Approval from the Research Ethics Committee of the Ministry of Health, Lesotho	A letter that provides approval for the research to be conducted within the health sector of Lesotho, provided the research proposal and methods meet the requirements by the committee
3. An Approval from the Chief Executive Officer of the Christian Health Association of Lesotho (CHAL)	The letter that provides approval for the researcher to conduct research at the CHAL healthcare facilities. The letter has to be shown the facility operators when requesting time for the participants to be interviewed
4. The Informed Consent Form	Signed by the research participants as an indication that they participate at their own will,

Tools/Materials/Instrumentation	Purpose
	with the understanding that they can withdraw anytime during their participation
5. Interview questions for Healthcare Professionals	The interview questions prepared for doctors and nurses (the healthcare professionals)
6. Interview questions for potential patients	The interview questions prepared for potential patients (the beneficiaries of the healthcare services delivery)
7. Interview questions for Healthcare Administrators	The interview questions prepared for the Healthcare Administrators
8. Discussion points for a focus group	The discussion points for the focus group meeting deliberations
9. Taguette Software	A web-based software used for data analysis when applying the thematic analysis techniques
10. Microsoft Excel	The Microsoft application used for further analysis using pivot tables

Study Procedures and Ethical Assurances

Study Procedures

Procedurally, to conduct research, the researcher had to seek approvals from relevant authorities to certify that the research is authentic, that research subjects would not be harmed and that it is allowed to be conducted. Firstly, approval had to be sought from a university body in charge of the research activities, namely, the Unicaf University Research Ethics Committee. Therefore, for this study, the researcher applied for approval to conduct the research, and the Unicaf Research Ethics Committee provided the approval. The Unicaf approval is attached as **Annex 7**. Secondly, to conduct research within the Health Sector in Lesotho, the researcher must request approval from the Research Ethics Committee under the Ministry of Health (MoH) for the Government of Lesotho. For both research ethics committees, the researcher received approvals the two bodies were convinced that the research would be conducted safely and ethically such that the research subjects would not be harmed (Ministry of Health (MoH), 2013; Unicaf University, 2020). Thirdly, the Christian Hospitals Association of Lesotho

(CHAL) Group Chief Executive Officer also requested a clear written explanation of the research and a request to conduct the research at the healthcare facilities administered by CHAL. Lastly, the requests for participation were sent to each research subject to get their consent to participate in the research process. After receiving written approvals and permission from the relevant authorities and research participants, the researcher engaged with the participants to collect data.

The purposively selected and targeted participants are healthcare professionals, administrators and potential patients. To ensure the confidentiality of the participants, the data collection tools did not have a field for their names. Therefore, their identities were kept anonymous by not writing their names on the data collection forms. Instead, the numbers were used to distinguish them because, in social research, confidentiality is one of the critical principles of research ethics and standard practice (Surmiak, 2020). Contrarily, Dougherty (2021) argue that some researchers misuse the confidentiality and anonymity of the participants' identity to publish false information to cover fraudulent data, but Surmiak (2020) asserts that applying the principle of confidentiality and anonymity in social research must be done within the confines of the law.

As this study was conducted during the COVID-19 Pandemic, and the method of data collection is interviews and focus group meeting deliberations, there was a risk of infection to the researcher and the participants. However, instead of face-to-face interviews and focus group meetings, data was collected virtually through collaboration software platforms that suit the participants, such as Zoom or Google Meet. In cases where it was not possible to have virtual meetings due to telecommunication challenges, face-to-face interviews were conducted under careful consideration and adherence to COVID-19 protocols, such as sanitising of hands, social distancing and wearing of masks.

As approved by the Research Ethics Committees (REC) for Unicaf and the MoH, respectively, data were collected through virtual interviews with healthcare administrators {*their role is to ensure that the healthcare facilities are functional and conducive for healthcare services delivery*}, potential patients {*beneficiaries of healthcare services delivery provided by the healthcare professionals*}, healthcare professionals, specifically nurses and doctors for this research {*healthcare services providers*} and focus group meeting deliberations with doctors. Per guidance by Unicaf, the procedure for collecting data is as follows: -

a) A signed letter by the researcher was written to an individual introducing the research and requesting his/her agreement to participate in the research.

b) A consent form was attached to the letter.

c) The contents of the consent form for the participants indicated that participation is at the participant’s own free will, without being forced and that participants are free to withdraw their participation at any point during the interview if they so wish

d) After the consent form was signed as acceptance to participate in the research and returned to the researcher, a date for the interview was agreed upon.

The interview questions were conducted using the medium of communication as preferred or possible means by the individual participant. Media of communication are either Google Meet, zoom meeting, WhatsApp call or normal phone calls. However, due to telecommunication challenges in some areas, the face-to-face interview was the only way available. The challenges concerning the data collection using the virtual medium were that a) some potential participants indicated that the cost of data for connection required to join the virtual call was not unaffordable, b) for those who managed to connect, the telecommunication network sometimes lost connection or the connection line was not sustainably clear, which caused delays, and, c) sometimes some potential participants could not find a suitable time to attend the call though they had agreed verbally that they would sign the consent form and participate in the research. Therefore, some potential participants could not be interviewed as they could not find time to sign consent forms and return them to the researcher.

Ethical Assurances

The research was conducted in compliance with the qualitative research ethical standards, which require that the research conducted with humans must be justified and the participants must be informed properly and freely such that the risks, benefits and consequences of their participation in the research are highlighted (Taquette & Souza, 2022). This would facilitate free, informed decision-making by the participants that the researcher does not influence.

Therefore, in compliance with the standards for conducting the research and in regards to the research design, the researcher informed the participants that the research is conducted to determine the type of public health information management system that is efficient and affordable to all citizens of Lesotho. Furthermore, the potential participants were made aware that with the envisaged system, the healthcare service delivery will be improved in quality and safety, as the healthcare services would be provided to all citizens in all healthcare facilities nationwide, regardless of the owner of the facility. Moreover, the ethical assurances included informing the potential participants that a) the disadvantages of not performing the study are that the status quo of the healthcare services, which is risky to the lives of the patients, would remain, and b) the participants have the right to participate freely. However, they can withdraw their participation at any point in the research process if they don't feel comfortable. Furthermore, the full information regarding the research was provided to the participants with a request to sign a consent form for participation as confirmation that they understood their involvement (Unicaf University, 2020). Additionally, Dooly, Moore, & Vallejo (2017) suggest that researchers must determine how they would keep their subjects anonymous and their information confidential because knowledge of such would also help the participants to make an informed decision. Therefore, the potential participants were informed that the information they provide will not be used for any other purposes except for the research, and their names will not be written on their interview responses or on the focus group meeting deliberations to ensure that their responses remain confidential and anonymous.

To get Informed Consent from the potential participants, the following procedures were followed as guided by the Unicaf Ethical Assurances Guide:-

a) A potential participant would be called telephonically and informed that the researcher is conducting research, and they would receive a letter that requests their participation.

b) A gatekeeper letter giving information regarding the research, signed by the researcher and requesting the participation of the potential participant, would be sent along with the Informed Consent Form.

c) In the gatekeeper letter, the potential participant would be requested to sign and return the Informed Consent Form as their confirmation for participation, for which the date for their participation would be agreed upon after a signed form is received.

d) If the potential participant does not return a signed Informed Consent Form, no appointment for participation was set.

Moreover, there was a requirement that there would be tools used to collect data from categories of participants, as the researcher had suggested (Unicaf University, 2020). The following is a list of tools that were used to collect data: -

a) Interview questions for Health Care Professionals
b) Interview questions for healthcare administrators
c) Interview questions for potential patients
d) Discussion points for focus group meetings

Finally, according to the research ethics guidelines, data collection would only start when there is approval from the Research Ethics Committee; please see the flowchart in F**igure 13 below**. An approval document from UREC has been attached as ***Annex 7***.

Figure 13

Research Ethical Considerations by Concerned Institutions

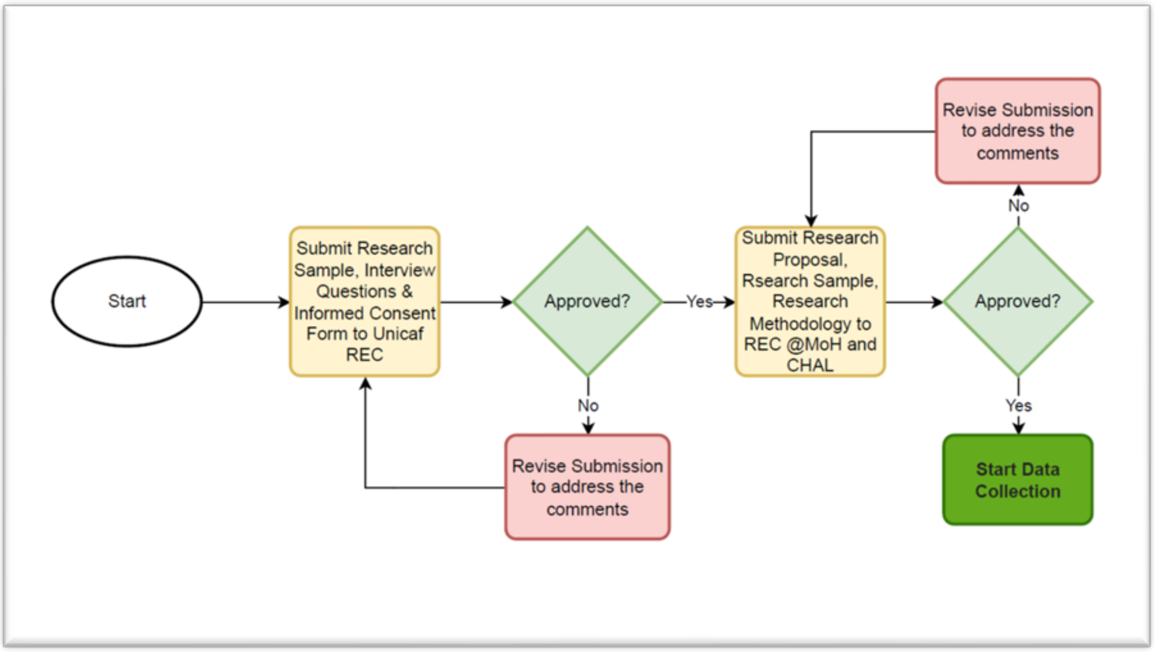


Figure 13 above is a flowchart illustrating the process of ethical assurances that the researcher had to follow. After submission of the required documents to the Unicaf Research Ethics Committee for approval, the researcher awaits approval. If not approved, the researcher is given the comments to address. But if approved, the next step in the process of ethical assurances is triggered, where a set of the documents required by the Research Ethics

Committees (REC) for the Ministry of Health (MoH) and to the Chief Executive of the Christian Health Association of Lesotho (CHAL) must be sent to them. Only when approvals have been granted does the researcher move to the next stage, which is data collection. Failure to approve, the researcher had to address the comments from the RECs and re-submit the corrected documents. This is the most critical part of the Research as the institutions must protect the research subjects under their leadership, especially if they are humans, to ensure that their rights will be observed and, most importantly, they will not be harmed by the research processes as the research methodology and methods are explained in the submitted research documents (Arifin, 2018).

As indicated in the diagram, second from the Unicaf REC, formal ethical assurances were required by the Ministry of Health (MoH) in Lesotho through their Research Ethics Committee. According to MoH REC guidelines, the following ethical assurances were required (Ministry of Health (MoH), 2013, pp. 14-15)):-

a) The interviews will be conducted safely, as it was during a time when the world was struggling with the COVID-19 pandemic.

b) The researcher understands the benefits and risks or disadvantages that the study can bring to the participants and that participants would be informed accordingly to facilitate the informed decision to participate.

c) Explanation of how the participants' information would be kept confidential

d) Whether the participants would provide the information freely, with a written and signed consent

e) Justify if the minority groups or disadvantaged people would be included as research participants.

After the submission of the required research documents by the MoH REC, approval was provided and is attached as ***Annex 8***.

Furthermore, the CHAL Head Quarters also request an application from the researcher, detailing what the research is about and how it would affect the participant, and also to show the affiliated University that has provided the approval to conduct the research. Therefore, a formal approval letter was provided to the researcher, which allowed the researcher to continue with the research at the CHAL facilities. The letter is attached as **Annex 10.**

It is therefore prudent to note further that researchers are obliged by ethical conduct not only to take care of the rights of the research participants but also to be honest to the institutions within which the research may have a significant impact so that when approved and allowed for implementation, all its activities are ethical (Arifin, 2018; Reid, Brown, Smith, Cope, & Jamieson, 2018). Moreover, the work that would result from ethical conduct would provide the research community with invaluable information to enhance a much-needed body of knowledge (Arifin, 2018; Ngozwana, 2017; Reid, Brown, Smith, Cope, & Jamieson, 2018).

The researcher's role in the research was to collect data through interviewing the participants, recording the interview, and later transcribing the recorded interview conversation for later analysis. The data collection dealt with three main categories of the research, namely, a) the challenges faced by healthcare professionals during the provision of care, b) critical success factors of an efficient Public Health Information Management System (PHIMS), and c) the Policy/Legal framework suitable to regulate the envisaged PHIMS. Therefore, the biases were not possible when participants were asked about the challenges encountered by healthcare professionals during the provision of care, as they would be sharing their experiences.

Otherwise, for the critical success factors and appropriate policy/legal framework to regulate the system, there were possible biases, as those are personal opinions or suggestions. However, the biases by the researcher during the interviews were avoided by requesting clarifications where the provided information was not clear, instead of refuting what the participant would be saying as data was collected from the participants and not provided by the researcher.

Data Collection and Analysis

Data Collection

As indicated above, the research adopted the case study design, which allows the collection of data through interview questions and focus group meeting discussions. For this qualitative study, data collection relies on the research questions that the researcher intends to address and which have been formally accepted by the two research ethics committees at Unicaf University and the Ministry of Health (MoH) in Lesotho, respectively. Four data collection tools were developed in line with the research questions, as illustrated below.

Data that were collected were the participants' responses, in the form of phrases and statements made during the interviews conducted by the researcher, and healthcare professionals' focus group meeting deliberations, which were later analysed using Taguette Software.

Four data collection tools were developed to collect data from four types of targeted research participants, as illustrated in Table 11 below: -

Table 11

Research Participants and Corresponding Data Collection Tools

Participants	Data Collection Tool
1. Healthcare Professionals (Doctors and Nurses)	Interview questions for Healthcare Professionals
2. Healthcare Administrators	Interview questions for Healthcare Administrators
3. Potential Patients	Interview questions for potential patients
4. Focus Group Meetings	Discussion Points for Healthcare professionals available for the Focus Group meeting discussions

The data collection tools were developed in such a manner that the data to be collected should assist the researcher in getting responses to the three research questions and from the perspective of research participants' groups. Getting responses to the interview questions in the data collection tools assisted the researcher in achieving the objectives of the study, thereby facilitating the gathering of information regarding the phenomenon being studied, which is dependent on the quality of data collected. The following three research questions, in Table 12 below, as already mentioned above, have facilitated the development of the interview questions for the data collection tools, attached as Annexes 1,4 &5. For each tool, the interview questions relate to the research questions, as illustrated in Table 12 below

Table 12

Relationship between Research Questions and Data Collection Tools

Research Question	**Data Collection Tool Questions for Healthcare Professionals**	**Data Collection Tool Questions for Healthcare Administrators**	**Data Collection Tool Questions for Healthcare Beneficiaries**
1. **To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?**	a) What challenges do you encounter regarding availability of patients' historical data in providing healthcare for new or returning patients?	a) What challenges do you encounter when preparing reports using the current health management system?	a) How do you choose which healthcare facility (clinic or hospital) to go to when you need medical attention? b) Where is your medical record/history stored? Do you have access to it?
2. **What could be the appropriate critical success factors for a PHIMS to ensure its efficiency**?	What functions of an electronic Public Health Information Management System (PHIMS) for Lesotho, do you consider critical for its design to ensure quality and safety of care?	What functions would be ideal for the design of an electronic Public Health Information Management System (PHIMS) to facilitate timely reporting?	How would you prefer to be attended when you go to any health facility in the country for medical attention?
3. **How could the policy/legal framework be formulated to effectively regulate the implementation of a**	b) What policies, guidelines, laws or standards, locally or internationally, could be used to guide the design and development of PHIMS?	b) What policies, guidelines, laws or standards, locally or internationally, could be used to guide the efficient operation of the PHIMS?	c) What policies, guidelines, laws or standards, locally or internationally, could be used to guide the efficient operation of the PHIMS?

Research Question	Data Collection Tool Questions for Healthcare Professionals	Data Collection Tool Questions for Healthcare Administrators	Data Collection Tool Questions for Healthcare Beneficiaries
PHIMS to ensure its efficiency?			

The process for collecting data was as follows: -

a) During the interviews, the researcher recorded the discussions and later transcribed them into text to facilitate analysis.

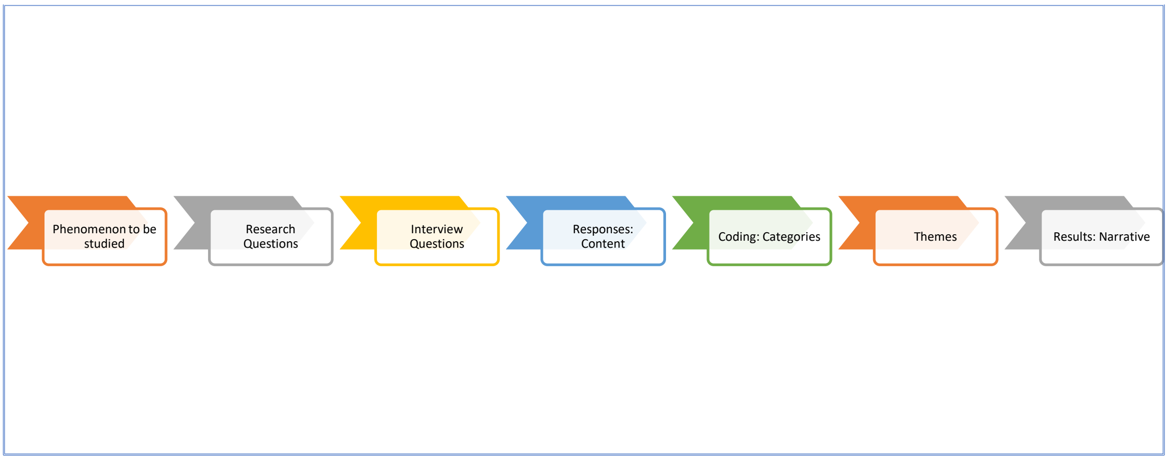
b) For a focus group meeting, the recording was done during the deliberations to ensure that views, concerns and debates were captured for later transcription into text to facilitate analysis.

Data Analysis

The data analysis method selected for use in this qualitative study is Thematic Analysis. The analysis was guided by the Thematic Analysis Framework, which illustrates the coordination of the stages for the qualitative study process indicated by **Figure 14** below:-

Figure 14

Thematic Analysis Framework for the Qualitative Research (Castleberry & Nolen, 2018)



The diagram above is a framework that illustrates the overview of how the thematic analysis was guided. A phenomenon was identified and became a reason for the research to be conducted. The Researcher developed relevant research questions to study the phenomenon, and then the interview questions that are intended to gather data that will be used to address the research questions were developed for specific research participant groups. Thereafter, from the interview questions and the focus group meeting deliberations, responses by the participants, which were in audio format, were transcribed to usable data to facilitate the analysis known as coding (Castleberry & Nolen, 2018; Dawadi, 2020). Coded data was categorised with their response to research questions. The categories were then grouped into themes, which were used to provide the narrative of the phenomenon being studied (Castleberry & Nolen, 2018; Dawadi, 2020).

Moreover, according to Castleberry & Nolen (2018), this data analysis method is very systematic and, if followed properly, can provide a clear interpretation of the qualitative research findings. The analysis is done in five steps, namely, Compiling, disassembling, reassembling, interpreting and concluding (Castleberry & Nolen, 2018, p. 808).

Thematic Analysis Steps Conducted

Step 1: Compiling

Compiling refers to modifying collected data into a form that can be useful (Castleberry & Nolen, 2018). For the current research, compiling was done by transcribing recorded audio data for each participant and for the focus group deliberations into text.

Step 2: Disassembling/Coding

Transcribed participants’ data files were uploaded onto Taguette software in preparation for coding. Castleberry & Nolen (2018) define disassembling as rearranging data and putting it into meaningful groups, also known as coding. The transcribed data from the interview questions and focus group meeting discussions were allocated certain codes using a combination of descriptive and “In Vivo” coding (Castleberry & Nolen, 2018).

For descriptive coding, after transcription of the information into text, the researcher used descriptive words to explain what the participant meant. In “In Vivo” coding, the researcher used the same words used by the participants (Castleberry & Nolen, 2018). Therefore, coding involves selecting similar words or topics and putting them into categories that would also be put into themes, resulting in phrases explaining the phenomenon being studied (Fereday & Muir-Cochrane, 2006; Chandra & Shang, 2019). Fereday & Muir-Cochrane (2006) suggest that a “good code” captures the qualitative fullness of the phenomenon.

Consequently, when good codes are constructed from the participants’ responses individually and from a focus group meeting, meaningful themes about the phenomenon being studied are formed, thereby satisfactorily addressing the research questions.

According to Castleberry & Nolen (2018), alternatives to the popularly used software programs for coding qualitative data, such as MAXQDA, Nvivo and ATLAS, Microsoft Excel and Access, can be used to analyse qualitative data. Therefore, for strengthening PHIMS through the integration of Health Information Management Systems Research, the researcher utilised Taguette for coding and Microsoft Excel as the Computer-Assisted Qualitative Data Analysis software application.

Step 3: Reassembling

The codes that were created from data were put into common groups known as themes, which bear information that responds to the research questions (Castleberry & Nolen, 2018).

Castleberry & Nolen (2018) caution that at this stage of the analysis, the researcher can be biased and use data to support their theory, which could lower the credibility of the results. However, the researcher used data collected to provide information about a phenomenon under study so that the interpretation of the findings could be considered credible (Castleberry & Nolen, 2018; Fereday & Muir-Cochrane, 2006).

Step 4: Interpreting

At this stage, the researcher interpreted the themes into meaningful information that responded to the research questions (Castleberry & Nolen, 2018; Fereday & Muir-Cochrane, 2006). Notwithstanding the constructs regarding the themes, the researcher ensured that the interpretations have five important qualities (Castleberry & Nolen, 2018):-

a) **Complete**: it must be clear how the interpretation was reached
b) **Fair**: if data were to be given to the research community, the same findings would be reached
c) **Accurate**: must represent the data collected
d) Following the current literature
e) Methods and interpretations must be credible and trusted by colleagues

Step 5: Concluding

The researcher provided conclusions on whether the themes interpreted above provide answers to the research questions and are also aligned with the purpose of the study (Castleberry & Nolen, 2018). Castleberry & Nolen (2018) caution that qualitative conclusions can’t necessarily be generalisable but should be noted that if adopted for a different context, differences and similarities of situations must be identified to facilitate the degree of applicability to the new context.

Summary of the Chapter

To achieve the objectives of the research, which are a) To determine why the healthcare service delivery in Lesotho is not coordinated and, therefore, risky to the lives of the patients, b) To establish why the healthcare facilities in Lesotho do not share patients' medical information to facilitate collaboration and improve the quality and safety of care, c) To determine why there is no Policy/Legal Framework in Lesotho that binds and regulates the sharing of patient's medical information to facilitate efficiency in healthcare service delivery and avoid poor management of medical records, the research adopted the interpretivism research philosophy.

The adopted philosophy allowed the researcher to gather different perspectives of the phenomena being studied from many participants willing to share their experiences through interview questions and a focus group meeting. Moreover, for the collected data to be processed into information, the research approach was to utilise the induction research methodology because it allows the researcher to use empirical data to explore the phenomena being studied. In planning how the empirical data would be collected, the researcher adopted the case study design as it allows data collection through interview questions and focus group meeting deliberations. To ensure the validity of the research, the researcher recorded the interviews and a focus group meeting deliberations to maintain rich data, which can be referred to for confirmation of what transpired at any stage after the research was conducted (Coleman, 2021).

In selecting the research sample, purposive sampling was chosen because it is a non-probability sampling method, which helps researchers avoid involving participants unfamiliar with the phenomenon under study (Etikan & Bala, 2017; Pace, 2021). Therefore, only participants with experience in the phenomenon under study, being the healthcare service delivery in Lesotho, were required to participate, such as the healthcare professionals, healthcare administrators, and potential patients who would normally receive healthcare services in Lesotho.

The research tools included signed approvals for conducting the research by the research ethics committees of Unicaf and the Ministry of Health, the gatekeeper letters explaining the purpose of the research to the potential participants, the informed consent form, interview questions, a questionnaire for busy healthcare professionals, and a set of deliberation points for a focus group meeting.

Procedurally, the researcher received approvals from research ethics committees and relevant healthcare authorities before the research was conducted. Moreover, for ethical assurances, the researcher informed potential participants about the purpose of the study and their right to withdraw their participation at any point of the research process and requested them to sign and return the informed consent form as confirmation that they understand their involvement in the research process and are willing to participate (Taquette & Souza, 2022). Furthermore, since the research subjects were human, the researcher had to assure the participants that they would not be harmed and that they stand to benefit in the long run by participating, as the purpose of the research is to present a healthcare service delivery system that is less risky to their lives and can improve the quality and safety of healthcare services.

Data was collected using the research tools developed by the researcher. The tools include three types of interview questions, administered to three groups of participants, namely healthcare professionals who provide healthcare services, the healthcare administrators who create a conducive environment for healthcare services to be provided at the healthcare facilities, and potential patients who are the beneficiaries of the healthcare services. Otherwise, for a focus group meeting deliberations, a set of discussion points were used to conduct the meeting. The researcher recorded the conversations and deliberations during both the interviews and a focus group meeting for transcription at a later stage in preparation for analysis.

Data analysis was performed using thematic analysis techniques, where data collected through the interviews and focus group meeting discussions were categorised using a thematic analysis technique known as coding (Lester, Cho, & Lochmiller, 2020). The formed categories of data were grouped according to similar subjects known as themes (Fereday & Muir-Cochrane, 2006; Lester, Cho, & Lochmiller, 2020). The themes were analysed further to produce phrases or sentences that provide an interpretation of the findings regarding the research objectives and research questions (Castleberry & Nolen, 2018; Lester, Cho, & Lochmiller, 2020).

CHAPTER 4: FINDINGS

Introduction

The research aims to develop a concept for designing an efficient Public Health Information Management System (PHIMS) for Lesotho. This has resulted from the problem identified by the researcher that in Lesotho, the healthcare service delivery is fragmented, not coordinated and therefore risky to patients' lives. For example, the country has healthcare facilities nationwide. However, the Ministry of Health has no public health system that helps the Ministry to control and monitor the healthcare services delivery, such that healthcare statistics generated at the healthcare facilities, public and private, could be captured, analysed and reported timely to inform decision-making (Ministry of Health, 2016). Secondly, patients who are suffering from multiple chronic illnesses and need to be seen by different healthcare specialists periodically have their medical information fragmented at various geographical positions per the healthcare facilities, resulting in incomplete medical information during the provision of care. Thirdly, the healthcare facilities in Lesotho, as in other African countries, store the patients' medical records in paper-based form rather than electronic format. The paper-based format of medical records makes it difficult for healthcare facilities to share the medical records to provide care, resulting in the healthcare professionals providing care with incomplete patients' medical information (Persaud, 2019). When the patient's medical records are incomplete at the point of care, healthcare professionals can easily commit medication errors (Mirgane, 2021; Persaud, 2019; Ramesh, Manimegalai, & Priya, 2020). Therefore, the research was conducted to confirm the status of the Lesotho healthcare service delivery and determine measures that can be put in place to minimise medication errors and save lives.

Firstly, the chapter discusses the trustworthiness of the research data collected. The report discusses the selection of participants using the purposive sampling method. It further discusses the data collection and analysis techniques applied by the researcher. It indicates that the research sample is appropriate and relevant for the qualitative research undertaken and that the findings can be transferable to the larger population of the Basotho nation.

Secondly, the chapter illustrates the reliability and validity of the data collected by demonstrating that the research methods and materials used match the Case Study research design, which is suitable for the study. The Purposive Sampling Method was used to target healthcare stakeholders in the form of a) the healthcare providers, b) the healthcare administrators, and c) the healthcare services delivery beneficiaries, also referred to as potential patients, conform to the criteria of Case Study Design (Tomaszewski, Zarestky, & Gonzalez, 2020; Baxter & Jack, 2008). The Case Study design allows the researcher to collect data through interviews and focus group deliberations (Tomaszewski, Zarestky, & Gonzalez, 2020). The data collection exercise was done using interviews and focus group meeting discussions, while the data analysis was performed using thematic analysis techniques.

Thirdly, the research findings are a compilation of responses from the research participants during the interviews and a focus group meeting deliberations regarding the three research questions, thereby ensuring that the research objectives are being achieved. The participants' responses illustrated by **Figures 16,17 and 18** below, indicate the themes, sub-themes and categories of the responses during the interviews and focus group meeting deliberations.

Fourthly, the findings are evaluated in light of the theoretical framework, OmniPHR, which is about having one record per patient, which must be available to healthcare professionals during the provision of care. The responses from the participants' interviews and focus group meeting deliberations are categorised by their relevance to the three research questions indicated below:-

a) To what extent do the challenges encountered by healthcare professionals during the provision of care affect the safety and quality of care?

b) What are the critical success factors that would enhance the design and implementation of the envisaged PHIMS to make it efficient? and

c) What would be a suitable Legal/Policy Framework to regulate the design and implementation of the envisaged PHIMS to make it efficient?

Finally, a summary of the research findings, categorised by the three research questions, is provided to highlight key findings.

Trustworthiness of Data

Introduction of Trustworthiness of Data

Trustworthiness of the qualitative research data or findings refers to the four elements that the research has to satisfy (Johnson, Adkins, & Chauvin, 2020; Quintão, Andrade, & Almeida, 2020; Cypress, 2017; Daniel, 2019):-

a) Credibility: evidence that the findings represent what the research has studied
b) Transferability: providing enough contextual information that can assist the reader in determining whether the findings apply to his/her situation
c) Dependability: the study process is clear to the reader such that it can be repeated
d) Confirmability: clear communication that the findings are as obtained from the participants and not a biased interpretation of the researcher

The researcher is an Information and Communications Technology (ICT) specialist with many years of experience in the management and supervision of ICT support in corporate organisations. For more than seven years, the researcher has led an ICT project that supports

ICT Health Systems in the Lesotho Health Sector and is aware of the history of health information systems in Lesotho. Considering the phenomenon being studied, the researcher has an assumption that the country has not managed to have an efficient public health system because the Health Information Systems that have been introduced within the Ministry of Health were given to the Government of Lesotho without much involvement of the locals in the systems designs. Hence, they were not accepted, or if accepted for use, there have been different operational issues from data capturing to report generation. Therefore, the research will provide recommendations after data collection and analysis.

Participants Selection

The qualitative research was conducted in the mountain kingdom of Lesotho. The selection of participants was made through purposive sampling, where participants were selected to provide insights into a phenomenon being studied because of their experience or expertise in the subject (Andrade, 2021). Therefore, **Table 13** below indicates the total number of research participants and the participants' selection criteria used. Moreover, **Figure 15** indicates how the districts are distributed in the highlands and lowlands as appearing under the criteria column in **Table 13** below are located in Lesotho.

Table 13

Participants and Selection Criteria

PARTICIPANTS	#	CRITERIA	Participants Anonymous Identification
Healthcare Professionals (5 Nurses and 3 Doctors)	8	Highlands & Lowlands must be represented	A1-A8
Healthcare Administrators	8	Highlands & Lowlands must be represented	B1-B8

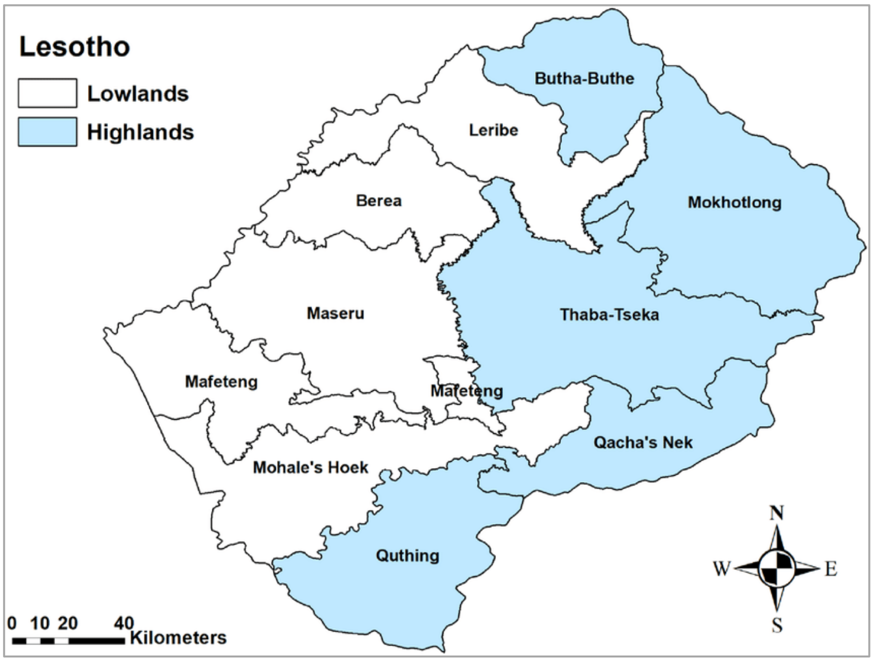
Potential Patients (3 per district)	30	All **Ten Districts** were represented	C1-C30
Total Participants	**46**		
Focus Group (3 Doctors)	3	Availability	FG Participant

Participants Selection Criteria

The terrain divides the country into highlands and lowlands. Some facilities in the highlands are hard to reach, resulting in services being delayed. Therefore, the researcher has assumed that the life experiences of people living in the highlands, especially regarding health, differ from those in the lowlands. Therefore, ensuring that the research participants represent people from both the lowlands and the highlands in the research may increase the reliability of the research data (FitzPatrick, 2019). The rationale is that all the healthcare professionals and administrators are managed, monitored and controlled by the Ministry of Health through the national health policy (Ministry of Health, 2018). But for potential patients, every district has been represented as the patients are free to interact with any facility in all the districts nationwide. The districts are illustrated in Figure 15 below. Therefore, the different experiences of potential patients from all districts increase the validity of the findings (FitzPatrick, 2019).

Figure 15

The Lesotho Map (Lepheana, Oguttu, & Qekwana, 2020)



The research focused on participants that form part of the three categories of stakeholders in healthcare service delivery. The categories are namely, a) the healthcare professionals comprising three Government Hospital doctors who were working in Maseru at the time of the research but have experience working in other districts and five nurses who were working in five different districts, Maseru, Mafeteng, Thaba-Tseka, Mohale’s Hoek, and Leribe; b) The healthcare administrators who ensure that there is a conducive environment for healthcare professionals to deliver the services, and for the patients to come and receive the services freely. The healthcare administrators were from the highlands and lowlands, namely, CHAL deputy chief executive officer, based in Maseru, providing oversight on CHAL healthcare facilities (hospitals and clinics) nationwide, seven hospital administrators for the following Hospitals:

Mantsonyane CHAL Hospital in Thaba-Tseka district, Mokhotlong Government Hospital in Mokhotlong district, Motebang Government Hospital in Leribe district, Butha-Buthe Government Hospital in Butha-Buthe district, St Joseph's CHAL Hospital, Scott CHAL Hospital, and Maseru Private Hospital in Maseru district, and c) The potential patients who are inherently the beneficiaries of the healthcare services, comprising three participants per district for the ten districts.

Since the healthcare facilities are available and accessible to anyone country-wide, and the healthcare professionals are placed and rotated across healthcare facilities in the country, the experiences and the challenges they encounter are similar in all the facilities, regardless of where they are currently or have previously worked, or they may be transferred to in future. Moreover, healthcare services are provided to patients under the management, control and policy guidance of the Ministry of Health (GoL, 2013).

For data collection, the research adopted the case study design, which allows data collection through interviews and focus group discussions with people who have experienced healthcare services delivery in Lesotho (Baxter & Jack, 2008; Tomaszewski, Zarestky, & Gonzalez, 2020; Rashid, Rashid, Warraich, Sabir, & Waseem, 2019; Mfinanga, Mrosso, & Bishibura, 2019). Due to the COVID-19 pandemic, interviews and the focus group meeting discussions were conducted virtually. There were various challenges related to Information and Communications Technology experienced when we were about to have some virtual interviews, such that some participants could not be available, either because they could not access the internet outside working hours or telecommunication connections were poor and the sound was not clear, which hindered the interviews. Therefore, in some instances, replacing scheduled participants for the interviews was not possible, resulting in the total number of available participants being lower than planned. However, key participant groups were all represented, which enhanced the credibility and validity of the research.

The data analysis was performed through the Thematic Analysis Techniques using the software known as Taguette. The analysis was guided by the Thematic Analysis Framework in **Figure 14** above.

Though researchers accustomed to quantitative research methods feel that qualitative methods such as thematic analysis lack objectivity, qualitative methods assist researchers in gathering original and authentically rich insights into the phenomena studied by the experienced participants (Carminati, 2018; Castleberry & Nolen, 2018). Therefore, qualitative research is not about what numbers describe but about exploring the beliefs and ideas of experienced participants to understand why things happen the way they do (Carminati, 2018; Castleberry & Nolen, 2018).

To perform the thematic analysis, participants' responses were transcribed by the researcher. Following the transcription of the responses, phrases and sentences containing ideas related to the study were identified through the process called coding (Castleberry & Nolen, 2018). This is where similar phrases, ideas or words are identified and marked. Similar coded phrases and sentences were grouped into categories, which were then grouped into themes (Castleberry & Nolen, 2018) about the research questions, as guided by the thematic analysis framework above. The relationship between the themes forms the basis for the findings of the research as they provide a clear description of the phenomenon studied from the participants’ perspectives.

Transferability of Findings

Transferability of the findings in qualitative research is about the findings of research in a certain context being applicable in a different setting or group of participants (Daniel, 2019). Using transferability, the researcher provides evidence to the reader to review the integrity of the outcomes of the research (Daniel, 2019).

Smith (2018) suggests that transferability is one of the four types of generalizability in research. Others are naturalistic generalisation, analytic generalizability and intersectional generalizability (Smith, 2018). According to Smith, it is not true that qualitative research cannot be generalised because it is about finding people's rich ideas regarding a topic being studied. Therefore, any number of participants chosen through purposive sampling because of their expert knowledge or experience on the subject under study will be enough to provide the researcher with a clear understanding of the phenomenon being studied, thereby inferring the transferability of the findings to other situations (Carminati, 2018). It is important to remember that the objective of the case study research design is to use complementary sources of evidence to gather multiple opinions on the phenomenon being studied (Quintão, Andrade, & Almeida, 2020).

The findings of the research described below qualify to be inferred to other situations because the healthcare system in Lesotho is the same in all the ten districts, i.e. public and private facilities nationwide treat the patients similarly, and healthcare professionals are employed under the same policies, such that the research participants (patients, healthcare administrators and professionals) have a similar experience in the Lesotho Healthcare service delivery. For example, during the data collection process, one participant said:

> "*Sometimes patients misplace the booklets and go to the health facility with a new booklet that will obviously not have old patient history*" (Interviewee A3, a healthcare professional),

and the other said:

> *"Like I said sometimes they lose the bukana. So, whatever treatment they were given, it is not recorded in the bukana(health booklet) you have access to. For the new ones is the same thing; the bukana has space and makes accommodation for things like vaccinations, but most of the time, like I have said, like 99% of the time, it is not filled*" (Interviewee A1, a healthcare professional).

Unavailability of historical medical information due to misplacement of the health booklet or not filling information by the healthcare professionals can compromise the quality and safety of care because wrong decisions regarding the patient can be made due to lack of information, which can cause medication errors (Ramesh, Manimegalai, & Priya, 2020) – these are examples related to the challenges of using the health booklet, which is the same in all the districts. Therefore, if the same research could be repeated elsewhere in the country, the findings would be the same because the healthcare services are under the control of the same government ministry, namely the Ministry of Health, regardless of whether a facility is owned by the Government or by the Christian Health Association of Lesotho (CHAL) (Ministry of Health, 2018).

Limitations to Data Collection

The limitation of the data collection is that in Lesotho, some people are uncomfortable communicating formally with ICT gadgets, such as computers or smartphones. However, due to COVID-19 protocols, the interviews and focus group meeting discussions were conducted virtually. Therefore, the researcher could not get as many participants as planned because some participants declined due to technological challenges; secondly, some participants were intimidated by technology and could not exhaust their thoughts; thirdly, communicating virtually removes human interaction feeling, and does not allow the researcher to observe body language and perhaps probe the participant for more information, which could be vital to the research. Failure to get the originally planned number of participants may be perceived as if the research has not reached saturation in data collection, which may compromise the quality of the research (Saunders, et al., 2018). However, the data collected was good enough to provide insights into the ideas, beliefs, and experiences of those who know what happens in Lesotho's Healthcare Service Delivery. The research participants were doctors (3), nurses (5), healthcare administrators (8), and potential patients (30). According to Staller (2021), the strength and logic of purposive sampling are in selecting information-rich participants to facilitate an in-depth study that will provide insight into a phenomenon being studied, as opposed to an empirical generalisation required for Quantitative Research (Staller, 2021). The qualitative research report aims to explain, interpret, and describe the phenomenon being studied (Staller, 2021). Therefore, when the researcher is getting the same responses from interviews and focus group discussions, it does not matter how big the participants' sample is, the thematic analysis will provide the same findings. Hence, the quality of the participants selected through the purposive sample is key to the qualitative research findings (Staller, 2021; Saunders, et al., 2018).

Reliability and Validity of Data

Reliability is about the possibility of the research being replicated by another researcher using objective methods and obtaining the same findings (Quintão, Andrade, & Almeida, 2020; Cypress, 2017). On the other hand, validity is defined broadly as the state of being logical, sound and justifiable (Cypress, 2017). It is about the accuracy of the findings from the perspective of the researcher, participants and the audience of the research (Rose & Johnson, 2020). Therefore, the lack of validity and replicability of the findings of qualitative research is a result of the inconsistent application of the research methods (Daniel, 2019).

Cypress (2017) suggests that reliability and validity are the key concepts of qualitative research that define the rigour of the research, without which the research is not valid. Moreover, reliability and validity are vital components of quality (Cypress, 2017). Therefore, reliability and validity can assist the researcher and the audience in appreciating the level of quality of the research.

Internal Validity

The phenomena being studied refer to the risky healthcare services delivery in Lesotho because of the fragmented patient records and uncoordinated healthcare systems. The fragmentation of a medical record will result in the incomplete clinical history of a patient during the provision of care, which is considered risky because it can cause healthcare professionals to commit medication errors due to a lack of historical medical information about the patient (Ramesh, Manimegalai, & Priya, 2020), such as prescribing medication that the patient is allergic to, as there would be no such information in the accessible patient's medical history. Therefore, for the research to establish the following aspects of the phenomena being studied, using the research questions through interviews and focus group meeting discussions with the key stakeholders of the healthcare service delivery provides internal validity to the research (Rose & Johnson, 2020):-

a) The extent to which the challenges encountered by healthcare professionals during the provision of care affect both the quality and safety of the healthcare services delivery;

b) the appropriate and relevant critical success factors for the suggested solution of the PHIMS to ensure its efficiency and

c) The formulation of a legal/policy framework that can regulate the implementation of the envisaged system to make it efficient

Through the above-mentioned aspects, the researcher can confirm that the problem identified negatively affects the healthcare services delivery so much that the healthcare services delivery in Lesotho is risky to the life of the patients, recommend a solution in the form of appropriate critical success factors for the envisaged PHIMS and guidelines that would regulate the implementation of the solution of a PHIMS to ensure its efficiency. This was achieved first through the interviews of the three target groups of participants, namely, the healthcare professionals as the healthcare services providers, the healthcare administrators as they play the oversight role for the healthcare services delivery nationwide, and the potential patients as the beneficiaries of the healthcare services delivery; and second, through focus group meeting deliberations, with doctors, which is part of the healthcare professionals. The focus group meeting intended to get more insight into the healthcare services delivery in a different interaction environment, where instead of just an interview, there was time for deliberations and points of clarification to get more details and clarity on opinions and experiences regarding the Lesotho healthcare services delivery issues. The internal validity was reached because for both the interviews and the focus group meeting deliberations, the research participants qualified to partake in the interviews and focus group deliberation meeting as they provided signed informed consent forms, and they also fully understood the subject being discussed.

External Validity

According to the Health Sector Strategic Plan 2012/13 – 2016/17, the Ministry of Health is in charge of the delivery of healthcare services in Lesotho. Key responsibilities include healthcare policy development and implementation, health resources mobilisation, health standard and guidelines development, and monitoring and evaluation of all healthcare interventions in the country (GoL, 2013). Therefore, the participants' experiences in healthcare services delivery in any part of the country are the same, as the same standards and guidelines under the Ministry of Health guide healthcare services issues. For example, the rules for managing the storage of patients' medical records are the same nationwide, in that in all public facilities, patients are expected to produce a health booklet, also known in Lesotho as "bukana", where healthcare professionals write healthcare management notes for the patient, while in private facilities a different system, specific to the individual facility is used. One participant (potential patient) said:

> "*I have been in at least six health facilities. Stored in the old way of filing for public facilities, there is a health booklet which contains my record. When I left it at home, they asked me to buy a new one, which will record the ailment of the day. Private facilities… they seem to keep records, as once I got there, they had my record of the last time I had visited. I have no full medical history. Instead, there are pieces of information in as many facilities I have been to and also in the health booklets that I managed to keep*" (Interviewee C27).

The other participant (healthcare professional) on the issue related to the health booklet said:

> *"The other problem would be that most people lose their bukana, so they usually have new ones, yet you find that they are chronically ill patients who had been taking medication or being followed up from a certain facility, and then they come to you with a new bukana, and you have to start from scratch basically, and take complete history without vital information you could find from the old bukana" (Interviewee A1).*

These findings indicate that paper-based medical records are unreliable because the unavailability of patient historical medical information during care provision, can result in medication errors, by healthcare professionals, which compromises the quality and safety of care (Ramesh, Manimegalai, & Priya, 2020). Therefore, the issue of being forced to buy a new health booklet (bukana) to replace a lost one is the same in healthcare facilities nationwide, regardless of where a patient is provided with care in hospitals or healthcare centres. So, the research findings, which were obtained through interaction with participants that were selected through a purposive sampling method, can be generalised to the bigger population of the country, as the health standards and guidelines are the same countrywide because they are under the guidance of the Ministry of Health (MoH), which is the supreme body in the Health Sector (GoL, 2013).

Reliability

Reliability is understood as care and consistency in the application of research methods (Cypress, 2017; Rose & Johnson, 2020) in conducting the study. Moreover, reliability is related to the possibility of replication of the findings should the study be performed by another researcher (Quintão, Andrade, & Almeida, 2020). Therefore, the research findings are reliable because the research design, case study, and methods of conducting the research were followed (Rose & Johnson, 2020). The case study research design requires that data be collected through interviews and focus group meetings with the participants (Quintão, Andrade, & Almeida, 2020). Every category of the participants was interviewed with a relevant set of interview questions, and for the focus group meeting deliberations, the discussion points were used as guidance to the focus group meeting deliberations. Thereafter, data were analysed using thematic analysis techniques (Castleberry & Nolen, 2018). The research methods of data collection and data analysis are consistent with the research design of the Case Study, which guides that data collection is done through participants' interviews and focus group meeting deliberations with participants who have experience and insights into the subject being interviewed on or discussed, and therefore the data collected is reliable (Cypress, 2017).

Research Findings

The research findings are organised by research questions to illustrate the participants' experience and knowledge of issues related to each research question and demonstrate whether or not the objectives of the research were met.

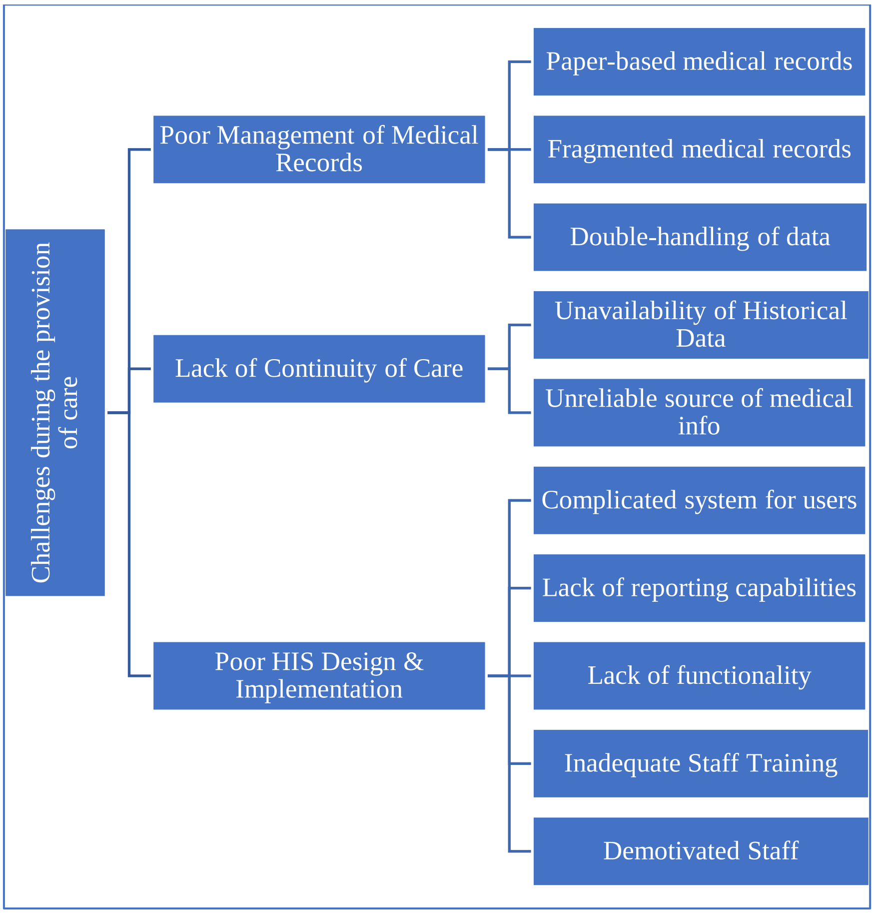
Research Question 1:

To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?

Figure 16 below provides the findings for the question regarding the challenges encountered by healthcare professionals during the provision of care.

Figure 16

The challenges encountered by Healthcare Professionals during the provision of care



The findings in Figure 16 above indicate that there are three categories of challenges encountered by healthcare professionals during the provision of care, namely 1) Poor Management of Medical Records, 2) Lack of Continuity of Care, and 3) Poorly Designed Existing Health Information Management Systems. The categories are described in detail below:-

Poor Management of Medical Records

According to the participants, as illustrated in Figure 16 above, the participants indicate that Poor Management of Medical Records is one of the main challenges that healthcare professionals encounter during the provision of care. The challenge is divided into three parts, which are described in detail below, namely, a) Paper-based Medical Records, b) Fragmented Medical Records, and c) Double-handling of patient data or patients' medical records.

a) Paper-based Medical Records

According to the participants, the healthcare facilities in Lesotho store patients' medical records in paper-based format. The paper-based records are either booklets, which the patients must bring along to the public facilities to seek medical attention, or physical files that private facilities use to store patients' medical information and are kept at the facilities. The participants suggest that, for public facilities, some patients do not bring the healthcare booklet during the provision of care and are required to buy new booklets. However, the new booklets do not contain any information about the patient's previous encounters at the facilities, which healthcare professionals need when providing care. On the other hand, when the file is misplaced at private healthcare facilities, a new file is created, which unfortunately does not have the medical history that the healthcare professional needs for reference during the provision of care. In this regard, one participant (potential patient) said:

> *"I have been to about six facilities, private and public facilities. My medical history is stored at all the facilities I have been to, and they are stored with the ailment of the day. I do not have access to my medical history. In public facilities, my record is in the health booklet – the challenge is the booklet gets lost and destroyed by water or misplaced – therefore I always have to buy a new one, which will record the latest medical record" (Interviewee C24).*

While on the same issue, a participant (hospital administrator) said:

> *"Currently, the patients are using health booklets, if the booklet is lost, the patients are required to buy new booklets, meaning that there will be no historical data, which may have negative consequences" (Interviewee B5).*

Still on the same issue of the paper-based records, a participant, who is a healthcare professional said:

> *“So, I use the historical data to know what other doctor did to that patient. So, if we depend only on bukana when the bukana is lost, then it will be difficult to determine the status of chronically ill patients. Otherwise, the system will have complete patient information” (Interviewee A1).*

Moreover, another reason paper-based records are a challenge to healthcare professionals during care provision is that they are not easily retrievable when needed. If the medical records are written in a health booklet, the challenge is it could either be forgotten at home, misplaced or the handwriting not legible. However, if they are in a file at the healthcare facility where files are used to store the patients’ medical records instead of health booklets, the file could also be misplaced, or if available, some pages could be missing, or the handwriting on some pages is not legible. One participant (Hospital Administration Officer) said the hospital stores files for the in-patients; however, they experience some challenges when they need information from those files. The participant said:

> *“We have a room where we have kept our files, but the problem is other files are already missing because they are kept haphazardly because they are already …we are no longer keeping them sequentially” (Interviewee B5).*

b) Fragmented Medical Records

Other than records being in paper-based format in a healthcare booklet or a physical file, the participants suggest that the other challenge is the fragmented patients’ medical records, which make it difficult for healthcare professionals to provide care as there are always gaps in the recorded patient’s medical information, when needed the most, which is during the provision of care. In confirming the challenge, one of the participants said:

> *" I have been to both private and public facilities in the country – about nine. My medical record is in all these facilities with respect to the ailment of the time. I also have a health booklet as it is used at the public facilities. I have many booklets as when one is lost, I have to buy a new one. And most times the booklet get misplaced – and the records in it would not be known until I find it, which could be after many visits to the health facilities” (Interviewee C21),*

In confirmation of this assertion, the other participant said: *"The healthcare facilities are not linked to each other, so each doctor has the record they kept" (Interviewee C23).*

This is because healthcare facilities don't follow a similar system for storing records, and, therefore, are unable to share the patient's medical records.

As indicated above, public facilities record medical information in health booklets known as "bukana" in Lesotho, while private healthcare facilities use physical files that are stored at a facility. Therefore, the challenge is that for a patient who has been to many facilities, the pieces of the patient's medical records are stored in many facilities, resulting in difficulty in having complete medical information during the provision of care. Furthermore, in highlighting the challenges associated with the healthcare booklet, another participant said the following:-

> *"The problem with the health booklet is sometimes I forget it at home or leave it purposely if I don't want the doctor to know my previous history. For example, if I am at a doctor where I don't want them to know I am HIV Positive"(Interviewee C15).*

Therefore, for a patient who has been to different healthcare facilities over time, their records would be scattered in many facilities furthermore, if a patient has been admitted to a hospital, a different kind of challenge is experienced, which is also caused by poor management of medical records, which means that only healthcare professionals working at the hospital can have access to the patient records. This is confirmed by a Hospital Administration Officer, who said:

> *"If a patient was admitted at the hospital, the management of the patient's medical information is left with the hospital, and other healthcare facilities don't have access to it" (Interviewee A4);*

In addition, the other participant asserted that their medical records are fragmented and stored in different facilities as the facilities don't share the records, the participant said:

> *"I get medical services from two facilities in the country and one in South Africa. My medical record/history is in the three facilities. These facilities are independent, and they don't share my records in any way" (Interviewee C7).*

Therefore, the fragmentation of the patients' medical records can be described in many ways. For example, one patient's medical record is available in more than one healthcare booklet, which he or she takes to the public facilities, or in the booklet and physical files used at public or different private healthcare facilities, respectively. Moreover, according to the participants, sometimes patients go to a facility and when they get there, the facility cannot find their record, yet they have been there before, and probably they have come for a check-up. Consequently, a new file with no medical information is opened to facilitate the provision of care for the day. Therefore, one patient has as many records as the number of healthcare facilities they have visited or the number of booklets and files that were created for them at the facilities they have visited to seek medical attention.

Furthermore, the participants assert that because patients are free to seek medical care anywhere in the country, but the facilities do not share the patients' records, the healthcare professionals do not have the opportunity to get access to complete patient information during the provision of care. To demonstrate the fragmentation of patients' medical records, which is caused by the poor management of medical records, a participant said:

> *"I have about three health booklets, but I take any of them when I go seek medical attention. Therefore, I have about three pieces of my medical history in my health booklets, which I easily misplace" (Interviewee C10).*

In confirmation of the fact that the potential patients suggest that the main challenge is fragmented records, the other potential patient said*:*

> *"I have been to 15 health facilities constituting private and public. My medical records are as many as those facilities because each facility keeps medical records in their own way, some physical on paper and some electronic"(Interviewee C22).*

Moreover, the other potential patient said:

> *"I have been to at least five facilities. Private facilities keep patients' medical records in files, but public facilities keep my records in my health booklet. When the booklet is lost, I am asked to buy a new health booklet in which they record the current ailment. I believe my medical record is scattered to the facilities I have been to and in the health booklets that I ever presented" (Interviewee C28).*

c) Double-handling of Patients' Data

The other challenge caused by poor management of medical records is the double handling of patients' data. According to the participants, at some healthcare facilities, data is recorded on physical data sheets and then transported to the local district health management team for input into an electronic District Health Information System. This means data is captured twice before it can be processed. Therefore, errors can occur when data is being copied from one media to the other. For example, a character can be mistaken for a digit because of illegible handwriting or mere lack of concentration by the person copying data from paper to an electronic system. One Hospital Administrator voiced out their observation regarding the handling of patients' data by saying the following:

> *"But also, there is DHIS2, which is used for reporting. However, data, if filled on forms first and then later captured into DHIS2, could also cause errors" (Interviewee B4).*

In agreement with the above statement that the patients' data is being double-handled, a Hospital Administrator from a different hospital said:

> *"Also, inpatient processing is not part of the DHIS2, it is done manually, it is paper-based, and that data can easily be lost any day" (Interviewee B6).*

Lack of Continuity of Care

The findings in Figure 16 above illustrate that the participants suggest that lack of continuity of care is one of the challenges encountered by healthcare professionals during the provision of care. The participants asserted that the lack of continuity of care is caused by the unavailability of patients' historical data and unreliable sources of medical information received by healthcare professionals at the point of care. According to the participants, this challenge affects mostly patients with chronic diseases. The participants asserted that, since patients' medical records are not properly organised or updated, the continuation of care is hindered, which may result in compromised care quality and safety. The participants suggested that the unavailability of patients' historical medical information and unreliable sources of medical information deny healthcare professionals the opportunity to make informed decisions during care provision. For example, one participant indicated that it was important for patients to seek transfer letters if they have to move from one district to the other so that a proper explanation about their condition could be written to provide the patients' health status to the healthcare professionals of their destination. One healthcare professional said:

> *"What is supposed to happen if a patient is saying no, I want to transfer to a private facility, then that doctor has to write a transfer note, indicating that Mrs X has been my patient for so long, I have been treating her for this, with this medication, please take over management as she now wants to be seen at a private facility. But usually, our patients don't understand*

> *that that is how it is supposed to be, if they want to go to another doctor, they just go" (Interviewee A1).*

The findings are presented in detail below:-

a) Unavailability of Historical Data

Moreover, a participant provided an example indicating how some challenges caused by the poor management of medical information negatively affected healthcare service delivery because it resulted in total loss of historical medical information in the country, one participant said:

> *"There was leprosy, but there is no data for current healthcare professionals for them to learn or refer to historical data regarding the pandemic – Lesotho does not have patient historical data storage that could be accessible by those currently providing care" (Interviewee A4).*

Therefore, as mentioned by the participant regarding leprosy, there is some vivid knowledge that leprosy existed in Lesotho some years ago. However, there is no historical data available for current healthcare professionals to read about the disease.

Furthermore, participants suggest that in some healthcare facilities, the healthcare professionals do not write any clinical notes in the patient's healthcare booklet, especially where the medical records are kept in the healthcare facilities' physical files. Therefore, without knowing why and what the healthcare professionals normally write in the health booklets, for those who have the booklets, when the healthcare professionals don't ask for the health booklet, the patients cannot request that the healthcare professional write anything in their healthcare booklet, resulting in the record being only the files at the facility. To highlight the challenge, participants asserted that the health record systems at the healthcare facilities are not that functional, as the patient's medical information is never complete wherever it is recorded. For example, a patient would indicate that they are HIV AIDS patient verbally, with nothing to support the claim because the medical record systems are poor.

To emphasise that the unavailability of patients' historical medical information is one of the challenges hindering healthcare services delivery during the provision of care, the other participant, a healthcare professional, provides some of the causes of the unavailability of historical medical information by saying:

> *"Also, patients who go to private facilities, because private doctors do not write clinical notes in the bukana, they keep files. It is difficult when they visit a public facility, then they tell you they are hypertension patients and say I just don't know the name of the medication, I can't remember when I started it, but my file is with my doctor" (Interviewee A1).*

The other participant, the hospital administrator, added that one of the issues caused by the non-recording of patients' medical information at the healthcare facilities by saying:

> *"You see, with the current information, as we are taking care of patients, the current information is important and easily retrieved, but with older data, we have challenges, maybe if there are some documents that need to be produced. For example, if people who were working in the mines and have been nursed here, you find that information is not easy to retrieve, and those people are unable to access the services outside the hospital because of having no data"(Interviewee B3, a hospital administrator).*

When referring to medical information lost when a patient moves between healthcare facilities, seeking medical attention, one participant said the following:

> *"For the healthcare professional to depend on the health booklet may be risky and not reliable, especially because patients lose booklet for various reasons or some doctors, particularly in private healthcare facilities, do not fill medical information in the booklet; Sometimes patients misplace the booklets and go to the health facility with a new booklet that obviously will not have old patient history"* (Interviewee A3, healthcare professional).

b) Unreliable Sources of information

The participants asserted that another challenge that needs serious attention by healthcare professionals during the provision of care is unreliable sources of medical information.

According to the participants, this happens when there is no patient's medical history, and the healthcare professional asks the patient questions about historical clinical activities, procedures, and medication to capture all that the patient can remember to facilitate the provision of care. Additionally, the unavailability of a patient's medical history can make the healthcare professional request answers from a patient regarding the clinical information that a patient may remember about his/her previous encounter with the healthcare professionals either in the same facility or other facilities. Therefore, the participants perceive relying on patients for historical medical information as using an unreliable source of medical information during the provision of care. The reason is that patients may forget some critical information and create problems for themselves. For example, a participant said:

> *"I might forget some of the important info required by the doctor due to lack of knowledge, but with the concern regarding the current ailment. I consider that as a waste of time and maybe risky because it may not be important to you at that time, yet it may be required to help the provision of healthcare. I may forget what I am allergic to and fail to disclose"* (Interviewee C4, potential patient).

The other participant suggested that sometimes patients decide to hide their medical information from healthcare professionals for reasons known to themselves. The participant said:

> *"The health practitioners depend on my knowledge and recollection of previous health encounters if I had been in other facilities for healthcare. Otherwise, they would have kept the record in their system independently of other facilities. Sometimes I may decide, for various reasons, to withhold information if they don't know it" (Interviewee C22, potential patient).*

In the discussed cases above, the healthcare professional requests medical information from the patient, who can easily forget or miss critical information or choose to hide information.

Moreover, one participant indicated that it might be futile for the healthcare professional to depend on the patients for medical information regarding previous visits to the healthcare facilities when historical medical information is missing because patients are not healthcare professionals and cannot be trusted to provide accurate medical information, the participant, a potential patient said:

> *"I have been to many health facilities, and my record is in any of them, but those facilities do not share my medical history. The health facilities depend on me for previous health encounters in other facilities, which may not be as accurate as it could be if they had access to such information" (Interviewee C6).*

Furthermore, different from the challenge of poorly managed medical records because they are paper-based, in some healthcare facilities where there is an Electronic Medical Record System, the challenge is different, as the healthcare professionals rely on the patient for historical data for new patients, which is never accurate because the healthcare facilities do not share the patients' medical information. This is explained by the research participant, a healthcare professional, who said the following:

> *"We just depend on a health information system called EMR for returning patients. But we rely on information from the patient for new patients. HIV is a huge disease – if a healthcare professional could rely on the system, it would be much better because health data would be more accurate"* (Interviewee A2).

Therefore, according to the participants, relying on the patient for their historical medical information may not be a good thing because the patient is not a healthcare professional and can easily forget what happened or was said during the previous encounter with healthcare facility staff or doctors, as he/she does not know clinical terms, procedures or processes.

According to the participants, the current healthcare systems where the healthcare facilities do not share patients' medical records create a challenge of lack of continuity of care for the healthcare professionals, especially for patients with chronic diseases where medical history is required to continue with the provision of care at a new location. Moreover, the participants understand and suggest that continuity of care is vital for the improvement of healthcare service delivery. One participant, a Hospital Administrator, said:

> *"You find that the current problem that the patient is at our institution is we work with what we have at hand, we don't have any other information unless we have the booklet of a patient. Let's say the patient has had hypertension, but the booklet they have does not have that historical information, then we concentrate on the current ailment, such as the broken arm, but nothing helps us to get the source or relation to their medical history to assist the provision of care, especially when the blood pressure is currently under control" (Interviewee B3, a hospital administrator).*

Furthermore, continuity of care could be within one healthcare facility or across various healthcare facilities, depending on the nature of the healthcare or ailment that the patient is faced with. One participant, a healthcare professional, highlighted a lack of continuity of care in the growth of a child when he/she said*:*

> *"For children particularly am… you have a page where you track their weight gain, which is very important. Sometimes, you find that the healthcare workers don't complete it or the patients themselves don't take their child for weight monitoring, so you get a four-year-old who last had their weight taken when they were six months, so it is impossible to know if the child has been growing well or not. Also, the vaccination is included on the front page, but it is usually not completed or incomplete" (Interviewee A1, a healthcare professional).*

The other participant blamed the lack of continuity of care on the lack of organisation and poor management of patients' medical records by each healthcare facility when saying:

> *"Also, when we take care of our patients, you find that they are our regulars, but when they come, it's a new diagnosis, the older one is shelved, we don't consider it anymore, but if we had all the database of the patient then we would be able to see that this patient suffered 1,2,3 maybe the information would be articulated" (Interviewee B3).*

Furthermore, the findings suggest that lack of continuity of care is also caused by defaulting patients on their treatment schedules or failure to take medication as instructed, which creates complications in the provision of care that compromise the quality and safety of care. For example, one participant, a healthcare professional, said the following:-

> *"Sometimes they (patients) hide information – they default all the time and only go to the facilities when they feel really sick" (Interviewee A5, a healthcare professional).*

The other participant, a healthcare administrator, provided an example where defaulting causes the lack of continuity of care by saying:

> *"If a patient comes to the hospital, but they have defaulted in their current treatment, it means we start from the beginning, you come as new, which has caused a lot of problems, which is the case with HIV patients who most times hide their sickness, the treatment will not continue" (Interviewee B5, a hospital administrator).*

Poor Design and Implementation of Existing Health Information Management System

The participants suggest that in healthcare facilities where electronic Health Information Management Systems have been implemented, different types of challenges affect the quality and safety of the provision of care, such as a) Complicated system for the users, b) Lack of reporting capabilities that the users encounter when using the system, c) Some functions of the system not accessible by the users, d) Inadequate Training of Users, and e) Demotivated Human Resources.

a) Complicated Health Information System for the users

The users suggest that the current systems are very complicated to understand and use. One participant said:

> *"For new patients, the system used is not user-friendly – it takes lots of time to collect data needed from a patient" (Interviewee A3).*

The other said:

> *"As I fill in the information into the system, the system captures information, let me say of its choice, it is already kind of tailor-made to capture certain information as opposed to what I intend report on, it gives general info about the number of deliveries and it does not serve what I would like it to do"(Interviewee B3).*

To further express frustration due to operating a complicated Health Information System, B3 concluded by saying "The system is not user-friendly".

b) Lack of Reporting Capabilities

According to the participants, one of the challenges encountered when trying to use the existing Health Information Systems is that they do not have enough reporting capabilities. For example, one participant said the following: -

> *"Currently, we do not have a standard reporting as the administration department, but the clinical department and other departments have standard tools they use for reporting" (Interviewee B2).*

c) Some Functions of the Current System are not accessible to the users

The participants suggest that in some healthcare facilities where HIS exist, there are issues regarding access to the system, which are not clear to the users and pose challenges to the usage of the system, hindering the provision of care. For example, a participant said the following: -

> *"Is it even possible to know where the patient has been? We don't have that functionality to track the patient's whereabouts in relation to her sickness…." (Interviewee B6).*

Moreover, in accord with the above participant's views, another participant expressed their views on functionality challenges when trying to use the existing HIS at their facility and said:

> "*Some passwords are needed to access some information. Therefore, I am unable to access some information because the passwords are not active. I have to have access rights*" (Interviewee B3).

d) Inadequate User Training

The participants suggest that some key operators of the system who generate a lot of data that the system requires to produce required information, such as reports, have not been trained or if trained, only one would be trained, and when they are off duty, no one knows how to operate the system. For example, one participant, a healthcare administrator, said:

> "*Training is also a challenge, it is not adequate, for example, you find one person has been trained, and when they are not at work, no one knows what happens*" (Interviewee B6).

Furthermore, on the same issue of inadequate training, another healthcare administrator asserts that key people generating data that could be used for billing patients are not adequately trained to input data into the system, resulting in critical data being uncaptured. The administrator said:

> "*Some of our staff members, especially the practitioners, are not conversant with recent IT systems, but they have much input into the system, for example, the billing feature relies heavily on the doctors and nurses because they are the ones who bill the patient on the operation level*" (Interviewee B7).

Moreover, Interviewee B7 suggest that one more challenge caused by inadequate training of the healthcare facilities' Information and Communications Technology staff is delayed support because the facility has to source external expertise. Interviewee B7 said:

> "*One of the biggest challenges is that our systems are administered from outside Lesotho. In some other instances, we spent about two days before our challenges were addressed, especially where internal support did not have the capacity*" (*Interviewee B7*).

e) Demotivated Human Resources

One more challenge concerning the implementation of an electronic HIS in some healthcare facilities is demotivated users of the system. For example, one administrator said:

> "*Capturing information at the OPD is a challenge – doctors would say they have a lot of work; they don't have time to capture patient data*" (Interviewee B6).

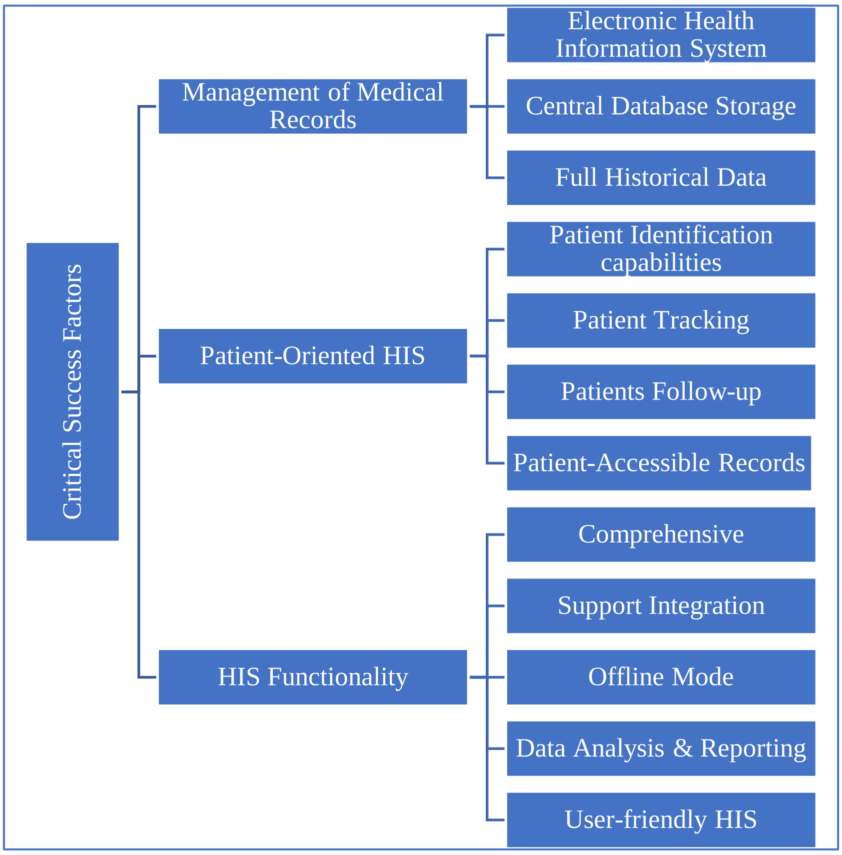
Research Question 2:

What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?

Figure 17 below provides the participants' views on what they believe are the critical success factors of the envisaged PHIMS.

Figure 17

The Critical Success Factors for the envisaged PHIMS



The findings illustrated in **Figure 17** above indicate that there are three main categories of the Critical Success Factors for the envisaged PHIMS to be efficient, as suggested by the participants during the research data collection exercise. The categories are namely, 1) Management of Medical Records, 2) Patient-Oriented System, and 3) Health Information

System (HIS) Functionality. Therefore, the categories are described in detail below with evidence extracted from the participants' interview transcripts: -

Management of Medical Records

The participants asserted that for Lesotho to have an efficient Public Health Information Management System, it must have effective management of medical records, which comprises three functions: a) An electronic Health Information System, as opposed to a paper-based medical records system, b) A central database to store Lesotho patients' medical records, and b) Full Historical Medical Information for patients who have been to the healthcare facilities to receive any treatment or medical services. Therefore, the suggested Critical Success Factors of the envisaged PHIMS are described in detail below: -

a) The System Must be Electronic-Based

One critical success factor suggested by the participants is that for the envisaged system to function efficiently, all healthcare facilities must migrate their medical records from paper-based to electronic-based patient records management systems.

For example, the participants in a focus group meeting agreed to a suggestion made by a member of the group when saying the following:-

> *"The comorbidities and certain conditions must be there so that you may decide how you manage the patient. A big file is not that helpful, an electronic system would be much better"(*Focus Group deliberations*).*

In affirmation that the healthcare facilities should consider migrating the patients' medical records from paper to electronic format, one participant, a member of the focus group, highlighted the importance of having an electronic system versus a paper-based one, in the following words:

> *"We are using bukana, that is sharing information, but is not everybody that read the bukana from page 1 to the page where he has to write. Which means if there are no systems that can compile the information together, I mean the relevant information that is needed at that point in time, certain information can be missed" (*Focus Group deliberations*).*

Furthermore, another participant, a potential patient but not a focus group member, confirmed the need to replace paper-based records with electronic medical records by highlighting the risk of storing medical records on paper and said:

> "*Do away with physical health records because they are not secure – they are prone to unauthorised access by anyone who can enter the facilities*" (Interviewee C24).

b) Central Database

The participants believe that the envisaged Public Health Information Management System (PHIMS) would be efficient if patients' medical records were better organised, such that there is a central database to store the medical records. The central database must be updated with patients' medical information during or after the provision of care in all facilities in the country, regardless of who owns the healthcare facility. In Lesotho, the healthcare facilities are owned by the government, private companies, or associations, such as the Christian Hospital Association of Lesotho or the Red Cross Society of Lesotho. For example, one participant, a healthcare professional, said:

> *"There must be a central database of patient info – so that I can access the data of a person who has been to other facilities – to avoid patient hiding information or going to many facilities looking for something different" (Interviewee A3).*

Emphasising the importance of having a central database that contains patients' medical records that would continuously be updated with medical information from various healthcare facilities, another participant, a healthcare professional, suggested that a central database would enhance the analysis and reporting capabilities for the Ministry of Health on the national health data shared across all the facilities when saying:

> *"It would help to have a central database to facilitate clinical data analysis. For example, the diseases that cause most deaths; the trends could be known and help to provide care" (Interviewee A4).*

Moreover, for some participants, it seemed very important that the central database should be accessible only by authorised healthcare professionals so that when the need arises, the action taken on the system can be traced back to the registered users with all the necessary details. For example, one participant, a potential patient, said:

> *"There must be a central database where authorised registered doctors should have access to it, and doctors should be either private or public doctors, and a central database should contain the information for all patients" (Interviewee C4).*

Furthermore, the participants suggested many benefits of having a central database of patients' medical records for all people living in Lesotho. For example, having a central database would make it easy for the country to provide reports concerning health status in Lesotho. They assert that the reports would help the government plan future development activities for its citizens and, on the other hand, provide the national health outlook as may be required by international health bodies such as the World Health Organisation because all data in the country would be available centrally. The following are some of the extracts from the participants' interviews regarding their opinions on the development of a central database to store patients' medical records.

(a) "*There should be a system central and accessible by all health practitioners – so that a full record of the patient is available – that would ensure that patients get relevant required service because of the full medical record for each patient. It would also help the doctors to use available information*" (Interviewee C28, a potential patient).

(b) "A c*entral database would ensure that there is no duplication of health information, as one patient would appear once in the central database*" (Interviewee C7, a potential patient).

While participants agree that there must be a central database for patients' medical information/records, it is important to note that the participants are very cautious about who should access the central database to ensure control, safety and privacy of patient information. Therefore, they suggest some restrictions to be followed. For example, the following participants provided their opinions accordingly:-

> "*There must be a central database, which is accessed only by authorised people for authorised processes in order to ensure that the info is used to save lives and not be used against either the patient or health practitioners*" (Interviewee C6, a potential patient).

While the other said:

> "*Doctors should be able to access the central database to access the medical history of the patient from anywhere in the country. It may be accessible only when the patient is available and being given medical care. It should be accessible to only authorised people*" (Interviewee C14, a potential patient).

c) Full Historical Data

The participants suggest that the envisaged PHIMS must be set up such that at the point of care, the healthcare professionals can have access to the patient's full medical history, regardless of the number of facilities the patient has visited in the country and received medical care. According to the participants, having access to the full historical data would enhance healthcare service as healthcare professionals would make informed decisions during the provision of care. For example, in a focus group meeting, the members agreed to the following statement made by one of the members:

> *"So, it is important to have historical data and kept in a way that it is made available anytime, as soon as it is needed, because that helps in the management of a patient at that point in time. For example, if a patient was in Quthing yesterday, and was given a particular treatment, and now he comes to Maseru, as they always do. If you give them the same treatment that the person got yesterday, they will take that treatment because they don't know that the treatment we give does not work magically, it takes time to work" (Focus Group deliberations).*

Additionally, one participant, a potential patient, believes that data that are collected during the visit to the healthcare facility, which formed the patient's health record, should be used to the patient's advantage during the next visit to determine whether their health improved. The participant said:

> "*Patient record must be stored such that on subsequent visits the same record is retrieved – and health practitioners must be able to advise me of proper lifestyle – they should determine if health wise I am improving or declining*" (Interviewee C27).

Moreover, on the same issue of the importance of full medical history for a patient during the provision of care, another participant, a healthcare professional, indicated that historical data is very informative to the process of care provision when saying:

> *"We all know as healthcare workers to take clinical notes, so since we always work as a team and handover care of our patients to the next clinician, they need to know what we did and how – also, in hospitals, you must write proper clinical notes as you take rounds so that the next healthcare professional can clearly see what the history of such a patient is" (*Interviewee A1*)*

Furthermore, the participants suggest that with full historical data of the patient at the point of care, safety and quality of care can surely be exercised by those providing care. For example, one participant, a healthcare administrator, said that a full medical history can assist healthcare professionals "*to avoid harming a person with medication that they should not be given and were identified before*" (Interviewee B8).

On the same issue of avoiding harming the patient, the importance of full historical data is emphasised by focus group meeting participants when saying:

> "*Patients have allergic reactions to certain treatments. Therefore, one may repeat the same treatment - so there must be historical data that is available so that you may not repeat the same problem. The system has to show you allergies without even asking for them*"(Focus Group).

Finally, participants in the focus group meeting confirmed the importance of complete historical data of the patient at the point of care by agreeing that historical data gives a care provider knowledge about the patient, thereby advancing care provision before attending to the patient. They agreed on the following statement made by one of the members:

> "*Historical data is always important; it assists the mission of having knowledge of the patient. All this can give you an orientation of the current or present situation the patient is experiencing, and you can see if it is something new or something went through in the past, and if it is sore, how was is it managed, did he recover from that, maybe there are still some approach that you can copy from history*" (Focus Group deliberations).

Patient-Oriented Health Information System

The participants suggest that an envisaged PHIMS will be efficient if it is patient-oriented, as opposed to being healthcare-facility-oriented. Therefore, according to the participants, a patient-oriented HIS has the following critical success factors as its features to ensure the system is efficient: a) Patient identification capabilities, b) patient tracking function, and c) Patient follow-up functionality. The findings regarding these features are presented in detail below.

a) Patient Identification Capabilities

The participants asserted that the envisaged PHIMS should have a feature that facilitates the identification of patients so that available medical records in the system can be matched with the patient who has come to the facility for medical attention. This means the system must have a feature that should assist healthcare providers to confirm that if they are dealing with a returning patient, the patient is who they say they are. In affirmation, one participant said:

> *"Each person should have a unique medical person identification number such as that of tax record – that information should be centralised and protected" (Interviewee C14).*

Additionally, on the same issue of the patient identification feature, one participant added the benefits of having that capability during the process of providing care, the participant said:

> *"I think if the work of the practitioners could be well coordinated such that they end up having one system, and they should have other systems that interact or that talk together so that maybe patients may have one unique identity, so that they end up having, providing.. eh proper treatment" (Interviewee C30).*

Alternatively, in the focus group meeting, the participants agreed that the patient identification method for the envisaged system should be a fingerprint identification method because the fingerprints are unique to an individual. And they agreed to the following statement during the deliberations:-

> "*Nowadays, it is easier to capture a patient's or individual's fingerprints. So that in the case where a patient does not have an ID, then there has to be a provision for fingerprint readers so that any information that is captured in a system is linked to a patient. And that also, I think, will help to provide information, so that when the patient comes for the second time, you don't need to go through all that process of looking for names and all those things, because fingerprints don't change*" (Focus Group deliberations).

b) The system must support patient tracking

According to the participants, continuous tracking of patient movement in terms of, for example, a) the current treatment, b) scheduled appointments, and c) past and present medication is critical for the improvement of the quality and safety of care. Therefore, the participants suggest that a system that facilitates tracking of patients' health status and behaviour can contribute towards improving health outcomes. In affirmation, one participant said:

> *"To improve service delivery in public hospitals – a patient tracking system should be developed"(Interviewee C2, a potential patient).*

c) Patient Follow-up Functionality

The participants define the follow-up functionality as an important feature of the envisaged PHIMS because it can help the stakeholders of the healthcare services delivery to work together and increase the quality and safety of care. The reason is that the participants suggest that patients' follow-up functionality should remind the healthcare professional to find the patient they provided care for and establish the extent to which the treatment has worked to improve the health of a patient. To highlight the importance of patient follow-up functionality, one of the participants said the following:-

> *"I would recommend a follow-up system that helps to track the patients, especially for follow-up assessments, which would have been recorded in the system. Village health workers would be used by the health sector to do such follow-ups in the villages – this would be made possible by consistent records keeping at all health facilities, private or public" (Interviewee C16).*

Furthermore, another patient provided more clarity on the need to ensure that the envisaged PHIMS must have, among its features, the functionality to follow up with patients and to establish what needs to be done differently if need be. Therefore, the other patient asserts as follows:-

> *"I don't know what could be done at the public facilities to follow-up patients on the medication of the ailment – something that facilitates follow-up for doctors or health practitioners must be able to share (in the same facility for repeat visits) information regarding the patients to facilitate follow-up and provision of care – instead of having to rely on patients for medical information – because the patient may not know what would be vital or info or they may forget what the doctor said in the previous encounter" (Interviewee C11).*

Alternatively, the participants suggest that the follow-up functionality should be able to remind both the patient and the healthcare professional about the next check-up appointment when it is due.

> *"An important feature of the system would be a feature which reminds patients of the upcoming appointments or check-ups"(Interviewee C16).*

d) Patient-Accessible Medical Records

According to the participants, each patient must be able to access his/her medical records to stay up-to-date with their health status. For example, they should be able to remind themselves of the next appointment dates, their allergies, and any medical conditions about themselves to ensure their safety. For this important patient-oriented preference, one participant, a potential patient, said:

> "I w*ould like to be able to access the patient file to facilitate providing information if required – such as allergies to tell the other doctors if asked – or anyone who would like to use the info*" (Interviewee C1).

Additionally, another participant, a potential patient, echoed the understanding that patients must have access to their medical records and said: *"Each patient should be given access to his/her own medical history*" (Interviewee C22).

HIS Functionality

According to the research findings illustrated in **Figure 17** above, the third category of the Critical Success Factors (CSFs) is divided into six parts, namely, a) HIS must be comprehensive to capture all services offered at the healthcare facility, b) The HIS must be interoperable to support integration, e) The system must have the Offline Mode to facilitate continued data capturing when telecommunication network is not available, f) The system must have Data Analysis and Reporting capabilities, and g) HIS must be User-Friendly to allow smooth operation even for users who are not computer savvy. The CSFs are described in detail below:-

a) The HIS must be comprehensive

The participants suggest that the system must be built with the functionality to capture data relevant to all services needed to deliver healthcare services to the patient during the provision of care for any encounter. For example, one participant, a hospital administrator, said:

> *"The system should capture all the services that are offered at the facility – because we are investing money and time to offer those services" (Interviewee B1).*

Additionally, on the same understanding, another participant, also a hospital administrator, said:

> "*We want an application that covers all the services we offer here, and covers everything so that even if an outbreak comes tomorrow, we are able to say go this way to capture necessary info to provide reports*" (Interviewee B4).

The services such as registration, capturing of the vital signs at the triage, clinical Information Management, finances, pharmaceutical information, laboratory information and any other information that complete the experience of the patient at the facility. The participants assert that all these functions must be provided with access restrictions from one user to the other, which would depend on the required access level. In addition to being able to capture the patient's status of health on all the relevant services within a facility, the participants suggest that for the system to be considered comprehensive or robust, it must be able to capture detailed information about the patient. One participant, a healthcare professional said:

> *"The system should have birth history; next of kin; resident at which chief; all names before and after marriage/parents; past medical history; past surgical history; current condition" (Interviewee A8).*

Additionally, on the same issue of comprehensiveness of the health information system regarding detailed patient information, the participants in the focus group meeting suggested the preferred detail that should not be missed, when they said:

> "*Among the elements that can be included social demographic features: e.g. village, age, gender, employment status, marital status, ID, passport number Vitals, Comorbidities of patient*" (Focus Group deliberations).

Moreover, another participant suggested that the system must have information that can facilitate sharing information with other government departments that may need citizens' health information that is relevant to their work. The participant, a healthcare professional, said:

> "*In the healthcare, we provide information about citizen's birth, and death, which is used by many institutions such as – home affairs for statistics that is collected by Bureau of Statistics for government planning purposes*" (Interviewee A2).

Furthermore, the participants suggest that an electronic system should be made so comprehensive that data generated at any point of service in the hospital, be it inpatient or outpatient department, would be captured for use to the benefit of improving healthcare service delivery. For example, a participant, a hospital administrator, said:

> "*One important thing is the system must be electronic, the system.. because if the system is electronic, it means it will be able to incorporate every generation of data that happens in the hospital*" (Interviewee B5).

b) The System Must Support Integration

The participants suggest that the envisaged system must allow integration with other systems as may be required by the Ministry of Health and its stakeholders. For example, when a child is born at a healthcare facility, other institutions of government such as the Home Affairs Department and the Bureau of Statistics need such information to include in the national information database. Therefore, one participant, a potential patient, said the following:-

> "*The patients' records should be linked to Home Affairs information using the National ID, the patients' records must be linked to death certificates information such that information for the deceased must be archived. All the medical test labs must have a link to the central database for patients such that the results must be uploaded to the central database to*

> *facilitate health facilities access to the patients' medical tests results faster*" (Interviewee C7).

Additionally, one participant, a potential patient, suggested that when Health Information Systems are properly integrated, costs can be saved because activities performed in one healthcare on a patient will not be repeated when the patient visits another facility to seek medical attention as they would easily be shared. The participant said:

> *"There should be standards that must be followed to facilitate patient record keeping which will allow easy integration of systems that carry patient data. This would minimise test costs as they would not be repeated across the facilities, but if it is old data then a test can be taken again to inform the current care process" (Interviewee C5).*

Moreover, according to the patients, if the envisaged system is designed to allow integration with other health systems, relevant government institutions, private health institutes such as pharmacies and medical insurance companies will benefit from the envisaged public health system information, and healthcare professionals will be able to collaborate easily as they will be able to share information. For example, one participant, a healthcare professional said:

> "*In the healthcare, we provide information about citizen's birth, and death, which is used by many institutions such as – home affairs for statistics that is collected by the Bureau of Statistics for government planning purposes*" (Interviewee A2).

Furthermore, the participants suggest Health Information Systems integration will enhance collaboration among healthcare professionals through timely sharing of medical records. For example, one participant, a potential patient, said:

> "*The facilities should be able to share patient records such that when a patient moves from one facility to the other there is some continuation such that the latter facility is aware of the information from the former facility*" (Interviewee C6).

In agreement, a hospital administrator added that the requirements of the National Health body such as the Ministry of Health would be shared easily through the integration of Health Information Systems. The Hospital Administrator said:

> "*I would recommend our domestic system to be integrated with the health system to have a sort of a server platform or folder for all stakeholders to access the information, that would enable us to be aware of the information required so that we can provide the information needed regularly*" (Interviewee B7).

Finally, the participants suggest that if the system's functionality supports integration, the government can develop national plans to deal with threatening health situations. For example, to this effect, one participant, a potential patient said:

> "*It would help to ensure that when healthcare services are offered, medical history could be provided into the health of a patient in order to inform healthcare provision countrywide. If even data exists showing the type of illnesses for a group of people by location or age – it would assist the country to plan well – but now there is no such data – but people go to facilities all the time – it would also assist in resource allocation by the government to citizens - by area or by age group at any point in time*" (Interviewee C3).

c) Offline Mode

The participants suggest that the envisaged system must have an offline mode such that when there is temporarily no electricity, the users should continue to capture patients' medical data in an offline mode, and later synchronize with the stored medical records on the system to update them with the latest information from the offline mode. One participant, a healthcare professional, emphasised the need for the envisaged system to have an offline mode, and shared his/her experience as follows:

> *"For a facility where there is no network, the system would not work – so the offline mode should work such that when one gets back to the network the system can automatically update" (Interviewee A1).*

Additionally, the same participant, A1, asserts that due to the mountainous country of Lesotho, even when there is electricity, telecommunication services are reliable and can cause unstable connections and this would therefore require an offline mode. The participant said:

> "*So, another important thing, our country in terms of IT systems is still behind, just in my district, Berea, the cellular phone network is a big issue. I think the system should be able to work offline, taking into consideration the highlands districts*" (Interviewee A1).

d) Data Analysis and Reporting

The participants suggest that the envisaged Public Health Information Management System (PHIMS) must have a data analysing and reporting functionality to support timely decision-making processes. The participants asserted that the data analysis module or function should follow specific health protocols or policies built into the system as expected, directed or approved by the Ministry of Health. For example, one participant, a potential patient, said:

> "*Introduce the DNA analysis system – medical facilities must have information in a database – which can be used to identify a person even when the person is unidentifiable – (bitten/burnt). Blood ID: we will know blood type – and blood analysis – pick up the ailments from the blood – some can be picked up from DNA*" (Interviewee C26).

Another participant, a hospital administrator, suggested that any kind of data analysis, which would produce a report, could assist in decision-making. The participant said:

> *"I would like the system to help me much when it comes to the analysis so that I can easily make decisions based on that data" (Interviewee B3).*

On the other hand, the other participant, also a hospital administrator, who is not receiving reporting functionality regarding the activities of his/her department when using the current HIS said the following:

> *"If we have a standard tool for reporting, for example, we have caterers who prepare food for patients however most times, revenue collection does not tally with patients lists because such data is manually recorded… I think information from all departments, must be included in the system such as District Health Information System2 (DHIS2), we must be able to report in an integrated manner" (Interviewee B2).*

e) User-Friendly HIS

According to the participants, as illustrated by the Research Findings Model in **Figure 17** above, one of the Critical Success Factors of the envisaged PHIMS is the simplicity of the system, such that once trained, the users should be able to use the system easily as it should not have features that are difficult to understand. Therefore, the participants suggest that the system must be user-friendly. For emphasis, one participant said:

> *"It should be user friendly – like having to help me tick options; allow voice recognition – if I say cough, it should give information regarding cough" (Interviewee A3).*

Additionally, the participants assert that the system must make it easy for the users to operate. For example, the participants suggest that the system should allow healthcare professionals to tick or click boxes with fitting options for the diagnosis they perform on the patient, and also, where possible, for timely provision of care, the system must provide options for the doctor to choose, such as when prescribing medication. One participant, a potential patient, said: "*That system should capture the data easily without making the doctors type health record*" (Interviewee C21, a potential patient).

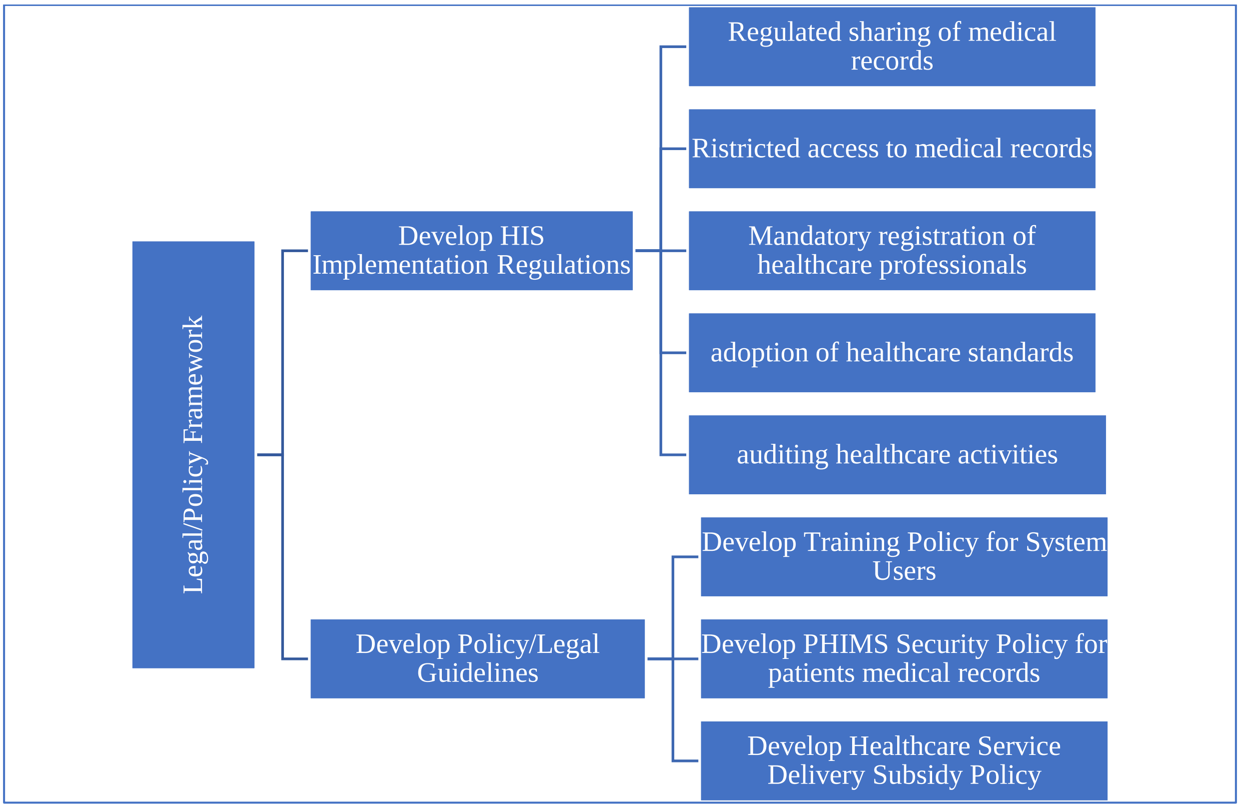
Research Question 3:

How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?

Figure 18 below provides the findings on the research question regarding the suitable Policy/Legal Framework that can be used to regulate the design and implementation of the PHIMS.

Figure 18

Policy/Legal Framework that can be formulated to regulate the implementation of the envisaged PHIMS



As illustrated in **Figure 18** above, there are two main categories of Policy/ Legal Framework, as suggested by the research participants, namely a) Develop PHIMS Implementation Regulations and b) Develop Policy/Legal Guidelines, and these categories are described in detail below:-

Develop PHIMS Implementation Regulations

The research findings illustrated in **Figure 18** above, indicate that the participants recommend regulation of the following components of the envisaged PHIMS, a) Sharing of medical records, b) Restricted Access to medical records, c) Mandatory Registration of healthcare professionals, d) Adoption of healthcare standards, and, e) Auditing of healthcare activities. These components are described in detail below.

a) Sharing of Medical Records

As illustrated in the research findings in **Figure 18** above, the research participants believe that one of the components of the system that needs regulation is the sharing of medical records across healthcare facilities in Lesotho, regardless of whether the facilities are owned by the government, private or by associations. In confirmation, one participant said:

> *"There must be a policy to ensure that health facilities in the country share patient data to facilitate improved healthcare because patient information would be complete – medical fraud could be eliminated through sharing of medical records"(Interviewee C3, potential patient).*

Additionally, a healthcare administrator provided an opinion on the benefits of sharing patients' medical records by healthcare facilities across the country and said:

> *"Sharing of data across facilities is important because, let's say the patient has been consulted in Mokhotlong (*district*) and they are making follow-up here (*another district*), then that would help me understand, that would be helpful. If the information is shared, it helps us to continue with care instead of starting afresh" (Interviewee B3, a hospital administrator).*

Moreover, another participant added more benefits that could be acquired in healthcare services delivery if medical records are shared across healthcare facilities and said:

> "*It will actually help because it means if we can retrieve information at any point, there would be no need for transport to go to the clinics to collect such data needed*" (Interviewee B5, a hospital administrator).

Furthermore, research participants in individual interviews and focus group meeting deliberations suggested that sharing medical records can be of great benefit to increasing the quality and safety of care. However, in a focus group meeting deliberations, members cautioned that the sharing of medical information is critical and needs serious regulations to ensure the safety of all parties involved. The following are the extracts from interviews and focus group deliberations on the issue of sharing medical records across healthcare facilities:-

(i) "*Data should be available and sharable amongst the facilities regardless of private or public health facilities*" (Interviewee A5, healthcare professional)
(ii) "*Sharing of info across facilities will help healthcare professionals to provide care*" (Interviewee A7, healthcare professional)
(iii) "*The facilities should be able to share patient records such that when a patient moves from one facility to the other there is some continuation such the latter facility is aware of the information from the former facility*" (Interviewee C6, potential patient)
(iv) "*Sharing the information is good, but it impacts on things we need to consider. Like ethical issues - consent on it. The patient also needs if info is shared with other facilities"* (Focus group deliberations).
(v) "*Sharing info can improve the quality of service, but we need to look at other elements which can actually make sharing the information make patients fear to attain services. So, when the information is shared and is not shared in a way that protects patient confidentiality*" (Focus group deliberations).

b) Restricted Access to medical records

According to the participants, there must be a law that regulates the management, access and usage of patients' medical records to ensure that they are protected against damage of any kind, unauthorised access, and misuse by those authorised to access the records. In the words of a participant :

> *"The access to update or retrieve patients' records should be at some central database, open to authorised users. That will mean that all practitioners must be registered as well as their health facilities to facilitate tracing of incidents where the need arises"(Interviewee C13).*

Additionally, participants suggest restricted access to patients' medical records to ensure that the medical information is seen by only those who must because of their work. For example, one participant said:

> "*There must be a law that protects privacy and confidentiality of patient info such that any abuse thereof can be penalised by law – data usage should be monitored in order to detect any untoward behaviour by those who have access to patients' central database*" (Interviewee C23, potential patient).

Moreover, the participants assert that access to the system must not only be restrictive but also auditable to ensure that users' activities on the system can be traceable. For example, one participant said:

> "*It should be said that anybody who accesses the patient information must use a unique ID and password, which cannot be shared with anybody, so that if anything happens to the patient information, then we can know at what time who accessed the patient information*" (Focus Group deliberations).

c) Mandatory Registration of Healthcare Professionals

The participants suggest that there must be a policy/law to compel and regulate the registration of healthcare professionals into the Lesotho database of healthcare professionals. They (participants) assert that the information regarding registered healthcare professionals should be published to facilitate easy identification of the health practitioners for their ailments.

Again, the participants added that registration of healthcare professionals is good for the regulation of healthcare services delivery, one participant said:

> "*Health practitioners must be registered as medical practitioners – this would facilitate going to the relevant specialist when the need arises and avoid going to general practitioners for specialized illnesses. All the healthcare facilities must be registered to ensure the authenticity of healthcare service delivery*" (Interviewee C5, potential patient).

Additionally, participants asserted that not only healthcare professionals must register, but also their facilities must be registered to enable the Ministry of Health to monitor the facilities' activities to ensure the safety of the patients, a participant said:

> *"Health practitioners and their facilities should be registered such that the public officers or the government is aware who handles patient information and how – when there are issues or problems there must be a way to audit what has happened"(Interviewee C6, potential patient).*

Furthermore, another participant added:

> "*The access to update or retrieve patients records should be at some central database, open to authorised users. That will mean that all practitioners must be registered as well as their health facilities to facilitate tracing of incidents where the need arises*" (Interview C13).

Moreover, participants suggested that healthcare professionals must register with the Ministry of Health so that their qualifications are checked for authenticity from the institutions they were acquired. According to the participants, the registration of healthcare professionals will also facilitate guiding the healthcare professionals of their expected conduct in dealing with health issues during the implementation of the envisaged Public Health Information Management System, as it would indicate activities that are considered to be within the approved principles or the confines of the laws of the country. For example, a patient said:

> "*As a matter of law, all health practitioners must be registered to ensure their authenticity to handling healthcare services*" (Interview C18, a potential patient).

d) Adoption of Healthcare Standards

The participants asserted that if international healthcare standards and/or guidelines are adopted when the system is designed and developed, especially those that are accredited or administered by the World Health Organisation (WHO), then its implementation will easily be accepted internationally as safe for use by all. For example, the medical equipment used must be certified under the international health standards, and a participant said: "*There must be a law enforcing the purchase and usage of ISO certified Medical equipment/ pharmaceutical products*" (Interviewee C17, a potential patient).

Additionally, participants emphasised the need for healthcare facilities to adopt the standard operating procedures in their everyday activities. One participant said: *"I would recommend introductions of WHO regulations – Standard Operating Procedures when one enters any facility"(Interviewee C26, a potential patient).*

Furthermore, participants suggested that for the government, through the Minister of Health, to ensure that the implementation of the envisaged Public Health Information Management conforms to the international health standards, a Health Commission must be set up. According to the participants, the commission will provide oversight on national health activities, including monitoring the implementation of the envisaged system, for all healthcare service delivery stakeholders to uphold acceptable ethical conduct. A participant said:

> *"For standards, there must be a Lesotho health commission that governs the recruitment and job allocation for health personnel in order to ensure that only authentic professionals are hired for healthcare services"(Interviewee C15).*

Moreover, participants suggest that people involved with the responsibility to manage and monitor healthcare services delivery must do their work passionately to ensure safety and improved quality of care and, in the process, save a lot of lives. Participants argue that to achieve the highest standard of taking care of the health of the citizens, the adoption of international standards can assist in guiding activities, plans or regulations that can be developed. For example, a participant said:

> "To *preserve, protect and develop the life of Basotho, the government must put up systems that do that. To determine how much to develop will be according to the goals set. We have to follow International Health Standards to gather information about everybody from birth up to just after they die. If we say how many people are alive in Lesotho, the answer should be at a click of a button, and also how many people are sick from a specific disease*" (Interviewee C9, a potential patient).

e) Auditing healthcare activities

According to the participants, periodic auditing of the healthcare service delivery must be included in the Ministry of Health's yearly activities to ensure that the healthcare services conform to the laws and policies of Lesotho and also to determine whether improvements are necessary. Therefore, participants suggest further that the envisaged PHIM system must be auditable such that actions of authorised users on the system can be reported by name, time and activity if the need arises. On this note, one participant said:

> *"All the authorized health practitioners and their facilities should be registered such that the public officers or the government is aware who handles patient information and how – when there are issues or problems there must be a way to audit what has happened" (Interviewee C6, a potential patient).*

Additionally, participants believe that the death of a patient at the healthcare facility must be a key priority to the government, which must be investigated with assistance from a possible system audit. A participant emphasised the need for the audit of the system to determine the cause of death of a patient, by saying the following:

> *"The doctor should sign off the patient when they release them from the facility – if the patient dies, it should be traced back to the qualified doctor. There must be a law to facilitate auditing of why patients died – if it is established as negligence of doctors or due to a pandemic – then the country would do something about it by law. The audit should be published. Health status in Lesotho should be published" (Interview C9, a potential patient).*

Furthermore, the participants suggest that auditing the system should also assist in proofing the good work of the healthcare professionals, if they may be wrongly accused of conducting their duties at the healthcare facilities. The participants asserted that the audit should be able to provide useful evidence. On this issue, one participant said the following:

> *“There must be a law that protects the patient information, such that it is accessed only during provision of care not for interest sake – and the system must be auditable so that it can be determined that the patient medical history is accessed as appropriate”(Interviewee C14, a potential patient).*

Moreover, some participants cautioned that when the healthcare system audit is conducted, the death of a patient should not be automatically blamed on the healthcare professional without proper investigations, as a healthcare professional in most cases would have followed all the required procedures but without much luck to save the life of a patient. The members of a focus group meeting agreed that when audits are planned, the following statement should be considered:-

> “*It should be clearly stipulating that a doctor or healthcare worker has a right to treat a patient, but the result does not depend on them. For example, if a patient unfortunately passes away, it should not be blamed on the healthcare system or care, yet they followed the guidelines. It should not be something to put on healthcare professionals’ backs*” (Focus Group deliberations).

Policy Guidance

According to the participants, as illustrated in **Figure 18** above, the implementation of the following components of the envisaged PHIMS needs policy guidance to ensure that the system is efficient. The components are namely, a) Training for System Users, b) Security for patients’ medical records, and c) Subsidy for healthcare services offered to patients. These components are described in detail below:-

a) Training for System Users

The participants suggested that for successful implementation of the system, such that the system is used with full knowledge and understanding to avoid errors that may be caused by a lack of knowledge of the system, a training policy must be formulated. The policy would cater for newcomers who are using the system for the first time, or old users who have changed roles within the healthcare service delivery and need to learn new functions of the system regarding their new roles. To highlight the importance of training for users of the envisaged system, one participant said: *"Recommendation is to have users trained so that the system can be efficiently used – there must be a training policy" (Interviewee C21, a potential patient).*

Additionally, participants suggested that the training policy should guide how continuous improvement must be managed or maintained, such that healthcare facilities' staff are trained and retrained to remain knowledgeable on the usage of all health systems, medical equipment and operating procedures. For example, a participant said:

> "*Continuous professional improvement must be enforced, such that if one does not get the latest training, one should lose the credibility to practice. Training should be included in the Government Policies and Laws*" (Interviewee C17, a potential patient).

On the same issue of continuous improvement, other participants said the following:

(i) "*Lesotho must educate healthcare professionals to take care of patients*" (Interviewee C1, a potential patient).
(ii) "*Healthcare service delivery staff must be qualified to do the job*" (Interviewee C27, a potential patient).

b) Security for Patients' Medical Records

The participants suggest that a policy must be formulated that defines how patients' records must be protected to ensure their integrity, privacy, and confidentiality. According to the participants, securing patients' records would ensure that the records are only accessible and used by authorised personnel. To highlight the need for security of patients records, one participant said:-

> *"There should be a law that protects patients' records confidentiality and governs the way the records should be accessed. This would ensure that only authorised health practitioners may have access to such data" (Interviewee C13, a potential patient).*

Additionally, other participants expressed their views regarding the security of patients' medical records by indicating that the privacy of medical records is equally important, so the records must be guarded against misuse by authorised users. To highlight the importance of security, one participant said:

> *"There must be a law that protects privacy and confidentiality of patient information such that any abuse thereof can be penalised by law – data usage should be monitored in order to detect any untoward behaviour by those who have access to patients' central database" (Interviewee C23, a potential patient).*

Moreover, participants suggested that the integrity of medical records is also very important, as it would ensure that healthcare professionals make informed decisions during the provision of care using correct medical information. So, ensuring that medical records are protected against unauthorised users is critical for improved quality and safety of care, which would make the envisaged system very efficient. The following are the extracts from the participants' interviews regarding the protection of medical records:-

(i) "*Law related to privacy and usage of data – data should only be accessible to healthcare providers with the consent of the patient*" (Interviewee A4, a healthcare professional)

(ii) "*Only authorised people should have access to the system*" (Interviewee A3, a healthcare professional)

(iii) "*If we could have laws that protect that data, patient information, such as observing confidentiality of that data, but still making it accessible to authorized users*"(Interviewee B3, a hospital administrator)

Furthermore, other participants have suggested a method that could be used to ensure that data is only accessible to authorised users, such as having unique login credentials and passwords. For example, focus group members agreed on the following:

> "*It should be said that anybody who accesses the patient information, he or she must use a unique ID and password, which cannot be shared with anybody, so that if anything happens to the patient information, then we are able to know at what time who accessed the patient information*" (Focus Group deliberations).

c) Subsidy of health services for patients

Participants suggested that the government must consider developing a policy that will regulate subsidy of all healthcare services in the country, at all healthcare facilities, regardless of whether they belong to the government, private entities, or associations. According to the participants, subsidising healthcare services will ensure that citizens have equal opportunity to access affordable and improved medical services nationwide. Furthermore, participants asserted that subsidising healthcare services will improve the quality of health for the citizens because the number of patients that visit the healthcare services will increase nationally, as the services will be almost free at all facilities regardless of being private or publicly owned.

Evaluation of the Findings

The research aims at achieving the following objectives:-

a) To determine why the healthcare service delivery in Lesotho is not coordinated and, therefore, risky to the lives of the patients,
b) To establish why the healthcare facilities in Lesotho do not share patients' medical information to facilitate collaboration and improve the quality and safety of care, and
c) To determine why there is no Policy/Legal Framework in Lesotho that binds and regulates the sharing of patients' medical information to facilitate efficiency in healthcare service delivery and avoid poor management of medical records

The Impact of COVID-19 on Healthcare Systems in General

Though the research was not specifically on COVID-19, the media and the research community discuss the impact of COVID-19, which affects how healthcare professionals carry out their daily business activities (WHO, 2021). For example, in Lesotho, the healthcare system was challenged by the demand for oxygen, which forced the country to make plans to create oxygen plants instead of only buying some cylinders of oxygen before the COVID-19 era, and WHO has promised to assist countries with limited resources, with the procurement and maintenance of the Oxygen plants (WHO, 2021). The pandemic overburdened the healthcare systems the world over, such that healthcare professionals became exhausted both physically and mentally as in Jamaica (Lynch & Pusey-Murray, 2021). Though the pandemic overwhelmed the whole world, Africa was the worst affected, because countries were not adequately prepared, and as a result, were very slow to respond, such that many lives were lost as interventions were late (Tessemaet al., 2021).

According to the literature, though COVID-19 threatened the lives of people the world over, Lesotho could have been better prepared to deal with the pandemic if the health system were better strengthened, such that the following were in place:-

a) healthcare services were coordinated to support Universal Health Coverage to adhere to the International Health Regulations administered by the World Health Organisation to strengthen the national health systems (WHO, 2018).
b) Healthcare service providers have implemented electronic Health Information systems so that they can quickly realise and test critical issues such as pandemics. (Persaud, 2019; Kluge, et al., 2018)
c) The health information systems were integrated to enhance collaboration among healthcare professionals for better health and a sustainable future (Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Ohannessian, Duong, & Odone, 2020).

Coming back to the research that is intended to conceptualise the design for a Public Health Information Management System for Lesotho, below is the evaluation of the findings, where the meaning of the findings is presented in light of the research theoretical framework. The evaluation of the findings is categorised by the three Research Questions, and a summary is provided in a table at the end of the evaluation.

Research Question 1: To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?

The challenges have been identified by the participants during the individual interviews and deliberations in the focus group discussions. **Figure 16** above illustrates the challenges encountered by healthcare professionals during the provision of care, as experienced by research participants.

The findings indicate that there are three categories of challenges that healthcare professionals encounter during the provision of care, and which compromise the quality and safety of care. The categories are, a) Poor Management of Medical Records, b) Unavailability of historical data, and c) Poor Health Information System (HIS) Design and Implementation.

Poor Management of Medical Records

The findings indicate that the management of medical records in healthcare facilities is very poor and, therefore, compromises the quality and safety of care. For example, the participants suggest that the patients’ medical records are not only paper-based but also incomplete and fragmented. According to the participants, in public healthcare facilities, patients are expected to have a health booklet (popularly known as bukana in Lesotho), which they bring along to the facilities because the healthcare professionals write clinical notes in them. However, when the bukana is misplaced or forgotten at home, the patient must buy a new one in which the notes will be written. Moreover, participants suggest that private facilities do not use the bukana, instead, they create physical files for their patients, which are kept at the facility. Therefore, if a patient has been to public and private facilities and has more than one bukana, his/her medical record is fragmented into pieces of information in many health booklets and files in private facilities. Finally, the medical records in public facilities are captured twice, first in a form by a person at the clinic and then later into the District Health Information System by a different person, which makes the resulting data prone to irregularities.

On the other hand, the theoretical framework, the OmniPHR, is about having an electronic patient health record that is always available and complete at the point of care to assist a healthcare professional in making informed decisions when providing care (Roehrs, Costa, & Righi, 2017). Therefore, the findings indicate that the current healthcare services delivery system does not conform to the theoretical framework because one patient has many incomplete records kept in many health booklets and/or many files which have recorded incident ailments.

Unavailability of Historical Data

Additionally, the findings indicate that the unavailability of historical data during the provision of care is another challenge encountered by healthcare professionals. This is made evident by fragmented medical records as explained above, or sometimes when a patient brings a new health booklet yet they are not going to be receiving medical assistance for the first time, meaning they would be treated as newcomers to the facility, and this results to one more challenge of lack of continuity of care as there is no reference to previous visits. Contrarily, the theoretical framework is about a complete patient record all the time, which the unavailability of medical historical data does not follow (Roehrs, Costa, & Righi, 2017).

Poorly Designed and Implemented HIS

Furthermore, findings indicate that in healthcare facilities where electronic Health Information Management systems have been implemented, there are challenges caused by poor design and implementation. These challenges make it difficult for healthcare professionals to use the system efficiently. For example, the system becomes complicated to use as it would be difficult to locate the functions. In some cases, the other functions would not be accessible without clear knowledge of the users, or the users would not find reporting options relevant to their work. As for poor implementation, the findings indicate that the lack of training of some key users inhibits the use of the system. Key users resort to paper-based record systems, which, in most cases, demotivates employees because they cannot use available electronic health information system tools due to a lack of training. On the other hand, the theoretical framework requires an electronic system that captures patient data at any point of care, which is not the case because the system is not user-friendly and key users resort to paper-based records.

Research Question 2: What could be the Critical Success Factors for the Design and Implementation of a PHIMS to ensure its efficiency?

The findings in **Figure 17** above indicate that the Critical Success Factors (CSFs) are divided into three categories, namely, a) Effective Management of Medical Records, b) Patient-Oriented HIS, and c) Health Information System (HIS) Functionality. The CSF components are discussed below.

Effective Management of Medical Records

The findings indicate that effective management of medical records is one of the main critical success factors of a Public Health Information Management System (PHIMS) because that’s where the system will be electronic-based to facilitate storage of medical records in a central database that can be accessed by authorised users whenever the need arises. Therefore, with effective medical records management, medical historical data can always be available to assist healthcare professionals in providing care.

Patient-oriented Health Information System

Additionally, the findings show that for the PHIMS to be efficient, it must be patient-oriented, as opposed to healthcare facility-oriented, such that medical information inside a central database is stored using the patient record. For efficiency of the system, this setup would facilitate a) patient identification, being a process carried out when the patient requires medical attention at any healthcare facility, b) patient tracking to establish the whereabouts of the patient and medical programs he is engaged with, and c) patient follow-up to make healthcare professionals and the patient aware of the future appointments and/or responsibilities, and d) the system will facilitate access of the individual medical information by the patient for reference when a need arises.

General HIS Features

Furthermore, the findings indicate that certain general features of the PHIMS have to be available to ensure its efficiency. The features are: a) the system must be comprehensive to capture and process data regarding all services offered by a healthcare facility, to facilitate various departments' patients' health information requirements, b) the system must be interoperable to facilitate sharing of the medical records through systems integration across healthcare facilities, c) the system must have an offline mode feature, which would facilitate continuous health data capturing even when the telecommunication network is not available, d) the system must have data analysis and reporting capabilities as may be required by the healthcare facilities, and e) above all, the system must be user-friendly to enable smooth usage by all its authorised users.

The Meaning of the Findings in Light of the Theoretical Framework

On the other hand, the theoretical framework, the OmniPHR, is about a system that contains one complete electronic record per patient, which will be available when accessed by authorised healthcare professionals at the point of care. Therefore, the findings regarding the suggested Critical Success Factors of the PHMIS by the research participants are aligned with the theoretical framework because they are focused on the patient's medical information, from the stage of data capture during care provision through analysis up until reporting. This means that for the envisaged system, PHIMS, to be efficient, it must incorporate all the above features discussed, as they are aligned to the research theoretical framework, the OmniPHR, which has been tested for efficiency (Roehrs, et al., 2019).

Research Question 3: How could the Policy/Legal Framework be formulated to Regulate the Design and Implementation of PHIMS to ensure its efficiency?

As illustrated in **Figure 18** above, the Policy/ Legal Framework is divided into two main categories, namely a) Develop PHIMS Implementation Regulations and b) Develop Policy/Legal Guidance. The categories and their components are discussed below:-

Develop PHIMS Implementation Regulations

The findings indicate that the regulations for sharing medical records across healthcare facilities should be developed to protect the integrity, privacy, and confidentiality of patients' medical records. Additionally, access to the central electronic database that stores patients' medical records must be restricted to ensure that only authorised users can have access to the records, as this will ensure that the records are secure, and any security breaches must be dealt with legally. Furthermore, the registration of healthcare professionals and healthcare facilities at the Ministry of Health must be mandatory to ensure that only registered professionals and facilities are authorised to conduct the provision of care. Moreover, the design and implementation of the envisaged PHIMS must incorporate the International Health Regulations to ensure that the PHIMS complies with international health standards. Finally, the findings indicate that the Ministry of Health must facilitate periodic system audits for the envisaged PHIMS to ensure its efficiency so that inefficiencies can be addressed at the earliest occurrence.

Develop Policy/Legal Guidelines

The findings indicate that three critical policies must be developed to guide the implementation of the envisaged system to ensure its efficiency. The first policy to be developed is the training policy. This policy will ensure that users of the system continuously stay abreast with the PHIMS and its latest changes and techniques. This would minimise unnecessary errors and ensure proper usage of the system. Additionally, the findings indicate that a security policy must be developed to guard medical records against all sorts of unlawful conduct by both authorised and unauthorised users. Finally, the findings indicate that for the Ministry of Health to be able to achieve Universal Health Coverage, whereby all the citizens of Lesotho could get access to medical assistance easily and affordably, the Ministry must develop and implement a Healthcare Subsidy Policy. This is because the healthcare services in the country have different pricing as they are offered by public and private healthcare facilities that charge patients differently.

The Meaning of the Findings in Light of the Theoretical Framework

The policy/legal framework provided in the findings is aligned with the theoretical framework because the policy/legal framework suggested provides oversight to a) sharing of medical records across the healthcare facilities through regulation of the sharing of records, b) controlled access to the medical records centrally stored in an electronic database, c) Registration of healthcare professionals and their healthcare facilities, d) adoption, into the design and implementation of the PHIMS, of international health regulations that are relevant to Lesotho, and e) Periodic audit of the PHIMS to ensure continuous improvement of the system and people involved in the implementation of the PHIMS. Finally, the three policies that participants believe must be developed support the development of a system that ensures that there is one complete record for each patient at the point of care that is accessible only to authorised and registered users.

Table 14

The meaning of findings in light of the Theoretical Framework

Research Question	**Findings**	**The meaning of Findings in light of the Conceptual Framework**
1. To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?	**1.1 Poor Management of Medical Records compromises healthcare service delivery** 1.1.1 Paper-based records are unreliable 1.1.2 Patients' medical records are fragmented 1.1.3 Patient data is double-handled by healthcare professionals, making it prone to irregularities **1.2 Lack of continuity of care** 1.2.1 Unavailability of historical medical information 1.2.2 Unreliable source of medical information threatens patient's life **1.3 Poor HIS design & implementation renders the system unusable** 1.3.1 The system becomes complicated for users 1.3.2 Lack of reporting capabilities 1.3.3 Inaccessible functions 1.3.4 Inadequate user training 1.3.5 Demotivated users	The theoretical framework, OmniPHR, is about a patient medical record that is electronic, always available and complete at the point of care. However, the findings indicate a different situation where medical records are paper-based and fragmented, which sometimes data are missing or not available when needed, thereby disrupting continuity of care. Moreover, poorly designed and implemented systems cannot fully support the OmniPHR because they are unreliable, as they sometimes are not functional.
2. What could be the appropriate and relevant Critical	**2.1 Effective Management of Medical Records** 2.1.1 Electronic Health Information System 2.1.2 Development of Central Database Storage	The theoretical framework, OmniPHR, is about a patient medical record that is electronic, always available and complete at the point of care for

Research Question	**Findings**	**The meaning of Findings in light of the Conceptual Framework**
Success Factors (CSFs) for the PHIMS?	2.1.3 Availability of historical data **2.2 The system must be Patient-Based** 2.2.1 Patient identification capabilities 2.2.2 Patient Tracking 2.2.3 Patient follow-up function 2.2.4 Patient-accessible medical records **2.3 General HIS Functionality** 2.3.1 Supports healthcare facility services/operations 2.3.2 Supports Integration of medical records across healthcare facilities 2.3.3 Offline mode 2.3.4 Data Analysis & Reporting 2.3.5 User-friendly system	healthcare professionals to provide care. The findings indicate that an efficient PHIMS is the one which is electronic, managed centrally with complete patient medical history because it supports integration of medical records across healthcare facilities. The findings are aligned with the theoretical framework of the research.
3. How could the policy/legal framework be formulated to regulate the implementation of PHIMS to ensure its efficiency?	**3.1 Develop PHMIS Implementation Regulations** 3.1.1 Regulate sharing of medical records across healthcare facilities to ensure their integrity 3.1.2 Restrict access to medical records that are stored centrally, to ensure their security 3.1.3 Make registration of healthcare professionals and facilities mandatory to ensure their authenticity 3.1.4 Adopt international health regulation standards to ensure compliance 3.1.5 Implement a binding PHIMS periodic audit to ensure efficiency 3.2 **Develop Policy/Legal Guidelines** 3.2.1 Develop Training Policy for PHIMS users	The theoretical framework, OmniPHR, is about a patient medical record that is electronic, always available and complete at the point of care for healthcare professionals to provide care. The findings indicate that regulations will be developed for implementation of a PHIMS, such that sharing and access of medical records that are stored centrally are regulated, and policy/legal guidelines will also be developed to ensure that the system is secure and accessed only by authorised users. The findings are aligned with the theoretical framework because regulations and the policy/legal guidelines support sharing of medical records across the healthcare facilities, and centrally stored medical

Research Question	**Findings**	**The meaning of Findings in light of the Conceptual Framework**
	3.2.2 Develop PHIMS Security Policy to guard the patients' medical records against any kind of misconduct 3.2.3 Develop a Healthcare Service Delivery Subsidy Policy to ensure Universal Health Coverage	records that would be strictly accessed by authorised personnel.

Summary of the Chapter

Trustworthiness of Data

According to the literature, for the data to be trustworthy it has to conform to the four elements, namely, credibility, which is evidence that the findings represent the research conducted; transferability, which is providing enough contextual data to convince the reader that the findings could apply to their situation; Dependability, which a clear study process so that the reader can understand the process can be repeated; and Confirmability, which is clear communication showing that the findings are as obtained from the participants without any bias interpretation by the researcher.

Participants Selection & Criteria

The participants were selected based on their experience in the phenomenon being studied, which is the healthcare services delivery in Lesotho. Three groups of participants were selected because of their roles in the healthcare services delivery, they are the key stakeholders in the Lesotho healthcare services delivery. These are, a) the healthcare professionals who provide healthcare services, b) the healthcare services delivery administrators as they manage and monitor the healthcare services and ensure that the healthcare facilities are functional, and c) the potential patients who are the healthcare services beneficiaries. The research has ensured that the participants are from the ten districts of Lesotho to ensure wide participation so that the data could be reliable.

Transferability of the Findings

The report suggests that since the healthcare services delivery in Lesotho is managed and monitored by the Ministry of Health, and the citizens are free to seek medical attention anywhere in the country, the issues related to healthcare services are the same nationwide. Therefore, the findings obtained with the sample selected can be generalised to the population of Lesotho.

Limitations to Data Collection

On the other hand, there were limitations concerning data collection due to COVID-19 restrictions as data collection was done during the lockdown period. This period was a challenge for data collection because some selected participants could not be available as the interviews and a focus group meeting were conducted virtually. Some potential participants did not have the necessary tools to participate in the data collection exercise. Failure to get the originally planned number of participants, due to some telecommunications challenges, may be considered as lowering the quality of the research. However, these limitations did not have adverse results on the exercise as some participants were replaced, and most importantly all the districts were still represented in the sample that participated, especially for potential participants.

Reliability and Validity

The research design is a case study, which allows the collection of data through participants' interviews and focus group meetings (Nyumba, Wilson, Derrick, & Mukherjee, 2018; Rashid, Rashid, Warraich, Sabir, & Waseem, 2019). Therefore, the case study design methods were used to get the findings. Firstly, for sampling the participants, the researcher used a purposive sampling method to select the research participants, and the participants became the following:-

a) The healthcare professionals as their responsibility is to deliver healthcare services,

b) The healthcare administrators, because they manage and monitor the healthcare services delivery, and
c) The potential patients, who are the beneficiaries of the healthcare services.

The participants qualified to be in the sample because they have the experiences and knowledge about the phenomenon being studied, which is the healthcare services delivery in Lesotho.

Secondly, for data collection, the researcher used interviews and focus group meeting deliberations. Thirdly, for data analysis, the researcher applied the Thematic Analysis Techniques, where data collected during the interviews and focus group meeting discussions were transcribed into text that was analysed using a web-based software known as Taguette, and the findings were exported to Microsoft Excel for further analysis and reporting.

Having applied the above methods to select the research participants' sample, and collect and analyse data for the case study design, provides internal validity for the research (FitzPatrick, 2019) because appropriate methods for the case study were applied. The external validity of the research is brought by the fact that, no matter where the key stakeholders work in the country, they are subjected to the same rules, laws and or policies developed and monitored by the Ministry of Health (Ministry of Health, 2018). Therefore, management of the healthcare services is the same countrywide as the MoH is in charge of the whole health sector.

The Research Findings

Research Question 1: To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care**?**

The findings indicate that there are three categories of challenges encountered by healthcare professionals during the provision of care, namely, a) Poor Management of Medical Records,

b) Unavailability of Medical History, and c) Poorly designed and implemented Health Information Systems.

The findings show that the medical records are poorly managed in that a) they are paper-based such that in public healthcare facilities, the records are in a health booklet, known as bukana, while in private facilities, a file is opened for each patient. When the bukana or the patient file is misplaced, the patient is required to buy a new bukana or a new file is opened, b) Patient medical record is fragmented into pieces of information in many health booklets and many files, especially when a patient has been to both public and private facilities, c) in some instances where the electronic health information system exists, data is captured on paper first, known as the datasheet, and then later copied from paper to system, which makes the data prone to errors.

Additionally, the findings indicate that at the point of care, healthcare professionals encounter the challenge of unavailability of patient medical history, which is caused by fragmented record keeping in many health booklets and files. Therefore, the medical records in this kind of arrangement become an unreliable source of medical information during the provision of care, and the unavailability of medical history makes the continuity of care a serious challenge, especially for patients undergoing treatment.

Finally, poor Health Information System design and implementation is considered another challenge encountered by healthcare professionals. A poorly designed system is not user-friendly, as sometimes it would be difficult to find a function that the user intends to use, such as generating a report. Also, lack of user training has been identified as one of the challenges, which demotivates the users, especially when they have to revert to the paper-based system because users have not been trained.

These findings indicate that the way records are handled does not conform with the theoretical framework, OmniPHR, which requires that there must be one complete patient record available at the point of care.

The findings were expected because the research problem indicates that healthcare service delivery in Lesotho is not coordinated and, therefore, risky to the lives of patients.

Research Question 2: What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?

The findings indicate that there are three categories of Critical Success Factors, which must be incorporated into the envisaged system to enhance its efficiency, namely, a) Effective Management of Medical Records where the medical records are in electronic format, stored in a central database for access by authorised users, and a full history of medical information available when required at the point of care, b) The system is patient-oriented, as opposed to healthcare facility-based, where the system assists with patient identification when the patient visits any facility, patient tracking to determine the whereabouts of the patient in terms of the facilities visited or treatment program, patient follow-up function where follow-up is required, and for the patient to be able to access individual medical records for reference when a need arises, and c) good general functionality of the HIS, where the HIS is comprehensive to cover data capturing of patient data at all service points within the hospital, the system supports sharing of patient records across facilities, thereby facilitating integration of medical records, and also has offline mode to facilitate continuous data capturing even when telecommunication network is unavailable. Therefore, the functionality suggested in the critical success factors of the envisaged system is aligned with the theoretical framework, OmniPHR, which is about one complete patient record that is available to healthcare professionals at the point of care. Consequently, designing and implementing the system with these features will ensure that each patient has a complete record all the time, including at the point of care, and the patients will be able to access their records for reference when a need arises. These findings were expected because the research question asked for the features that would make the system efficient, and the participants, with various experiences and expertise, provided them.

Research Question 3: How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?

The findings indicate that two main activities must be executed to formulate the policy/legal framework that will effectively regulate the implementation of the Public Health Information Management System (PHIMS). Firstly, develop relevant regulations to ensure that a) the sharing of medical records maintains the integrity of the records, b) access to medical records is only allowable to authorised users, c) healthcare professionals and facilities are registered with the Ministry of Health to ensure their authenticity, d) implementation of the PHIMS incorporates national health policies and International Health Regulations to ensure compliance with the guiding health policies and principles, and e) the PHIMS is periodically audited to ensure continuous improvement of the system within the confines of the law.

Secondly, develop policy/legal guidelines to ensure the efficiency of the envisaged system by developing three critical policies: a) Training Policy: to manage the training of the PHIMS users such that all new users are trained on all system functions, users that change roles are trained on relevant system functions, users must be trained on new system developments to ensure optimum usage of the system, b) Security Policy: uphold the security of the patients' medical records to ensure their protection against the misconduct of any kind, and c) Healthcare Services Subsidy Policy: to subsidise the healthcare services in all healthcare facilities in the country to ensure that citizens get care services easily and affordably.

The regulations and policy/legal guidelines for the implementation of PHIMS are aligned with the theoretical framework, OmniPHR, which is about a complete record for each patient at the point of care. For example, one regulation deals with oversight on the sharing of patient medical records across healthcare facilities, thereby creating a central database and facilitating the integration of health information systems, which enables one record per patient. The findings regarding the third research question were expected because the understanding of the researcher has been that after the identification of the challenges encountered by healthcare professionals during the provision of care and establishing the critical success factors to address the challenges, then the regulations and policy/legal guidelines would be needed to implement the envisaged PHIMS efficiently within the confines of the law, guiding principles, and policies of Lesotho.

CHAPTER 5: IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Introduction

The problem that the research intends to solve is that the healthcare services delivery system in my country, Lesotho, is not organized and therefore risky to the lives of the patients. The existing healthcare facilities in the country operate as independent entities such that one facility has no way of knowing if a patient has been to other facilities for the same ailment and is undergoing a certain treatment, especially if a patient does not disclose it. Therefore, the Government of Lesotho is not able to control and monitor healthcare service delivery. The contributing factors to the problem are: a) poor management of patients' medical records because the health information management systems are paper-based, and the patients' medical records are fragmented as healthcare facilities do not share the records. Consequently, one patient has as many incomplete records as the number of healthcare facilities he has visited for medical examination. Incomplete medical records at the point of care can compromise the quality and safety of care because, due to lack of information, healthcare professionals can commit medication errors that can threaten a patient's life (Ramesh, Manimegalai, & Priya, 2020). Additionally, medical information is not reliable because data capturing is performed twice, first, on paper forms and then later from the sheets to an electronic system, which is used for data processing and reporting; b) Unavailability of medical history at the point of care, because in facilities where patients are expected to bring health booklets, sometimes the booklets are empty as when a booklet is lost the patient must buy a new one, while in facilities that use paper filing system, when a file is misplaced, a new one is opened; sometimes when data is available at the point of care, it is not entirely reliable, as it could be missing some information that was captured when the booklet or the file was missing; missing medical information at the point care makes it difficult for continuity of care, especially for chronic disease patients, which compromises quality and safety of care; c) Poor design and implementation of the electronic Health Information Systems where they exist, as the system may be complicated to use, or the system does not have required functionality or reporting capabilities, sometimes the systems, in healthcare facilities that have implemented them, are implemented without adequate user training, which leads to demotivated staff and rejection of the system resulting in healthcare professionals resorting to paper-based records, which are unreliable and cause medication errors that compromise quality and safety of care and put the lives of a patients in danger (Linden-Lahti, Takala, Holmström, & Airaksinen, 2021).

This qualitative study aims to show that integration of healthcare services delivery within and across healthcare facilities can be used as one of the strategies to strengthen the Public Health Information Management System to ensure its efficiency. This was achieved through conducting interviews for purposively selected participants, regarding the healthcare services delivery in Lesotho, and then recommending a solution that can best solve the problem. The participants are key stakeholders in the healthcare services delivery, namely, a) healthcare professionals, as the drivers of the healthcare services delivery, b) the healthcare administrators, who oversee the delivery of healthcare services, and c) the potential patients who would be the beneficiaries of the healthcare services. The research was to gather the participants' views on the following three issues regarding the healthcare services delivery in Lesotho, to determine whether the healthcare services delivery is uncoordinated and therefore risky to the lives of the patients:-

a) The participants' knowledge and experiences regarding the extent to which the challenges that healthcare professionals encounter during the provision of care affect the quality and safety of care.

Understanding the challenges that healthcare professionals encounter during the provision of care assists the researcher in getting full insight into the issues about the healthcare services delivery in Lesotho, and also to determine how those challenges impact the quality and safety of care. Healthcare professionals can indicate what hinders their performance in the role of healthcare services delivery in the current status of healthcare service delivery. On the other hand, healthcare administrators can share how their roles affect the healthcare services delivery, because they interact with the healthcare professionals, by providing them with the tools that facilitate the provision of care. The healthcare administrators oversee the healthcare services that make the facilities functional. The following are just an example of the services that the healthcare administrators have to provide to facilitate the provision of care at a healthcare facility:-

(i) Water supply
(ii) Electricity supply
(iii) Functional Medical equipment
(iv) Cleaning services
(v) Patients' medical records storage facilities
(vi) Communication facilities

Furthermore, the potential patients would also know how they impact the healthcare services delivery when they go to the healthcare facilities for medical attention. In sharing their experiences, they are expected to touch on possible solutions that would enhance the healthcare services delivery, and improve quality and safety of care. Therefore, all the information gathered during the data collection through interviews and focus group deliberations assisted the researcher in formulating possible mitigation measures to address the challenges, and at the same time work towards solving the problem that the study has identified, which is an uncoordinated healthcare system that is risky to patients' lives.

b) The participants' recommendations on the critical success factors that they believe should be incorporated into strengthening the Public Health Information Management System to make it efficient.

Being aware of the participants' recommendations on the critical success factors that the participants believe would make the envisaged system effective. Their recommendations are influenced by their experiences due to their roles in healthcare service delivery. For example, healthcare professionals look at critical success factors as the functionality of the system that can improve their efficiency during the provision of care, while healthcare administrators see the critical success factors from the perspective of enhancing their oversight role in healthcare service delivery, and potential patients view the critical success factors from their beneficiary role. Therefore, putting all these perspectives of the participants together, after data collection the researcher realises a well-rounded functional system.

c) The participants' recommendations on what they consider the proper or appropriate policy/legal framework to formulate for regulating the implementation of a public health information management system to ensure its efficiency.

Understanding the participants' ideas regarding the appropriate legal/policy framework that can help regulate the implementation of the envisaged public health Information Management system assists the researcher in picking what should be incorporated in the legal/policy framework for the envisaged system to conform to governance protocols, both at the national level and internationally. As in the other discussion regarding the participants' understanding of the requirements per research question, the three groups of participants view the components of the legal/policy framework from the perspective of their roles in healthcare services delivery as key stakeholders. All the groups bring up legal/policy components that would protect them when the envisaged system is in use. For example, in dealing with patient operations, healthcare professionals, need the consent of a patient to be included in the design of the envisaged system, on the other hand, the patients want a component that will protect their medical information from misuse and administrators would be most interested in the component that protects all stakeholders of the system so that their facilities can be seen to be efficient and effective. This does not mean the groups contradict, but they would just be more passionate about the component that makes them look good about their contribution as stakeholders of healthcare service delivery.

The research aims to, a) promote a paradigm shift within the Lesotho health sector, from independent healthcare systems to integrated healthcare systems within and across the healthcare facilities, which will enable information sharing across facilities and improve health outcomes (Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; WHO, OECD, World Bank Group, 2018); b) Highlight the importance of strengthening healthcare systems to minimise medical flaws and safe patients' lives; and c) Develop a concept for an efficient Public Health Information Management System that conforms to the laws of Lesotho and where applicable to international health regulations standards. Meeting the following objectives assisted the researcher to achieve the aims of the research:-

(i) Establishing the extent to which the challenges that the healthcare professionals encounter in Lesotho, during the provision of care, affect the quality and safety of care when using information from the current patients' medical records stored in various independent healthcare systems per health facility.
(ii) Establishing suitable critical success factors for the design of an efficient Public Health Information Management System.
(iii) Formulating a Policy/Legal Framework that can regulate the implementation of a Public Health Information Management System to ensure its efficiency.

The study was conducted using qualitative research methods. Through the purposive sampling method, the researcher targeted key stakeholders in healthcare service delivery. Namely, a) the healthcare professionals, being doctors and nurses, as they have vast experience in healthcare services delivery in Lesotho. Because of their experiences, they are aware of the pros and cons of dealing with the patients and the requirements from the authorities regarding the health services delivery protocols; b) the healthcare services delivery administrators, who are in charge of running the healthcare services facilities such as hospitals and healthcare centres. The administrators ensure that the healthcare professionals have the necessary resources to provide patient care. The resources entail fit-for-purpose buildings, equipment and qualified human resources as may be required by the facilities to function optimally; and c) The healthcare services delivery beneficiaries, who are the potential patients that can visit the healthcare services facilities voluntarily to seek medical care, involuntarily brought by next of kin as the patient may be incapacitated or routinely as a medical requirement by order of a physician. The researcher understands that all these groups qualify to participate in the research because they have experience with Lesotho's healthcare services delivery as they have been affected by such services personally or through their relatives or colleagues. Therefore, the researcher used Phenomenology Design because, by definition, phenomenology design is one of the qualitative strategies used for collecting data, which allows the researcher to learn a phenomenon from the perspective or knowledge of those who have experienced it (Teherani, Martimianakis, Stenfors-Hayes, Wadhwa, & Varpio, 2015; Qutoshi, 2018; Shudak, 2018; Neubauer, Witkop, & Varpio, 2019). Moreover, the research participants are deliberately selected because they meet specific requirements, in this case, they have insights into the Lesotho healthcare services delivery (Greening, 2019). Neubauer, Witkop, & Varpio (2019) argue that Health Professions Education scholars must consider using the phenomenology methodology because of its underlying philosophy of learning from others.

Following the research participants’ sample selection, data collection was conducted through participant interviews and a focus group meeting deliberations. The interviews were planned to be face-to-face, however, due to COVID-19 restrictions during the research data collection period, the bulk of the interviews were conducted virtually, and just a few were conducted face-to-face with strict adherence to the COVID-19 protocols, and participants’ responses were analysed using Thematic Analysis techniques, where participants’ transcripts, which were produced from audio recordings during interviews and a focus group meeting were transcribed to text and analysed.

The limitations of the research were on the data collection methods and tools, in that since data collection was conducted during the COVID-19 lockdown period by many countries, Lesotho included, the following were a result:-

(i) some participants could not manage to participate in the research due to a lack of communication tools

(ii) because of strict restrictions on COVID-19, almost all interviews and the focus group meeting with doctors were conducted virtually, with a few interviews, which were conducted physically with critical observation of the COVID-19 protocols, such as social distancing and using a mask.

The research was conducted with no harm or jeopardy to the participants, and they were allowed to provide signed informed consent to participate. Both the interview questions and consent form are attached as **Annexes** I and II.

The chapter discusses the implications of the findings obtained, which are categorised by the three research questions, a) The First Research Question (RQ1) is about the extent to which the challenges encountered by healthcare professionals during the provision of care, affect the quality and safety of care; b) RQ2 is about the critical success factors that could be adopted for the electronic public health information management system (PHIMS) to make it efficient, and c) RQ3 is about the legal/policy framework that could be formulated to regulate the implementation of the PHIMS. Moreover, the purpose and significance of the research are discussed, followed by a detailed description of the research problem. Thereafter the chapter discusses the recommendations for future research that is intended to support the envisaged PHIMS. Finally, the chapter provides conclusions on the research as discussed in the dissertation report, covering all the work done from the first to the fifth chapter.

Implications of the Findings

The first research question (RQ1):

To what extent do the challenges encountered by the healthcare professionals during the provision of care affect the quality and safety of healthcare services in Lesotho?

The findings, illustrated by **Figure 16** in **Chapter 4** above, indicate that healthcare professionals encounter three main challenges during the provision of care. The challenges are namely, a) poor management of medical records, as they are paper-based, and fragmented, and data for one patient are entered twice into two different systems, first on the manual system and later into the electronic system, b) Lack of continuity of care, because at the point of care, there is the unavailability of patient historical medical data, or if available, it has been found from unreliable sources, such as using the patient's recollection of their previous encounter with a healthcare professional or data would be found in a new health booklet or file with incomplete historical data of a patient, and c) Poor Health Information System design and implementation, found in healthcare facilities that have implemented electronic health information management systems. The systems are found to be poorly designed and implemented, as they are complicated for use by healthcare staff, or the expected features are not accessible to the users for reasons unknown to them, or critical users, such as supervisors or healthcare professionals that interact with the client and are expected to feed the system with data, are not trained, and therefore resort to a manual system, as the system is rendered useless.

Therefore, these challenges compromise the healthcare service delivery in that paper-based records sometimes are not available when needed, especially at the point of care, or if they are available, something is wrong with them, such as being incomplete or the handwriting is illegible because of poor storage facilities, thereby resulting into the disruption of the continuity of care, due to lack of information, which could be life-threatening for patients with chronic diseases, with ongoing health treatment programs. Moreover, if a healthcare professional can provide treatment that contains drugs that the patient’s body is allergic to because of the unavailability of historical data, as the records could not be retrieved from paper-based records, the drugs could put the life of a patient in danger. When elaborating on the issue of unreliability of the paper-based medical records, participants suggest most of the files are either missing or cannot be found. Participants assert that the situation is exacerbated by poor records storage facilities, as the store rooms are not organised into any sequence, dust gathers on the files because the storage facilities are never cleaned, resulting in the records gathering dust and not easily retrievable if needed.

Furthermore, another serious challenge encountered by healthcare professionals is the lack of training on the existing Health Information System if implemented at the facility. If key users of the system are not trained and resort to manual systems, that would render the system useless, which is a result of poor system implementation. An example, which was provided by a participant, is when a user, a healthcare professional, was unable to capture valuable information into the system, as they were not trained on how the system works. This resulted in the user concluding that the system was useless, and could not assist them in their duty of providing care, and therefore resort to paper-based routine. Therefore, proper training of users is crucial of successful implementation of the system.

The potential limitations that could have affected the interpretation of the findings are limited categories of research participants—for example, the exclusion of some stakeholders of healthcare service delivery, such as pharmacists. Perhaps, as research participants, the pharmacists could have highlighted other challenges which are encountered by healthcare professionals during the provision of care. However, this does not make the suggested challenges by the included groups any less important or the research study incomplete. Instead, it would mean that there is room for improvement, and those challenges could be captured by future research.

The findings confirm the study problem that the healthcare service delivery is risky to the lives of patients because it is not coordinated, in that the challenges encountered by healthcare professionals during the provision of care, of paper-based, fragmented patients’ records, and possible errors in capturing patient data, may result in incomplete or incorrect medical history for the patient, which can lead to medication errors that could jeopardise the patient’s health (Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020). Therefore, the challenges reduce the quality and safety of healthcare service delivery for the patient.

The purpose of the study is to show that the integration of health information systems across healthcare facilities is a strategy that can be used to strengthen the envisaged Public Health Information Management System. Therefore, paper-based and fragmented patients’ medical records cannot support the integration of medical records because the healthcare facilities are independent of each other and do not share medical records (Binarti & Fitriyana, 2022; Lepeleire, 2022).

Additionally, the research theoretical framework is about the one complete patient record (OmniPHR) available at the point of care. However, the findings indicate that the challenges encountered during the provision of care of paper-based, fragmented and double-handling of patient data are not aligned with the theoretical framework, as instead of a complete single medical record for the patient, there are as many records for one patient as the number of facilities they have visited for medical assistance. Having one complete patient record at the point of care is important because complete medical information allows healthcare professionals to make informed decisions and avoid medication errors. For example, knowing a patient’s allergies can assist the healthcare professional in prescribing medication that would not harm the patient (Säfholm, Bondesson, & Modig, 2019). Therefore, without the OmniPHR, the quality and safety of care for the patient would be compromised because the healthcare systems would not be able to share patients’ medical information as they would not be integrated, resulting in a risky healthcare service delivery (Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020).

The findings regarding the extent to which challenges encountered by healthcare professionals during the provision of care were expected, given the literature that medical records in most African countries are still paper-based because most governments are slow to adopt electronic healthcare information systems (Govender, Long, & Miot, 2020).

Implications for the Ministry of Health

As the main role player and critical stakeholder in advocacy for policy directions and being the custodian of the healthcare service delivery system, the Ministry has to note and validate the challenges highlighted by the research to facilitate the development of plans to address them. The research recommendations for solving national health challenges can also be weighed with the advent of the latest health sector requirements or demands to ensure the relevance of suggested solutions.

Implications for Healthcare Administrators

(i) Healthcare Administrators need to find strategic solutions to create conducive environments for healthcare professionals to provide responsive healthcare service delivery at their healthcare facilities, facilitating integration of healthcare services within and across healthcare facilities. For example, they must migrate patient's medical records from paper-based to electronic format to enable easy sharing of medical records and facilitate integration of health information systems.
(ii) They must initiate procurement and implementation of electronic health information systems that would support the integration of patient medical records and which are easy to operate for the healthcare staff.
(iii) They must be willing to be fully involved in the acquisition of the electronic Health Information System to ensure that a) the system fits their requirements, such as being comprehensive to cover all services offered by their facilities, b) users are well trained to use the system, and c) patient-oriented features are built into the system.

Implications for Healthcare Professionals

(i) Recommend the implementation of an electronic Health Information System to move away from the paper-based system.
(ii) Advocate for integration of healthcare systems within and across healthcare facilities to ensure that they have access to full patient medical information at the point of care.
(iii) Recommend discarding of processes that disrupt continuity of care
(iv) Recommend discarding processes that are prone to inconsistencies, such as capturing patient data twice
(v) A complicated system may result in users making medication errors and harming patients

Implications for Potential Patients

(i) To improve the quality and safety of care, patients must not have the sole responsibility to keep their paper-based records because they are not reliable as they misplace the records easily instead, an electronic web-based system must be created and be accessed by healthcare professionals and the patient.
(ii) Patients contribute to the lack of continuity of care by forgetting their medical records when going to healthcare facilities. Therefore, an electronic health information system must be introduced to which they can have controlled access.
(iii) The training programs for patients must be developed to facilitate access to their electronic records.
(iv) Lack of training for users of the health information system can disrupt the continuity of care for the patient, as the patient may be turned away due to system problems.

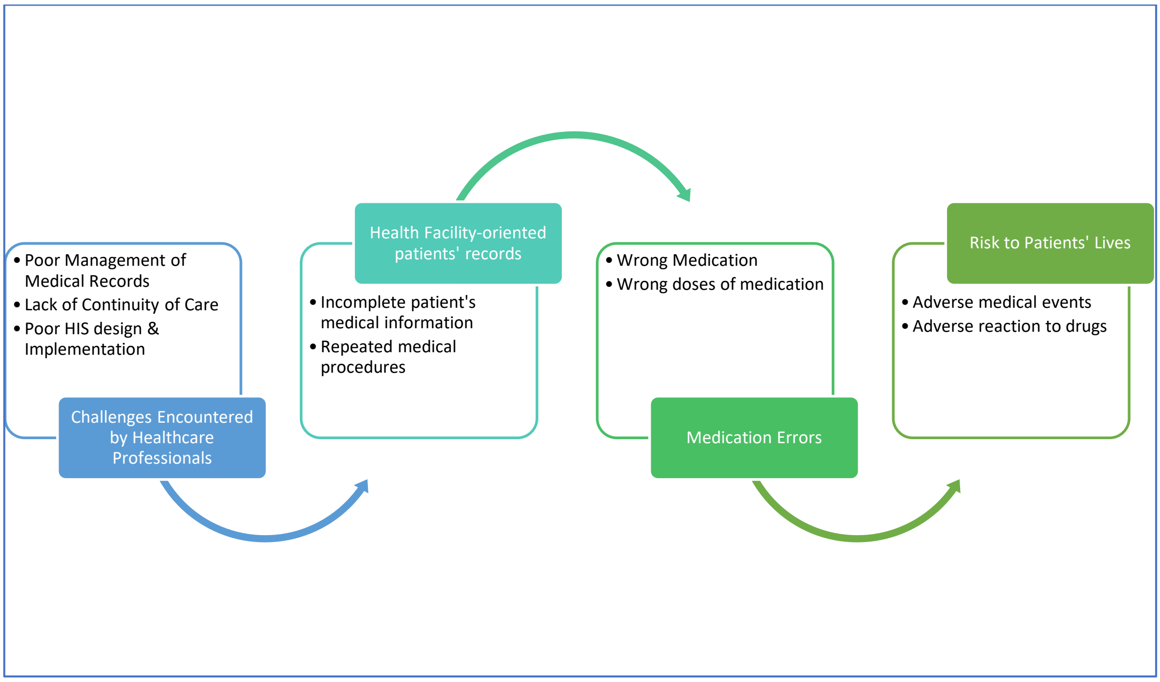
(v) A complicated system may result in users making medication errors and harming patients.

The findings indicate that public and private healthcare facilities work independently and do not share patient records yet serve the same patients. This is a drawback to the health outcomes because this situation disrupts continuity of care. In terms of integration of health information systems, the literature shows that most researchers studied integrated health information systems within facilities, such as a hospital, which could be running multiple systems like the patient registration system, dental management system, finance system, out-patient management system, and many others, and not much has been researched on the integration of health information systems across healthcare facilities. The research intends to show that by application of a theoretical framework, OmniPHR, supported by blockchain technology to ensure the security of medical records across networks, the integration of health information systems within and across all healthcare facilities, regardless of who owns the facility, can assist a country in improving healthcare service delivery and strengthening its public health information management system.

Below, in **Figure 19,** is the summary of implications for challenges encountered by healthcare professionals during the provision of care; the figure illustrates that due to the challenges encountered, healthcare professionals commit medication errors such as providing wrong medication or doses of medication, indicating that the challenges are risky to the patients’ lives as they negatively affect the quality and safety of care because they cause adverse medical events or adverse reactions to drugs by patients.

Figure 19

Implications of the challenges encountered by healthcare professionals for the current healthcare service delivery (Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017)



The second research question (RQ2):

What critical success factors would strengthen the design and implementation of the PHIMS of Lesotho to make it efficient?

The research findings in Chapter 4 above indicate that for the envisaged system to be efficient, it must have three main critical success factors. The factors are, namely, a) Effective management of medical records. According to the participants, medical records can effectively be managed through the implementation of an electronic Health Information System because, unlike paper-based files, electronic files will not need a specially built storage room, which would require health facility staff to arrange some labour to collect the files. Instead, the electronic files can easily be retrieved with a click of a button on the computer. In an effort to emphasise the advantages of the electronic Health Information System over the paper-based one, the participants suggest that its design should be such that getting the reports at the end of the day or any time as required, should be one of the key features, as it would enhance the provision of care by far, contributing to improved quality and safety of care for the patients.

Moreover, the participants believe that electronic health information systems can facilitate the integration of healthcare systems from various healthcare facilities nationwide by setting up a central database containing patients’ medical records, which would pull patient data from health information systems of healthcare facilities across the nation, and integrate it into a single record, within the database. In addition, participants would like to see a situation where they are not required to carry their medical records with them, instead, their existing records, from previous encounters with various healthcare facilities, should be stored somewhere central, in an electronic database where healthcare professionals can access to provide healthcare services.

However, the participants assert that the central database should only be accessible to authorised users such as healthcare professionals because they understand the importance of historical patient medical information in the provision of care. Therefore, they would be able to protect the integrity, privacy, and confidentiality of the patient’s medical information.

The participants also suggested that if all healthcare facilities in the country were compelled to share their patients’ medical information with other healthcare facilities by sending it to a central database without fail, the Ministry of Health would have an enhanced and meaningful contribution, because of the all-encompassing national health data, to the national strategic planning to improve government planning in addressing health-related national objectives.

Furthermore, the participants suggested that to ensure that medical records are effectively managed, full patient medical history must be available during the provision of care because historical data assist healthcare professionals in dealing with current ailments. The participants suggested that with full patient medical historical data, healthcare professionals can make informed decisions about the possible causes of the existing ailment for the patient because they would have information such as ongoing treatment programs for the patients, the results from previous medical tests, and drug allergies for the patient, which would assist the healthcare professional to avoid worsening the patients’ ailments and putting the lives of patients in danger.

Among the participants, the healthcare professionals acknowledge and emphasise the importance of historical data and its positive contribution to care provision. However, they caution that some healthcare professionals provide very little or no information in terms of the medical notes when attending to patients, such that it becomes challenging to the next healthcare professional to provide care with unclear or little historical medical information written within the patient’s medical record. They assert that the implementation of a public health information management system, will need the highest degree of dedication and understanding that medical notes in a patient record will assist the next healthcare professional and contribute towards better quality and safety of care. Moreover, the participants cautioned that not only is the availability of historical data important but more importantly, its correctness is very critical to saving lives. The participants asserted that if a patient has allergic reactions to certain medication but the patient's historical medical information does not indicate as such, the next healthcare professional may prescribe the same medication to which the patient has allergic reactions, and this could result in worsening the health conditions of a patient.

b) The system must be patient-oriented

The findings indicate that one of the critical success factors of the public health information management system is that it must be patient-oriented as opposed to healthcare-facility-oriented. According to the participants, a patient-oriented health information system stores information by patient and not by care facility, which would assist the healthcare professionals in searching the system for patient medical information regardless of which healthcare facility provides care. Therefore, the patient-oriented system helps the user to identify the patient because it must have patient identification capabilities, which would depend on the method of identification the country has decided to use. For example, the participants suggested that one of the identification methods could be biometric identification using the fingerprint image. The participants suggest that the use of fingerprint images is good for patient identification because of various reasons. They assert that using the fingerprint image would quicken registration of the patients on their subsequent visit to the healthcare facility as there won't be a need to look for their names in the physical files, what would happen is just to scan their fingerprint image and the health information system would display their medical record. Secondly, when the patient does not have any identification documents with them, either because they left them at home or they are unable to present them because of their medical condition, the fingerprint image would be sufficient.

The participants further agreed that for the PHIMS to be efficient, some of its patient-oriented capabilities should include patient tracking and patient follow-up features to assist the healthcare professionals to effectively manage healthcare service delivery to every patient all the time. However, if the management of care is left entirely the responsibility of the patient, medication errors may occur, as the patient may never know how critical following the guidance provided by the healthcare professionals is regarding medication or special activities agreed upon. On emphasising the need for the system patient monitoring features, participants suggested that those features would enhance information sharing between facilities when one healthcare facility sends patients on a referral to another facility. Additionally, according to the participants, the patient monitoring system would improve the monitoring capabilities of the healthcare authorities, such that they would identify healthcare service delivery challenges and gaps in the healthcare system, resulting in the authorities, such as the Ministry of Health, being able to make informed decisions in healthcare service delivery.

Still, on the need for the system to assist with monitoring activities regarding the patient, a participant asserted that follow-up reminders would also help the healthcare professionals to ensure that patients do not disrupt the continuity of care. Participants strongly recommended the inclusion into the design of a health information system, a patient follow-up feature to assist in tracking the patients, and reminding both the healthcare professionals and the patients of upcoming healthcare appointments at the healthcare facility, so that the patient may make necessary arrangements to visit the healthcare facility.

Participants also assert that for information purposes, patients should have access to their records in the envisaged system to access their medical information, which they can share with other healthcare organisations of their choice that may require access to the medical records or use the medical information for reference where the need arises. For example, if information is required regarding medication to which the patient has previously had allergic reactions, then the patient can check and share the information with a healthcare professional accordingly.

c) the HIS must be functional.

The findings indicate that one of the critical success factors for the envisaged systems is that the system must be functional, meaning that all its features must always function as expected. Otherwise, the system will be inefficient. Firstly, the participants suggested that being functional includes being comprehensive enough to capture patients' information for all services offered at a healthcare facility, from the registration point to the collection of drugs at the pharmacy on the way out of the healthcare facility. Failure to be comprehensive makes it difficult for other healthcare departments to report on their activities using the system. Participants asserted that the envisaged system must allow the users to capture data related to the services offered by the facility or functions performed at the facility when providing healthcare services to the patients.

Additionally, the participants suggested that an efficient health information system must support the integration of healthcare systems within and across healthcare facilities, which would ensure that medical information is shared across the facilities so that patient information is complete at the point of care. According to the participants, the sharing of patients' medical information across the facilities would facilitate integration of healthcare systems, which would ensure that there is a continuation of care when a patient who has received care in a certain facility visits another facility after some time when they need more health assistance.

Additionally, the participants assert that being able to get a full record of a patient when providing care would contribute to better decision-making and collaboration among healthcare professionals across the different healthcare facilities, resulting in improved quality and safety of care for the patients, as it would minimise the possibility of providing medication that could cause adverse results.

Moreover, the participants asserted that the PHIMS would be considered efficient if it had an offline mode, which would assist in the continuation of health data capturing even when telecommunication network coverage is affected so that when coverage is back on, captured patient medical data could synchronise with stored data at the central database, ensuring that patient data are updated accordingly. To substantiate the need for offline mode, participants suggest that the racket terrain and the low standard of technology in telecommunication infrastructure, sometimes the telecommunication network does not work, which would then suggest that the system could be offline frequently. Therefore, the offline mode of the health information system would be required to keep the operations going and later when the network is back online the systems can synchronise over the telecommunications network, and the patients' medical information could be updated accordingly.

Furthermore, participants suggest that the system must have a data analysis and reporting module to support decision-making processes for the nation. Authorised healthcare professionals and administrators can use the system module to analyse patients' medical data collected during care provision and produce reports regarding the national health data for submission to the Ministry of Health for dissemination to relevant healthcare service delivery stakeholders. Therefore, with the data analysis module, healthcare professionals and administrators can use it to address the reporting requirements regarding patients' medical information. Participants assert that with the data analysis and reporting module, they may not have to be involved with manual work, which causes them to make errors in analysis and produce inaccurate reports. Therefore, they envisage the data analysis and reporting feature of the system as something that would bring quality to their periodic reporting function.

Moreover, according to the participants, another critical success factor of a health information system is being user-friendly, as all trained users would easily operate it with little or no supervision. While participants understand that the users of the system must be trained to use it properly, they maintain that if the system is complicated and many functions are hidden, it may not serve the purpose it was intended to achieve, to the extent of being abandoned by its users, as it would waste time with little or no positive outcome after the struggle of using it. Participants suggest that they envisage a user-friendly system to make their lives easy, such that it would have tick box options where necessary or voice recognition mode where they could just talk and the system writes the words and update the patient’s records for them.

The potential limitations that could have affected the interpretation of the findings are limited categories of research participants—for example, the exclusion of some stakeholders of healthcare service delivery, such as pharmacists. As research participants, the pharmacists could have suggested other critical success factors to enhance the efficiency of the envisaged PHIMS. However, this does not make the suggested factors by the included groups any less important or the research study incomplete. Instead, it would mean that there is room for improvement, which could be captured by future research in similar studies.

The study problem concerns an uncoordinated healthcare service delivery system, which is risky to the patients' lives. The findings for the first research question, RQ1, regarding the challenges that healthcare professionals encounter during the provision of care, expound the study problem, indicating the sources of the study problem. Contrarily, the findings regarding

RQ2 suggest possible solutions to the study problem, which directly address the sources of the study problem. For example, RQ1 findings illustrate that the medical records are poorly managed, as they are paper-based, fragmented and probable errors due to double-handling of patient medical data. However, the findings for RQ2, the critical success factors of the envisaged system, present effective management of medical records, meaning RQ2 findings provide part of the solution to the study problem, as RQ3 findings complete the solution to the problem.

The purpose of this qualitative study is to show that integration of healthcare services delivery within and across healthcare facilities can be used as one of the strategies to strengthen the Public Health Information Management System to ensure its efficiency. The RQ2 findings show that an efficient PHIMS is an electronic system that is patient-based and supports the integration of healthcare systems within and across healthcare facilities. A patient-based system considers and deals with medical data by the patient and not by the healthcare facility. This means the findings meet the research purpose and are aligned with the theoretical framework, as it is about the integration of healthcare systems such that there is always one complete patient record at the point of care to improve the quality and safety of care (Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020; Säfholm, Bondesson, & Modig, 2019).

The significance of the RQ2 findings to the Ministry of Health will be information that can be used in setting up new strategies for strengthening the healthcare service delivery not only in public healthcare facilities but also in the health sector in general. These critical success factors provide a solution to the existing challenges highlighted by the RQ1 findings. Therefore, the Ministry can use the information as a specification for designing an all-inclusive Public Health Information Management System targeted to improve the quality and safety of care nationwide.

As a contribution to the literature described in Chapter 2, which deals with the integration of healthcare systems such that there is always a secure and complete patient health record, as guided by the theoretical framework, the RQ2 findings add specific patient-based features to ensure maximum benefits of the system to the patient. The features required are a) patient tracking, which assists the healthcare professionals to know the whereabouts of the patients as soon as they visit any healthcare facility in the country and to provide the details of the patient's encounter with the facility. This could add to the collaboration by healthcare professionals regarding the same patient and avoid unnecessary medication errors or complications. b) patient follow-up to remind the healthcare professionals and the patient regarding the next appointment or any critical health activity concerning the patient to enhance continuity of care, and c) patient-accessible medical records for the patient's reference when a need arises.

The findings were expected, given the literature which shows why and how public health information systems are developed to achieve, the difference is the findings provide specific features that the participants suggest as vital to ensure the efficiency of the envisaged PHIMS.

Implications for the Ministry of Health

In their endeavours to strengthen the health systems in the country, the Ministry of Health must include implementing a public health information management system, which integrates healthcare activities across healthcare facilities, regardless of whether the facilities are owned by government or private entities. Therefore, the Ministry can use the system to monitor healthcare service delivery nationwide and make informed decisions timely, should a need arise.

Additionally, should the Ministry decide to develop the system that is envisaged by the research as part of health systems strengthening, the critical success factors illustrated by the research can be included in developing the specific system requirements in terms of reference for procurement of the envisaged system.

Implications for Healthcare Administrators

Being in charge of the facilities that provide care and having been exposed to the critical success factors of the PHIMS that address the challenges encountered by the healthcare professionals during care provision, the healthcare administrators can advocate for the development and implementation of the health information system that integrates care activities across healthcare facilities as it would address the challenges that healthcare professionals currently encounter while providing care. This is important for healthcare administrators because one of their main duties is to oversee healthcare service delivery, ensuring that the healthcare facilities are fit for purpose and that healthcare professionals have quality tools to use, such as an efficient public health information management system suggested by the research.

Implications for the Healthcare Professionals

a) Should the critical success factors suggested by the participants be implemented, the challenges encountered by healthcare professionals during care provision will be resolved. For example, one of the challenges encountered by healthcare professionals during the provision of care is fragmented medical records resulting in incomplete patient records at the point of care, which is addressed by the critical success factor of integration of healthcare systems across the healthcare facilities, ensuring that each patient has one complete record at the point of care.

b) Additionally, healthcare professionals must be aware that resolving current challenges will require adaptation to new techniques in healthcare service delivery, such as using electronic-based health information systems, which need basic computer skills for healthcare professionals because they are the ones dealing with the patient during care provision, they must enter clinical notes into the system.
c) Healthcare professionals will no longer commit medication errors because of the unavailability of historical patient medical data because healthcare systems across healthcare facilities will be integrated.
d) The sharing of patients' medical records will facilitate collaboration among healthcare professionals.

Implications for the Potential Patients

a) Paper-based medical records, known as a health booklet, may no longer be required anymore as only electronic medical records will be available.
b) Smart devices may be required to access the individual medical information for reference should a need arise, such as reminding oneself of future appointments.
c) Hiding chronic illnesses or any diseases from healthcare professionals will not work because patient medical information will be shared across healthcare facilities through the integration of healthcare facility systems.
d) Continuity of care for patients with chronic diseases will be improved because tracking and follow-up of patients will be implemented as part of the system.

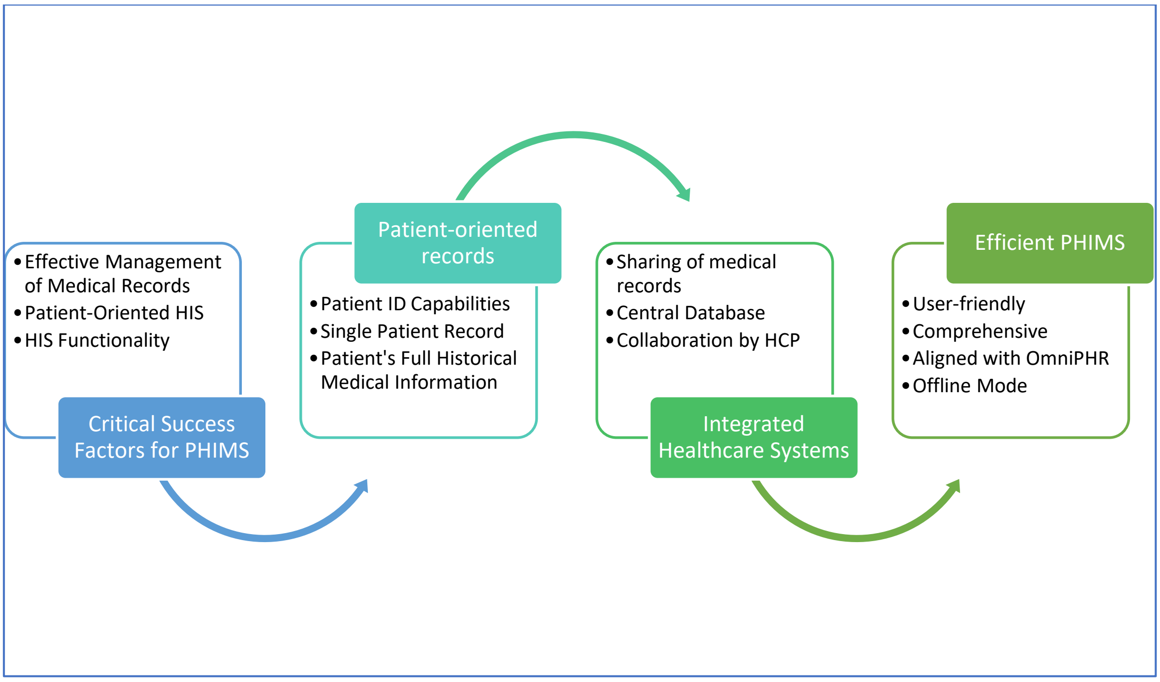
The findings indicate that the critical success factors which can be applied to the health information management system to make it efficient are a) effective management of medical records where an electronic system is implemented, which has a central database containing full patients’ medical history, b) a patient-based health information system (HIS) with features such as patient identification, tracking, follow-up, and patient’s accessible records, and c) a user-friendly functional HIS that captures all services offered by a healthcare facility and supports the integration of care systems across health facilities.

With the status of healthcare service delivery in Lesotho, where medical records in most healthcare facilities are still paper-based, causing fragmentation of patients’ records, the healthcare facilities must first migrate medical records from paper to electronic format nationally to facilitate the integration of the healthcare systems across the healthcare facilities, which will lead to OmniPHR and improved quality and safety of care (Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020; Säfholm, Bondesson, & Modig, 2019). Secondly, the Ministry of Health must lead the design and development of an efficient PHIMS, which must have a central database drawing data from all registered healthcare facilities through the integration of healthcare systems across healthcare facilities, ensuring that there is one complete medical record for each patient.

Figure 20 below is the summary of the implications regarding the second research questions findings. The figure illustrates that with patient-oriented records, health systems can be integrated to enable sharing of patients’ medical records and collaboration among healthcare professionals, resulting in having an efficient Public Health Information Management System.

Figure 20

Implications of Critical Success Factors on the envisaged PHIMS



The third research question (RQ3):

What policy/legal framework would be suitable to regulate the design and development of a PHIMS for Lesotho to make it efficient?

The findings illustrated by **Figure 18** in **Chapter 4** above indicate that the Policy/Legal Framework components are divided into two categories: Development of regulations for HIS Implementation and Development of Policy/Legal Guidance, briefly discussed below leading to the implications and recommendations.

a) Development of Regulations for the Implementation of PHIMS

The findings indicate the regulations for the implementation of the envisaged public health information management system must be developed, starting with regulating the sharing of medical records across healthcare facilities to ensure their integrity, confidentiality and privacy. Therefore, the Ministry of Health must regulate through a policy or guidelines how the sharing should happen and what type of information can or cannot be shared across healthcare facilities.

On highlighting the importance of sharing patient medical information or records across healthcare facilities, the participants suggest that sharing of medical records supports the continuation of care, especially for patients with chronic diseases, when a patient received care in the highlands and travelled to the lowlands, and need medication or visit facilities nearby for consultation, the records that were developed in the highlands is needed for the continuation of care for the chronic disease. Therefore, participants asserted that sharing of records in the quickest way possible could improve the quality and safety of care. However, participants caution that sharing medical records will only be useful if the healthcare professionals providing care ensure that they provide clear and complete medical information, instead of just abbreviated notes that may not have much meaning to the next healthcare professional.

Therefore, the sharing of medical records by healthcare professionals across facilities can only be meaningful if the information is clear and complete.

Furthermore, while participants agree that sharing patients' medical records across healthcare facilities is useful to the lives of patients, participants suggest that sharing patients' medical records alone will not get rid of all healthcare services challenges. Therefore, according to the participants, over and above sharing of patient medical records across healthcare facilities, the healthcare professional's expertise, such as the ability to interpret the shared information, and their commitment, together with appropriate resources to the exposure of the healthcare professional, are still required to provide quality and safe care to the patient.

As indicated above, the participants regard the sharing of records as vital to efficient care provision. Therefore, regulating the sharing of medical records will help to ensure that the purpose of sharing medical records is achieved instead of using the shared records for other means different from care provision.

Additionally, as illustrated by **Figure 18** in **Chapter 4** above, one more regulation should be policy guidelines on restricted access to medical records, which are shared across the facilities to protect the records from unlawful access. For example, the guidelines can indicate who should or should not have access to the system; the system users must have unique user identification names and passwords, which should not be shared among users. According to the participants, restricted access to patient medical information should be enforced through a law or policy that highlights the importance of confidentiality, privacy, integrity and safety of the patient medical records. Moreover, participants asserted that with this law, there must be an emphasis on the patient's medical information being accessed only by authorised healthcare practitioners from healthcare facilities registered with the Ministry of Health in Lesotho.

Further, the restriction must include sections that indicate that if users authorised to access the patients' medical information misuse the information, then hefty punitive measures must be inflicted on them to deter others from future untoward actions.

Therefore, following the policy guidelines on ensuring restricted access to the system will protect patients' medical records, as only authorised users will have access, leading to secure records.

In regulating the implementation of the public health information management system, the findings suggest that there must be mandatory registration for healthcare professionals with the Ministry of Health because they are expected to be key users of the envisaged public health information management system. According to the participants, the following are the benefits of having healthcare professionals and their facilities registered with the Ministry of Health:-

a) The Ministry of Health will effectively monitor healthcare service delivery in the country because healthcare service providers and their whereabouts will be known.
b) The Ministry of Health will have a complete list of healthcare professionals and their specialities and healthcare facilities where they practice. With this information, proper references can be offered where the need arises, instead of sending the patients to general practitioners when a specialist is needed.
c) The registration information would contribute towards the national health strategy to strengthen health systems by filling identified gaps in healthcare service delivery.
d) Incidents in healthcare service delivery would be quickly traced back to concerned healthcare facilities during forced or planned healthcare service audits

Therefore, mandatory registration of healthcare professionals and facilities would assist the Ministry of Health to be fully in charge of the healthcare service delivery by being aware of the key role players, as they would be registered, and monitor implementation of policy guidelines and instigate, where necessary, punitive measures against care professionals that do not follow the policy guidelines.

The participants suggested that the adoption and implementation of international healthcare standards for the design of the envisaged public health information management system must be regulated, to ensure that relevant standards that do not contradict the current National Health Policy are adopted. For example, the participants suggested that adopting a health standard, such as for keeping medical records, would facilitate the integration of records across healthcare facilities. This would assist in avoiding fragmented medical records where each facility keeps the medical records in whichever way they prefer; a particular standard, which would be adopted by all facilities nationally, would be useful for the integration of medical records.

Moreover, adopting the healthcare standards would allow the Ministry of Health to ensure that the healthcare service delivery in Lesotho is aligned with the International Health Regulations under the auspices of the World Health Organisation, the National Strategic Development Plan, the National Health Policy, and the laws of Lesotho.

Furthermore, the participants suggested that patients’ records must have detailed and clear information to facilitate auditing of healthcare activities performed by the healthcare professional on the patient or by the patient. Participants asserted that without detailed information on the patient’s medical record, it would be difficult for such information to assist investigations when mishaps have occurred, and that would not be fair to the patient, especially when their life has been negatively affected. Therefore, efficient record keeping of patients’ medical records, such as having an electronic health information system which integrates healthcare systems to draw patient data into a central database, will facilitate auditing of healthcare activities if necessary.

b) Development of Legal/Policy Guidance

The participants suggested that a training policy must be developed to ensure that all authorised users of the envisaged PHIMS are trained before using the system, and refresher training must be performed on old users of the system when there has been a role change or system's update or modification. According to the participants, only trained users of the system can use it efficiently and avoid unnecessary mistakes that could lead to adverse results in healthcare service delivery.

The training policy must guide who should be trained, how often the training must be conducted, and what should happen if a staff member has not received any training to avoid confusion.

Additionally, the participants assert that the security policy/legal guidelines for the PHIMS must be developed to protect the system from unauthorised access and/or manipulation of patients' historical medical information by intruders or authorised users. The issues of concern for participants concerning the protection of patients' medical information are physical security where electronic equipment is kept or where records are stored, to which they suggest that such places must be under lock and key at all times. Moreover, on the issue of misusing data by authorised users, participants suggest that the law/policy must indicate heavy punishment for those who do not obey the law to deter people from such misuse of medical information access opportunities under their responsibilities as healthcare professionals authorised to use the health information system.

Furthermore, participants suggested that one example of protecting the patient medical records that are contained in an electronic health information system is by giving each user unique credentials that would assist them in accessing the system. Participants asserted that each user must be given a unique identification name and a password to ensure that everything that happens in the health system, bad or good, can be traced back to the user for future reference. However, the participants cautioned that though protection of patient medical information is a good thing, it should not be done to the detriment of those authorised to use the system, such that the system does not give users access to the system features that they need to perform their duties and deny them or delay the delivery of care and negatively affect the patients.

Finally, in developing the policy/legal guidelines, participants suggested that a subsidy policy/legal guidelines for healthcare service delivery must be designed to ensure that all citizens can receive care affordably and at the nearest healthcare facility of their choice. The participants assert that if the Government can subsidise medical services throughout the country, in all healthcare facilities, patients' lives would be saved because patients would have access to healthcare services anywhere, and affordably.

The potential limitations that could have affected the interpretation of the findings are limited categories of research participants—for example, the exclusion of some stakeholders of healthcare service delivery, such as pharmacists. As research participants, the pharmacists could have suggested other policy/legal guidelines to enhance the efficiency of the envisaged PHIMS. However, this does not make the suggested guidelines by the included groups any less important or the research study incomplete. Instead, it would mean that there is room for improvement, which could be achieved by similar studies in future.

The study problem is that the healthcare service delivery is not coordinated and, therefore, risky to the lives of the patients. However, the findings on how the policy/legal framework can be formulated to regulate the implementation of the PHIMS to make it efficient indicate regulations and policies/legal guidelines that force implementation of the PHIMS to be within the confines of the law mostly by ensuring the protection of patients' medical information and making care services affordable by all. Therefore, the regulations and policies/legal guidelines suggested by participants support the sharing of medical records across the healthcare facilities, which would facilitate integration, enforce the protection of medical records, and recommend policies that would make the PHIMS efficient, leading to improved quality and safety of care as opposed to risky care that the research problem is all about, and thereby achieving the research purpose to show that integration enhances PHIMS.

The regulated sharing of medical records, which would facilitate integration, will result in having one complete medical record per patient and aligning the findings with the research theoretical framework, which is about one complete medical record per patient at the point of care.

The findings demonstrate the significance of the study in that the Ministry of Health and healthcare administrators will effectively oversee the implementation of the health information system with clear regulations and policies/legal guidelines. The training policy for healthcare professionals will guide users in operating the system efficiently, and the subsidy policy will ensure that patients receive improved healthcare services affordably. Therefore, an efficient public health information management system is one whose implementation is regulated and has clear policy/legal guidelines that must be adhered to by all stakeholders. The findings were expected as the focus was on a public system, and the regulations and policies/legal guidelines were expected to ensure that all stakeholders benefit from implementing that system.

Implications for the Ministry of Health

The system implementation tools, such as regulations and policy/legal guidelines, will be available, which can be improved if some areas of implementation are not covered or new requirements are realised during the implementation of the system. Therefore, the custodians of the system will be comfortable that it is implemented within the confines of the law and in alignment with International Health Regulations.

Implications for the healthcare administrators

In their role of oversight of healthcare services at the healthcare facilities, the healthcare administrators will be happy that a conducive operating environment has been created when the implementation of the system is regulated and the system operates within policy/legal guidelines to avoid unnecessary harm to all stakeholders.

Implications for healthcare professionals

Carrying out their duties in a regulated environment with policy/legal guidelines will make the healthcare professionals work in a less stressful environment, as they know specific regulations they must follow, and they have the law and policy guidelines for guidance and direction if the need arises. Without clear regulations and policy guidelines, healthcare professionals would depend on the changing attitudes of their superiors, which would make their working environment inconsistent.

Implications for the potential patients

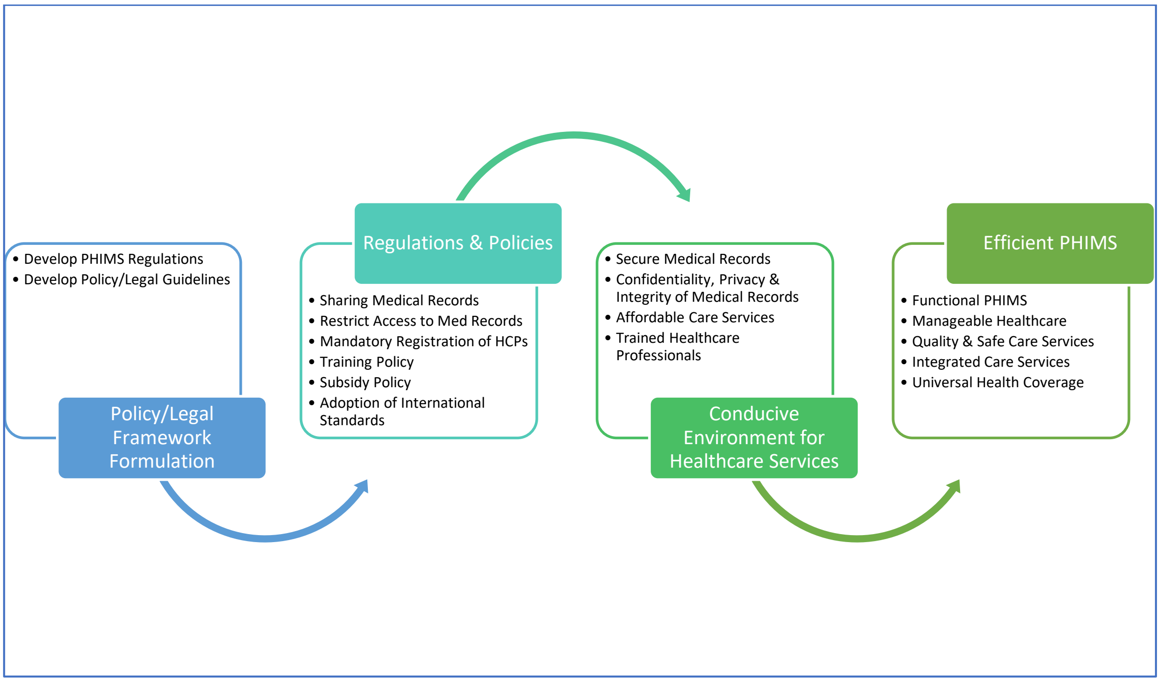
Regulated implementation of the public health information management system and availability of policy/legal guidelines that govern the implementation of the system imply that medical records are protected against abuse such that anyone violating the regulations or guidelines will face the law. The potential patients will happily go to the healthcare facilities to seek medical assistance with confidence that errors committed by healthcare professionals against regulations and policy/legal guidelines will be punishable by law if informed. Moreover, publishing the subsidy policy for healthcare services will encourage potential patients to visit healthcare facilities to seek medical attention.

The research problem indicates that healthcare services are uncoordinated and fragmented, making them risky to patients' lives. However, regulating the implementation of the public health information management system and implementing policies such as the subsidy policy for healthcare services will improve the quality and safety of care as potential patients will visit healthcare facilities to seek medical care timeously, with confidence by patients that they will be protected by law and will not pay high fees for medication due to subsidy. In a qualitative study that was conducted in the United States of America on why people avoid medical care, most participants reasoned that traditional barriers, such as being too busy and not having time, are the causes, however, the traditional barrier that ranked highest was not having enough money to afford such services (Taber, Leyva, & Persoskie, 2014). On the other hand, some literature indicates that barriers to accessing healthcare by potential patients are common all around the world. However, it is less prevalent in developed countries, to understand and overcome the barriers, it is best to study the healthcare system in a country of concern (Dawkins, Renwick, Ensor, Jayne, & Meads, 2021).

Therefore, with national health subsidy for healthcare services at all facilities, regardless of whether they are owned by government or private entities, as in the research findings, most people will visit the healthcare facilities when in need because of the subsidy, which can result in improved care. **Figure 21** below illustrates the implications for a well-regulated Public Health Information Management Systems.

Figure 21

Implications of Policy/Legal Framework Formulation



Recommendations for application

The first research question: To what extent do the challenges encountered by healthcare professionals during the provision of care, in Lesotho, affect the quality and safety of care?

The findings indicate that the main challenges encountered by healthcare professionals during the provision of care are poor management of medical records, Lack of continuity of care, and poor design and implementation of Health Information Systems. The challenges are caused by paper-based records as paper is sometimes misplaced, lost, or text has faded and become illegible. Lack of continuity of care happens when medical records are not available when needed at the point of care, or if the patient's medical information is incomplete during the provision of care, which results in re-starting the ongoing treatment, or healthcare professionals can commit medication errors, such as prescribing medicine that can have adverse results on the patient (Ramesh, Manimegalai, & Priya, 2020; Mirgane, 2021; Mulac, Taxis, Hagesaether, & Granas, 2021; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021).

According to the participants, paper-based records are either health booklets for the healthcare facilities that accept the booklets, which are mainly public facilities, and physical files in other facilities, mostly private facilities. Therefore, the issues with paper records are mostly that they are not reliable, sometimes those records would not be accessible because the paper is lost or misplaced, while in some instances, the handwriting is not legible. The most unfortunate problem caused by the paper is that healthcare facilities do not share medical records. This is true regardless of whether the facilities are owned by a single proprietor, i.e. government healthcare or CHAL healthcare facilities are unable to share the records among themselves because the records are paper-based and kept in files within each facility or in health booklets that are kept by the patients. For public facilities where a health booklet is always expected to be with the patient, sometimes the booklet is lost or forgotten at home. In the absence of a health booklet, the patient is normally requested to purchase a new booklet before he/she can be provided with care. Therefore, to resolve most challenges regarding the management of the patients’ records, the best solution would be to migrate the patients’ medical records from the paper-based system to the electronic-based health information system because if managed effectively, health information systems can improve the healthcare services delivery of the citizens, and enhance both the quality and safety of care (WHO, 2018; Linden-Lahti, Takala, Holmström, & Airaksinen, 2021; Ramesh, Manimegalai, & Priya, 2020).

Furthermore, as patients are free to seek medical attention from the public, CHAL and private healthcare facilities, the paper-based medical records for one patient could be available in the files, at the private facilities, or in the health booklet that is with the patient. Having the medical records as pieces of information in many locations is known as fragmentation of the medical records (Barr, Garrett, Marten, & Kadandale, 2019; Binarti & Fitriyana, 2022; Lepeleire, 2022). This means that during the provision of care, the healthcare professionals will not have access to the full medical information, as they would be providing care at only one place, which is risky to the patient’s life because it compromises the quality and safety of care (Mirgane, 2021; Roehrs, Costa, & Righi, 2017; Ramesh, Manimegalai, & Priya, 2020).

Moreover, Fragmented Medical Records, Missing Information during the provision of care and Unreliable Sources of Information are challenges related to handling medical records, which is a challenge that creates serious problems for the continuation of care, especially for patients with chronic disease. Some participants suggest that when patients are reluctant to share their medical information with healthcare professionals, and that information is written in their health booklets, they make a deliberate reason to hide the booklet, so that the healthcare professional may not know. However, that works against them because without such information, care provision will be delayed as new tests would have to be performed, resulting in disruption of the continuity of care.

The inability to share patients' medical information inhibits the provision of care because healthcare professionals are not able to access historical information for the patient they could use during care provision, which could result in healthcare professionals committing medication errors and compromise both the quality and safety of care (Ramesh, Manimegalai, & Priya, 2020). The following are examples of challenges caused by the inability to share patients' medical records by the healthcare facilities:-

a) If a patient has been to more than one facility to seek medical help, the patient will have more than one medical record at different facilities, which are not connected. If the patient's record remains fragmented, healthcare professionals will always have access to incomplete medical information, resulting in making the provision of care a risky activity (Lubin & Shah, 2022; Binarti & Fitriyana, 2022; Ramesh, Manimegalai, & Priya, 2020). Binarti & Fitriyana (2022) suggest that in Indonesia, medical records are files containing notes regarding patient identity, clinical examination, treatment, and any clinical information related to the patient or has been done on the patient. Therefore, if available, complete patient historical medical information will assist the next healthcare professional in making informed decisions and providing quality care timely (Lubin & Shah, 2022; Binarti & Fitriyana, 2022).

b) If, in the previous visit, medical tests were conducted and findings were kept at a facility, the same test would be conducted if the patient went to another facility. Some facilities in Lesotho are in rural areas, at hard-to-reach places. However, if facilities are independent and do not share medical records, a healthcare facility may be forced to transport a patient from one place to another to perform a procedure which could have been done previously in another facility. This is costly to the patient and could cause a life due to the delay in treatment (Fylan, Caveney, Cartwright, & Fylan, 2018).

c) If a patient is incapacitated and is taken to the nearest facility, she/has never been to, issues related to allergic reactions to medicines will not be known until she/he is given the same medicine to which they are allergic and may worsen the health condition or even cause death. Therefore, this situation would cause a healthcare professional to commit a medical error (Ramesh, Manimegalai, & Priya, 2020).

The recommendations for application:-

The findings confirm the research statement of the problem, which states that the healthcare service delivery in Lesotho is not integrated and, therefore, risky to the patients' lives. Having identified through the research that in Lesotho, like in many other countries in Africa (Azevedo, 2017) or Europe (Binarti & Fitriyana, 2022), different factors contribute to incomplete patients' medical records (Binarti & Fitriyana, 2022), the following factors are true to the Lesotho healthcare service delivery:-

a) **Man**: Some healthcare professionals do not elaborate enough in their clinical notes, while others do not write notes at all in the health booklet (also known as "the bukana" in Lesotho); or further, ineligible handwriting causes medical errors; or patients misplace, forget or leave the health booklets at home purposely or by mistake; or at some facilities, healthcare professionals misplace physical files. For example, one participant said that sometimes when a patient has been to the hospital, there are challenges with the medical records in that:

> "*So, some of the challenges I have faced are incomplete notes, where you find that like a discharge summary is not, eh.. doesn't give you enough information about what treatment the patient received; how long they were admitted for in hospital; what were the presenting complaints at that time; the medication, …..for how long*" (Interviewee A1, a healthcare professional);

On the other hand, to highlight that the healthcare service delivery in Lesotho is risky, participants suggest that some patients have more than one health booklet, so when patients visit healthcare facilities to seek care provision, they would either present one that they managed to pick when leaving home or bring a new one altogether. Both these situations do not give the healthcare professional enough patient historical data to work with in providing care, which could result in the healthcare professional committing medication errors.

b) **Materials**: In Africa, the patient records are still paper-based (Azevedo, 2017). From the research, the participants said public healthcare facilities use health booklets, and if not available for whatever reason, the patient has to buy a new one. Private facilities use physical files or electronic systems that capture only a few details of the patient, when the file is misplaced or lost, the facility opens a new file. According to the participants, sometimes the healthcare professionals do not write any clinical notes in the health booklets, because they do not recognise the health booklet as it is not the practice for the facility. Therefore, this situation also increases the risk in the provision of care, as part of the patient record will not appear in the health booklet as nothing would be written, yet the care has been provided.

c) **Method**: Since each facility keeps medical records in its preferred method – nothing standardised, the healthcare systems and patient records are fragmented, i.e. pieces of a patient record are in as many healthcare facilities as he/she has been to (GoL, 2013).

Therefore, the research recommends the following:-

a) Development and implementation of an electronic Public Health Information Management System, which will be web-based and accessible nationwide by all authorised and registered healthcare professionals. This will eliminate illegibility errors in the clinical notes written by healthcare professionals, enhance the quality of medical records to inform the healthcare professionals at the point of care, improve the quality and safety of care to the patients, and also quality records be used as evidence in legal issues that may arise regarding healthcare service delivery (Binarti & Fitriyana, 2022).

b) All healthcare facilities must migrate their healthcare systems from paper-based to electronic format to facilitate the integration of healthcare systems across healthcare facilities, minimise medication errors, and improve safety and quality healthcare service delivery (Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017; Mirgane, 2021).

c) The healthcare facilities must use the same structure of patients' health records in all healthcare facilities to facilitate the sharing of medical records across the healthcare facilities (Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; Barr, Garrett, Marten, & Kadandale, 2019; WHO, 2019), and the integration of healthcare systems within and across the healthcare facilities, ensuring that one patient has one complete medical record at the point of care, and avoid medication errors by the healthcare professionals (Lim, Pathmanathan, & Jaafar, 2021; Lal, Erondu, Heymann, Gitahi, & Yates, 2021; Roehrs, Costa, & Righi, 2017).

The second research question: What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?

The participants suggested that a central electronic database where patients' medical records should be stored can improve the provision of care, as patients' medical records would be accessible by all healthcare facilities during care provision. Participants suggest that with central database containing patients medical records, which are shared by healthcare professionals across healthcare facilities, there would be no more challenges of hiding information by patients, either deliberately or by mistake. They assert that the advantages for the sharing of information include being able to provide care with complete medical information of the patients, resulting in making informed decisions, and to avoid making medication errors caused by lack of information. Therefore, the central database would bring the patient historical data at a central place regardless of where a patient has received medical attention.

On the same issue of the need to have a central database containing patients' medical records, a participant cautioned that access to the records must be granted only to authorised users and, most importantly, healthcare professionals from all facilities. Some participants added that the central database should be accessible to all registered healthcare professionals, in every registered facility to ensure that the information remain secure, and if need be, it can be agreed that the patient data should be accessed only when the patient is available at the facility.

Therefore, the critical success factors are concerned with the sharing of electronic medical records by all healthcare facilities so that during the provision of care, a complete medical history of a patient, as guided by the theoretical framework OmniPHR, can be accessible by those providing care, to improve quality and safety of care in Lesotho, and avoid medication errors (Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017).

The existing literature is in accord with the theoretical framework that this research has adopted, known as the OmniPHR (Roehrs, Costa, & Righi, 2017), which asserts that there must be only one medical record for each patient. Moreover, to ensure that shared medical records maintain their integrity, security and privacy, blockchain technology must be used to support the OmniPHR model (Hakim & Vaze, 2021; Miller, 2021; Vora, et al., 2018; Jin, Luo, Li, & Mathew, 2019).

The research, therefore, recommends the following:

a) All healthcare facilities must migrate their healthcare information systems from paper-based to electronic-based health information management systems. This would result in the following benefits, which would enhance the quality and safety of care as the medication errors would highly be minimised (Adane, Gizachew, & Kendie, 2019; Abiy, et al., 2018; Mirgane, 2021; Ramesh, Manimegalai, & Priya, 2020):-

(i) The medical records would no longer be dependent on paper that can easily be lost, misplaced or forgotten elsewhere
(ii) No issues of eligible records due to fading of printed information
(iii) No more illegible handwriting inside the health booklets
(iv) Faster access to patient’s medical records
(v) Improved collaboration among healthcare professionals, as they would be sharing patients’ medical records.
(vi) Facilitates integration of healthcare systems across healthcare facilities, leading to complete patient medical records at the point of care, as guided by the research theoretical framework, OmniPHR.

b) An electronic Public Health Information Management System (PHIMS), which facilitates the integration of healthcare facilities across the healthcare facilities, based on the research theoretical framework known as OmniPHR, which is about ensuring that each patient has one record that is accessible by the healthcare professionals during the provision of care, must be developed (Persaud, 2019; Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017). This would improve the quality and safety of the healthcare services delivery because the healthcare professionals would have access to the complete medical information of each patient when the need arises during the provision of care.

c) Incorporate the usage of blockchain technology to support the PHIMS OmniPHR system to facilitate secure and safe sharing of medical records across the healthcare facilities’ information management systems (Ampomah, Malau-Aduli, Malau-Aduli, & Emeto, 2020; Hakim & Vaze, 2021; Mahajan, et al., 2021; Vora, et al., 2018; Miller, 2021).

d) Ensure that healthcare systems are integrated across the facilities to ensure that patients have complete medical information during the provision of care because the healthcare facilities would be able to share the patients' medical records, as the systems would be electronic (Mahajan, et al., 2021; Miller, 2021; WHO, OECD, World Bank Group, 2018).

e) The government, through the Ministry of Health, must make a deliberate decision to adopt a biometric system as a patient identification method, which will be integrated with the Public Health Information Management System. This will address the critical success factor suggested by the participants regarding the need to integrate the PHIMS with a patient identification system, which will assist the healthcare professionals in matching a patient with the patient information in the PHIMS during the provision of care in any patient capacity, including when a patient is incapacitated. The biometric system can be used to identify a patient through face recognition, fingerprint, eye scanning and voice identification (Mason, et al., 2020; Riplinger, Piera-Jiménez, & Dooling, 2020).

f) Fatima & Colomo-Palacios (2018) caution that though healthcare systems integration is a good thing because it is expected to ensure that at the point of care, the healthcare professionals can provide care having access to the full medical information of the patient, there are risks associated with the HIS that must be mitigated to ensure safety and quality of care. Therefore, the research recommends that the following key risks inherent in the implementation of HIS be mitigated to avoid HIS system failures:-

(i) Unauthorised access to the patients' medical information through hacking because of having internet access by the users of the HIS (Fatima & Colomo-Palacios, 2018; WHO, 2021). To mitigate this, appropriate access control measures must be adhered to, such as an ICT Policy that compels all users to avoid usage of multiple electronic devices on the network or closure of some web pages that may be considered unsafe, and implementation of appropriate IT standards related to HIS (Fatima & Colomo-Palacios, 2018; WHO, 2021).

(ii) Stealing of data by the employees or disposing of computer equipment without proper deletion of information contained in the devices or accidental deletion of data (Fatima & Colomo-Palacios, 2018). To mitigate these, data encryption must be implemented on all data related to the HIS, and users of the system must be trained periodically to ensure efficient use of the system and avoid unnecessary errors, such as deletion of data by mistake (Fatima & Colomo-Palacios, 2018).

(iii) HIS system failure due to outdated third-party software (Fatima & Colomo-Palacios, 2018; Sittig, Belmont, & Singh, 2018). To mitigate this, after identifying suitable ICT standards, ensure that the service providers who develop software follow the relevant IT standards, especially concerning Health Information systems (Fatima & Colomo-Palacios, 2018; Sittig, Belmont, & Singh, 2018).

(iv) Breakdown of the network resulting in unavailability of the HIS (Fatima & Colomo-Palacios, 2018; WHO, 2021; Sittig, et al., 2020; Sittig, Belmont, & Singh, 2018). To mitigate the breakdown of the network, ICT systems must be monitored continuously to determine any HIS safety hazards, ensure that ICT standards related to HIS are strictly adhered to, and implement security audit strategies such as penetration testing (Fatima & Colomo-Palacios, 2018; WHO, 2021; Sittig, et al., 2020; Sittig, Belmont, & Singh, 2018).

(v) Unavailability of the HIS due to natural disasters, such as fire, cyclones or floods (Fatima & Colomo-Palacios, 2018; WHO, 2021). To mitigate the unavailability of HIS due to disaster, a disaster recovery plan must be developed (WHO, 2021; Fatima & Colomo-Palacios, 2018).

(vi) Medication errors by healthcare professionals (Fatima & Colomo-Palacios, 2018; Sittig, et al., 2020). To mitigate medication errors by healthcare professionals, develop a training program relevant to the HIS and also implement appropriate guidelines, procedures and security controls, which must be available to healthcare professionals (Fatima & Colomo-Palacios, 2018; Sittig, et al., 2020).

(vii) Failure to input data or committing errors during data input due to the poorly designed user interface (Sittig, et al., 2020). To mitigate this data input risk, Software-developing organisations must follow well-established software development standards to avoid poor designs (Sittig, et al., 2020).

(viii) Unable to match the patient with patient information in the HIS (Sittig, et al., 2020). To mitigate the patient identification risk, improve interoperability capabilities of the HIS, and formulate a unique patient identifier and make it a law or use algorithms to formulate patient identification or select biometric systems such as facial recognition, fingerprints, iris or palm vein scanning, or voice recognition (Mason, et al., 2020; Sittig, et al., 2020; Sittig, Belmont, & Singh, 2018; Riplinger, Piera-Jiménez, & Dooling, 2020).

g) On the issue of Patient Identification, the research acknowledges different types that could be used, as indicated above. Such as (i) using Unique Patient Identifiers (UPIs) such as National Identification Numbers. The problem with this type of patient identification is that when the person is incapacitated, it may be impossible to identify them until it is too late ; (ii) using algorithms to formulate a UPI. The algorithm will require a specific type of data to be collected. For example, a combination of NID and Post Office code number. In this kind of method, there is a high risk of inaccurate or unavailability of the required information; (iii) and using the biometric system in the form of fingerprints, iris or palm vein scanning or voice recognition (Mason, et al., 2020; Sittig, et al., 2020; Sittig, Belmont, & Singh, 2018; Riplinger, Piera-Jiménez, & Dooling, 2020). Therefore, the research recommends the usage of any one biometric system, whichever would be cost-effective at the time of such a procurement.

The third research question: How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?

The participants suggested that for the envisaged PHIMS to be efficient, a policy/legal framework to regulate its implementation and provide policy/legal guidelines for its operation must be developed to be used by all the registered healthcare facilities in Lesotho.

Though the participants have listed the different categories as laws or policies, these would form components of the law that would regulate the implementation of the envisaged Public Health Information Management System. For example, Policies/Laws that regulate the sharing of patients' records can include regulations on how patients' records can be protected against unauthorised access, abuse by authorised users, compromised privacy or confidentiality.

Consequently, the following are recommendations for the application of the research to facilitate a positive change in healthcare service delivery:-

a) Make the registration of each licensed healthcare facility with the Ministry of Health mandatory.

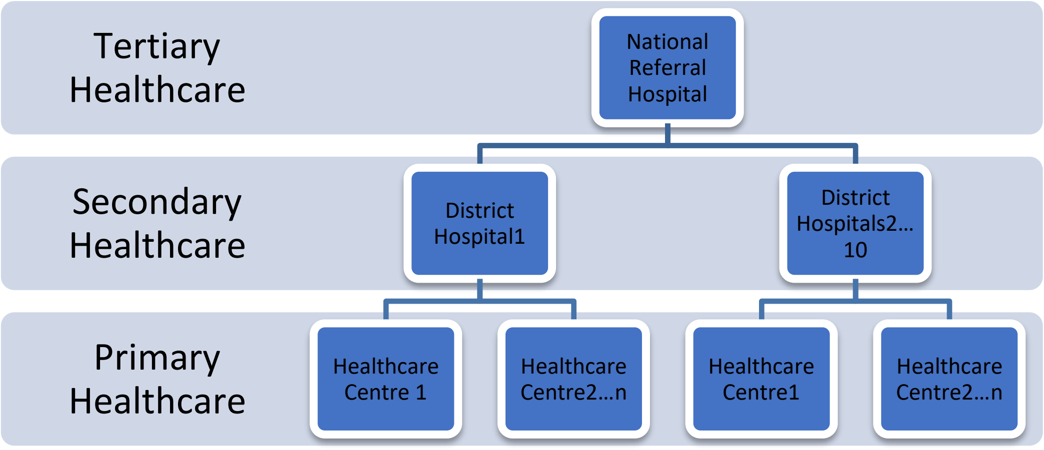
b) Make the registration with the Ministry of Health of each healthcare professional working in Lesotho mandatory.

c) The process of migration by Healthcare Professionals to other countries must include sign-off or clearance by the Ministry of Health to facilitate the update of the healthcare professional registry.

d) The existing legal framework that governs the different levels of healthcare delivery, namely, primary, secondary and tertiary levels, must be incorporated into the design and implementation of the envisaged PHIMS. **Figure 22** below lillustrates the levels of healthcare service delivery in Lesotho (GoL, 2013).

Figure 22

The Levels of Healthcare in Lesotho (GoL, 2013)



e) Ministry of Health must develop and implement a policy that standardises the structure of a patient health record and disseminate the policy for implementation by the key stakeholders, i.e. all healthcare facilities in the country, healthcare professionals and proprietors. This would support the integration of healthcare service delivery as the facilities would have similar medical record structures. Fragmented healthcare systems of a country make it impossible for the country to respond to severe attacks on the health of its citizens, such as those brought by a pandemic (Kurpas, et al., 2021). Therefore, the research recommends the integration of healthcare systems for the country to improve the tackling of diseases in a unified healthcare service delivery system, such as through the integration of healthcare systems.

f) MoH must recommend a law that regulates the sharing of medical records across all the healthcare facilities in the country, restricted access to medical records, mandatory registration by healthcare professionals, and the adoption of international healthcare standards, for example, the International Health Regulations by WHO.

g) As the envisaged system for managing patients' medical records is electronic, blockchain technology makes it possible for medical records to be accessible by patients while still maintaining both the security and privacy of patient's medical records among different authorised healthcare facilities (Vora, et al., 2018; Dubovitskaya, Xu, Ryu, Schumacher, & Wang, 2017; Miller, 2021). Therefore, the research recommends that the sharing of records across healthcare facilities and the accessibility of records by patients must be allowed. This would facilitate the integration of healthcare systems across the healthcare facilities, the development of a central database containing all patients' medical records for access by authorised users, and provide an opportunity for patients to have an up-to-date reference of their medical information when a need arises, especially when they need medical assistance.

h) According to the participants, abuse of medical records by those who are authorised and registered to access the medical records must be subjected to the full might of the law. Therefore, the research recommends that punitive measures for authorised users who abuse the privileges of access to patient's medical information must be stipulated and enforced to deter such behaviour from ensuring the privacy, integrity, and confidentiality of the medical records.

i) The records must be elaborate to facilitate future reference, especially for the next healthcare professional attending to the patient or in case of further research and litigation when evidence is required. In confirmation, participants suggest that the importance of proper medical records generated during the provision of care must be clear, detailed and correct to ensure that the next healthcare professional can easily use the medical records to make informed decisions regarding the health of the patient.

Therefore, clear medical records will contribute towards enhancing the quality and safety of care when the patient meets the next healthcare professional and help improve healthcare outcomes (Lubin & Shah, 2022; Binarti & Fitriyana, 2022).

j) The system must be auditable so that activities by authorised users can be traced to the user if the need arises. This would ensure that (i) the weaknesses of the healthcare system could be determined to facilitate necessary improvements, (ii) healthcare professional's performance usage of the system can be tracked to determine if there is a need for capacity building or coaching, to ensure that the users of the system use it effectively. The participants' views confirm this, as one participant said:

> "*There must be a law that protects the patient information, such that it is accessed only during the provision of care not for interest sake – and the system must be auditable so that it can be determined that the patient medical history is accessed as appropriate" (*Interviewee C14, a potential patient*).*

On the same issue, another participant re-affirmed the need for an auditable healthcare system and said:

> *"Every patient record should be detailed enough to facilitate any audit which may be needed to be conducted in case of a mishap – this will help to identify incompetent health practitioner"(Interviewee C4, a potential patient).*

Summarised Research Findings, Implications and Recommendations for the Application of Solutions

Table 15 below is a summary of research findings, implications and suggested mitigations for issues identified during the research process

Table 15

Summary of Research Findings, Implications and Recommendations

Summarised Research Findings, Implications, and Recommendations for the Application of Solutions			
Issues Identified		**Implications**	**Recommendations for Application Solutions**
Research Question 1 →		To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?	
1.1	Paper-based medical records	a) Unreliable storage of medical records b) Hinders collaboration among healthcare professionals	Migration of patients' medical records from paper-based to electronic
1.2	Independent and stand-alone healthcare facilities	Fragmentation of patient records, which can result in medication errors	Development of a central public health information management system, accessible across all healthcare facilities
1.3	Missing medical information during the provision of care	Risky healthcare services delivery, jeopardizing safety and quality of care	Development of a central public health information management system, accessible to healthcare facilities
1.4	Unreliable source of medical information	Compromised safety and quality of care	Implementation of the integrated Electronic Health information management systems, to facilitate sharing of patients' medical records
Research Question 2 →		What could be the appropriate and relevant critical success factors for a PHIMS to ensure its efficiency?	
2.1	Suggestion for a central database for the storage of patients' medical records	Healthcare facilities must have functional electronic health information management systems	Health Information Systems must be interoperable to facilitate integration across healthcare facilities

Summarised Research Findings, Implications, and Recommendations for the Application of Solutions			
Issues Identified		**Implications**	**Recommendations for Application Solutions**
2.2	Development of a robust system that supports interoperability to facilitate systems integration	Improved national telecommunication coverage is required.	MoH to form a partnership or Memorandum of Understanding (MoU) with telecommunication companies to facilitate coverage nationwide and optimum functionality
2.3	Healthcare facilities must migrate from paper to electronic records systems	Systems Integration will be possible through electronic Health Information Systems	All healthcare facilities must implement electronic health information systems
2.4	Health information systems must cover all healthcare services offered at the facility	Proper consultations with ICT systems developers will be conducted	Healthcare Facility-based specifications must be provided to the ICT systems developers
2.5	Patient Identification Method	A patient identification method must be decided by the authorities along with the development of the PHIMS	Among the different patient identification methods, Biometric system is recommended because it can be applied in situations when the patient is incapacitated and without anyone who knows him/her
Research Question 3 →		How could the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?	
3.1	Regulate sharing of medical records	Healthcare professionals must provide accurate and clear patients' medical records to the appropriate audience at all times	Inaccuracy in patients' medical records renders the medical information useless; and sharing the medical records to unauthorised audience should be considered a breach of confidentiality. Therefore, both incidents must be punishable by law.

Summarised Research Findings, Implications, and Recommendations for the Application of Solutions			
Issues Identified		**Implications**	**Recommendations for Application Solutions**
3.2	Regulate access to shared medical records across healthcare facilities	Access to the shared system should be by authorized users only	Healthcare professionals and their facilities must register to obtain authorization
3.3	Regulate the implementation of the public health information management system	There must be a legal/policy framework to regulate the implementation of the public health information management system	Formulate a legal/policy framework to regulate the implementation of the public health information management system

Recommendations for future research

The purpose of this qualitative study is to show that integration of healthcare services delivery within and across healthcare facilities can be used as one of the strategies to strengthen the Public Health Information Management System to ensure its efficiency. This was achieved through the involvement of the citizens of Lesotho as participants in research that studied the status of healthcare services delivery in Lesotho. The research participants were selected from the citizens using the qualitative research method known as purposive sampling, where only people who understand the phenomenon being studied are selected as the research participants (Saunders, et al., 2018; Andrade, 2021). Since data collection was conducted during the COVID-19 pandemic, when interaction between people was restricted, data was collected mostly through virtual interviews and focus group deliberations. However, where technology obstacles were met, face-to-face interviews were conducted under strict adherence to COVID-19 restriction protocols.

The significance of the research to the participants is defined per participant groups, namely, a) The Ministry of Health, b) Healthcare Professionals, c) Healthcare Administrators, and d) Potential Patients.

a) The Ministry of Health

Moreover, after the concept for the design of an efficient PHIMS has been developed, the researcher will present the dissertation report to the Ministry of Health (MoH) for information because the MoH provided authorisation for the research to be conducted within the Lesotho Health Sector. Furthermore, the MoH will be at liberty to use the report for future improvement of the healthcare services delivery in Lesotho. For example, if the MoH has the budget and the intention to improve healthcare services, the report could be used as the Terms of Reference or specification for the design and development of the PHIMS. The terms of reference for the system can be used as part of the bidding document to procure PHIMS for Lesotho.

b) The Healthcare Professionals

The tools that healthcare professionals need to provide care will be much improved, and their activities will be guided and protected by the law. For example, if the system is implemented as recommended, the challenges they encounter during the provision of care will be minimised while their experience of delivering care will be improved.

c) Healthcare Administrators

If the system is implemented, the healthcare administrators will be able to have full reports on the healthcare services delivery provided by their respective institutions because the healthcare information system will include all the integrated healthcare services.

d) Potential Patients

If the system is implemented, healthcare service delivery will be improved, diminishing the risk of compromised quality and safety of care because healthcare service delivery will be coordinated.

Furthermore, the country can use the concept as a plan for an efficient and robust healthcare system that will improve Lesotho's Primary Health Care intentions and aspirations. Moreover, the concept can be used to justify the budget request by the MoH from the government of Lesotho to fund the procurement of consultancy services for the development, implementation, and maintenance of the PHIMS for Lesotho. Moreover, the information can also be used to provide the basis for future research aiming to improve healthcare service delivery for the country.

The problem which caused the initiative for the research to be conducted is that the healthcare services delivery in Lesotho is not coordinated or integrated and, therefore, is risky to the patients' lives. The research reveals that during the provision of care, the healthcare professionals do not have access to the complete medical information of the patients, mainly because a) medical records are paper-based and not reliable, b) the healthcare facilities do not share the patients' medical records because they are paper-based, c) the healthcare information management systems within the healthcare facilities are fragmented, and d) the healthcare information systems across the healthcare facilities are fragmented and not coordinated. Therefore, each patient has as many records as the number of facilities in which he/she has received medical care. According to the literature, this is risky to the lives of the patients because of the following reasons:-

a) incomplete medical information can cause medication errors by healthcare professionals during the provision of care, which can lead to severe adverse results for the patients and sometimes could lead to fatalities (Poulos, Zhu, & Shah, 2021; Ramesh, Manimegalai, & Priya, 2020)
b) fragmented medical information can lead to a) delays in the provision of care and also b) expensive medical costs due to repeated medical tests (Ramesh, Manimegalai, & Priya, 2020)
c) Fragmented medical records can lead to litigation because medication errors can be committed, resulting in compromised patients' safety (Ramesh, Manimegalai, & Priya, 2020; Mirgane, 2021) or
d) Fragmented patient information can disturb the treatment course of a patient, especially for patients who suffer from chronic diseases (Lubin & Shah, 2022)

To resolve the problem, the research recommends the design of a web-based electronic PHIMS so that the following could be made possible:-

a) Migration of health information management systems from paper-based to electronic-based for easy management of patients' medical records, which will facilitate, among others (Abiy, et al., 2018; Adane, Gizachew, & Kendie, 2019), a) easy capturing of patient information, b) easy storage of patients' medical information, c) quick searching of the required information, d) timely reporting as required
b) The sharing of patients' medical records within and across the healthcare facilities to avoid medication errors caused by incomplete patients' medical information, caused by independent management of patient records by healthcare facilities (Mira, 2019;

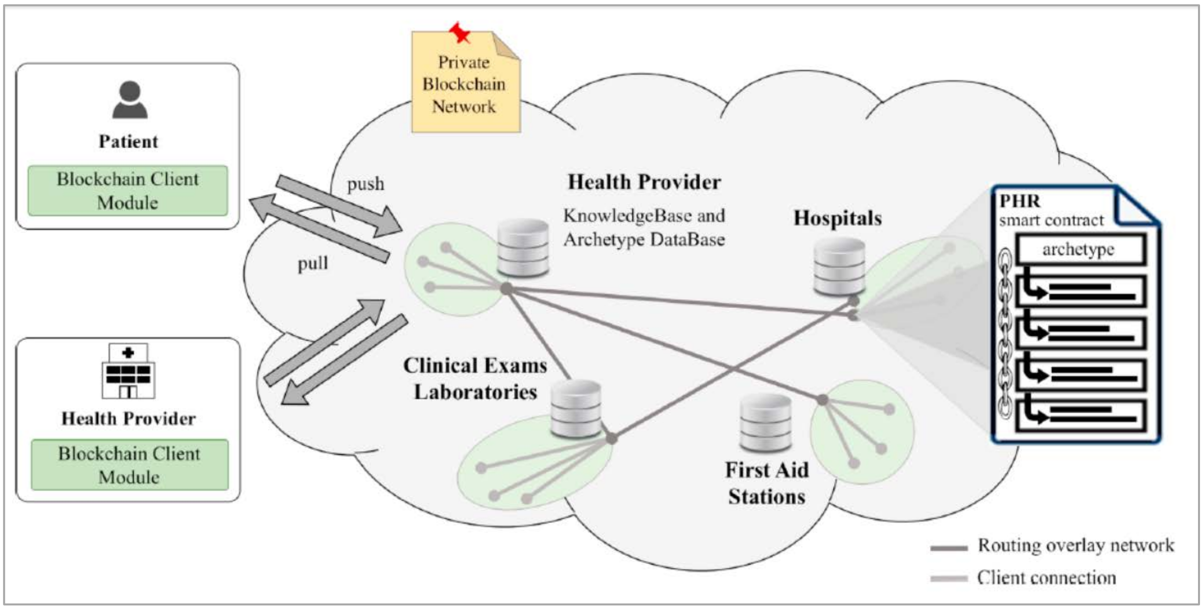
Ramesh, Manimegalai, & Priya, 2020; Roehrs, Costa, & Righi, 2017; Lubin & Shah, 2022).

c) The integration of patients' medical records across healthcare facilities, such that when care is provided at any healthcare facility in the country, the healthcare professional can access the full medical history of the patient, with minimal distraction (Saripalle, Runyan, & Russell, 2019; Lepeleire, 2022; Mahajan, et al., 2021).
d) Online collaboration by healthcare professionals throughout the country and worldwide enhances the provision of care and adherence to International Health Regulations, which advocates for a better life for global citizens (Kluge, et al., 2018; Ministry of Health, 2018).
e) Retrieval of medical reports or clinical management notes whenever required by the healthcare professionals for reference to assist in the timely provision of care, for research purposes to improve individual knowledge in healthcare services delivery or to acquire existing health information to assist in the provision of legal evidence as required (Granja, Janssen, & Johansen, 2018; Luz, Mussi, Dutra, & Chaves, 2021).
f) An audit trail of the system that records access by authorised users, indicating activities carried out during the provision of care. This would reveal whether there were problems associated with the health information system or if the user had ulterior motives when attending to the patients during the provision of care.

The key aspect of the integration of patients’ medical records across healthcare systems is the ability to share information across different networks. However, when data moves across networks, it becomes vulnerable to unauthorised access, so much so that security measures must be put in place to protect such information (Roehrs, et al., 2019). Therefore, **Figure 23** below illustrates how the security of data across networks will be put in place.

Figure 23

An example of the OmniPHR (Roehrs, et al., 2019)



The diagram shows the pushing and pulling of the information in and outside the blockchain network to the patient or healthcare provider client modules. Therefore, having to pull and push information across the healthcare providers requires reliable security as medical records are a very sensitive piece of information, and if not accurate or complete, can jeopardise the life of a patient (Dubovitskaya, Xu, Ryu, Schumacher, & Wang, 2017).

There are two recommended solutions to the Lesotho healthcare services delivery, which are not coordinated and risky to the lives of the patients. First is a tested and appropriate ICT technology approach that can address the identified problem, the OmniPHR model approach, which is about ensuring that each patient has a complete medical record at the point of care, regardless of where the patient seeks medical attention (Dubovitskaya, Xu, Ryu, Schumacher, & Wang, 2017; Roehrs, et al., 2019). **Figure 23** above illustrates the OmniPHR model, which is supported by blockchain technology to ensure the security and integrity of patient data, as patient information is shared across various networks for access by patients and healthcare providers over the Internet (Roehrs, et al., 2019). This arrangement requires reliable telecommunication coverage, which most African countries do not have, especially in rural areas where it is very hard to reach (Azevedo, 2017). However, with the notion of Universal Health Coverage (UHC), advocated by the World Health Organisation together with the Primary Health Care that Lesotho is very serious about, there is a national pressure to provide healthcare services for free nationwide, including at the hard-to-reach areas (GoL, 2013).

The researcher suggests that though the implementation of the envisaged PHIMS will address the problem identified, the solution will not be sustainable over time, especially when it is accepted by an increasing number of healthcare facilities. Therefore, for future advancement of the solution, there will be a need to establish techniques that can support the implementation of an effective PHIMS to facilitate the movement of large amounts of data that are collected or moved across health information systems of healthcare facilities through telecommunications networks. Those techniques should help interpret patients' medical data timely to fast-track clinical diagnosis and facilitate accurate, safe and quality care; these techniques are scientifically known as Artificial Intelligence (AI) (Kaul, Enslin, & Gross, 2020; Briganti & Moine, 2020). However, this solution is beyond the scope of this research. Therefore, the research recommends a future study to establish how artificial intelligence (AI) can be used to support the implementation of a PHIMS to enhance its efficiency and improve health outcomes. An efficient PHIMS will assist the country, through the activities of the Ministry of Health, to achieve the following objectives and improve the country's health outcomes (Luz, Mussi, Dutra, & Chaves, 2021):-

a) Efficient and safe healthcare delivery
b) Improved data collection and storage
c) Quick and reliable sharing of medical records with the assistance of the PHIMS

d) The improved decision-making processes to avoid the loss of patients' lives
e) The improved quality and safety of care
f) The contribution to the improvement of medical research

Moreover, the suggested solution of the OmniPHR approach, which is supported by blockchain technology, aims at collecting data from many sources countrywide, as illustrated in **Figure 23**, and facilitating one medical record per patient. For healthcare solutions, data must be put together, diagnosis provided, and much-needed care can be administered timely to save lives (Holzinger, Langs, Denk, Zatloukal, & Müller, 2019; Panch, Szolovits, & Atun, 2018). Therefore, AI is seen as a good transformation of healthcare services delivery, and Panch, Szolovits, & Atun (2018) suggest that it will revolutionise the medical practice within the Health Sector. AI is believed to recognise patterns in data that can help diagnose conditions faster than healthcare professionals can (Loh, 2018). Future research must assess the extent to which AI can support the implementation of the envisaged PHIMS because AI systems are believed to be efficient in the diagnosis of diseases, improvement of healthcare provider workflow and overall health outcomes (Kaul, Enslin, & Gross, 2020).

Conclusions

The problem that the study intends to address is that the healthcare service delivery in Lesotho is not coordinated, fragmented and therefore risky to the lives of patients. Therefore, the purpose of the study is to show that healthcare systems integration can be used as one of the strategies to strengthen the Public Health Information Management System, thereby addressing the research problem of risky healthcare service delivery because of being uncoordinated and fragmented across healthcare facilities.

To conduct the research, three research questions were established as follows:-

a) Research Question 1: What challenges do healthcare professionals encounter during the provision of care, which may compromise the quality and safety of care?
b) Research Question 2: What are the critical success factors for a public health information management system that can make it efficient?
c) Research question 3: How can the policy/legal framework be formulated to regulate the design and implementation of the PHIMS to make it efficient?

The research participants who formed the research sample were considered to be knowledgeable about the phenomenon being studied, which is the understanding that the healthcare service delivery system for Lesotho is not coordinated and, therefore, risky to patients' lives. The participants were, namely, the potential patients (healthcare service delivery beneficiaries), healthcare administrators (healthcare service delivery managers and monitors), and healthcare professionals (doctors and nurses).

The research findings were categorised according to the three research questions to illustrate how the findings relate to the theoretical framework, the purpose, and the research problem.

The First Research Question: To what extent do the challenges encountered by healthcare professionals, during the provision of care, affect the quality and safety of care?

The findings indicate that healthcare professionals encounter three main challenges during the provision of care, which compromise the quality and safety of care. These are a) Poor Management of Medical Records because the records are paper-based, fragmented across various healthcare facilities, and in some cases, patient data is double-handled from one facility to the other, which makes the resulting patient information prone to inconsistencies; b) Lack of Continuity of Care because of non-availability of patient medical information at the point of care, or unreliable source of medical information, such as healthcare booklets that are missing records from previous visits to the healthcare facilities, especially from the private healthcare facilities where healthcare booklets are not used; c) Poor Design & Implementation of electronic Health Information Systems, because they are not user-friendly, as some functions are inaccessible, or complicated to use, which in most cases resulting in some users resorting to paper-based systems, living information gaps, and lack of reporting capabilities. Moreover, implementation for some electronic Health Information Systems (HISs) lacks training for users, leaving them demotivated as they cannot operate the systems.

When patients' medical records are poorly managed, healthcare professionals will not have reliable patient medical data to use in providing care. Secondly, when there is a lack of continuity of care due to the unavailability of patient information, scheduled treatment will be disrupted, and the current healthcare professional will re-start treatment from scratch, which can delay the healing process for the patient, and increase medical costs as some tests may have to be repeated. When the existing electronic systems have been poorly designed and implemented, they may not function properly or can also be abandoned by users who have been trained or who find the system complicated to operate and then resort to manual systems, which can delay healthcare service delivery or cause confusion if other users can operate the system, and the patient data needed at the point of care will never be complete, which could result in medication errors that can compromise the life of a patient. The incomplete patient data at a point of care is a healthcare risk and against the theoretical framework, OmniPHR, which is about having one complete patient record at a point of care (Roehrs, Costa, & Righi, 2017). Therefore, the findings confirm the research problem that the healthcare service delivery in Lesotho is risky to the lives of the patients because it can cause healthcare professionals to commit medication errors (Persaud, 2019; Ramesh, Manimegalai, & Priya, 2020). The study is significant in that it highlights risks brought about by the current healthcare service delivery system to the patients' lives, which is important for the healthcare service delivery stakeholders, such as potential patients, healthcare administrators and healthcare professionals, to be aware of the current status of the healthcare service delivery, that it compromises quality and safety of care, so that they may feel eager to resolve the problem or embrace solutions to address the current situation if presented to them. The research highlights each stakeholder's contribution to causing problems encountered by healthcare professionals during the provision of care. For example, when patients move between healthcare facilities, they sometimes leave the health booklets purposely or by mistake; some healthcare professionals do not write clinical notes in the health booklets, or if they do, sometimes the handwriting is not readable; for the healthcare administrators, the medical records storage facilities are not the best. Therefore, all these result in poor records management, which can cause medication errors that can compromise the quality and safety of care.

The Second Research Question: What are the Critical Success Factors for the PHIMS that can make it efficient?

The research question seeks to determine what could be done to improve healthcare service delivery by establishing specific critical success factors that can make a public health information system efficient. The findings indicate that the critical success factors for the envisaged system are grouped into three main categories: a) Effective management of patients' medical records, where the records are in an electronic health information management system, the advantages of which include being able to have a central database that can be shared within a wide area network using the Internet, healthcare professionals. Moreover, when a central database is developed, patients' medical records can be stored for as long as agreed or provided for in the guidelines. The medical records can later be retrieved by healthcare professionals during care provision or by authorised users when the need arises. Therefore, the effective management of medical records will facilitate the integration of healthcare systems across healthcare facilities so that patients' records remain complete all the time; it will allow access by healthcare professionals to historical patient medical information when providing care or during collaboration among healthcare professionals so that informed decisions in care provision are made in a manner that will enhance quality and safety of care; b) For the envisaged system to be efficient, it must be patient-based, as opposed to being healthcare-facility-based, meaning the records must be stored based on the patient, and not by the healthcare facility that the patient visited to seek medical attention. As indicated above, this would be made possible if there is a central database which integrates health information systems across facilities into one central database, in which one patient would have one complete record, regardless of how many facilities they visited to seek medical attention. For efficiency, the features of a patient-based system must include, (i) patient identification capabilities to ensure that available medical records on the system are matched to the true owner on patient arrival at the healthcare facility; (ii) patient tracking capabilities that will show the facilities that the patient has been to, and what treatment they are currently undergoing, to enable continuity of care and avoid medication errors; (iii) patient follow-up function to indicate when the patient is expected to visit the healthcare facility for observation or check-up, to evaluate treatment progress and determine if there is need for change, so that the patient may be reminded; (iv) the system must have a feature that gives the patient access to their medical records to facilitate reference to the medical information when a need arises, and this may require policy/legal guidelines to determine to what extent the medical information can be made available to the patient; c) The overarching functionality of the envisaged health information system must have the following qualities, (i) the system must support all the services/operations the healthcare facility deals with, to facilitate systematic periodic progress reporting on the activities of the facility; (ii) the system must support integration of medical records across healthcare facilities, to facilitate collaboration and enable patients records to be complete; (iii) the system must have an offline mode that would allow the users to continue capturing information on local computers even when telecommunication network is not available so that when it becomes available, the central database can be updated by medical records that were captured during the absence of telecommunication network; (iv) the system must have data analysis and reporting functionality to facilitate analysis and reporting per the requirements of stakeholders, being authorised users of the system; (v) finally, the system must be user-friendly so that it can be effectively used by all authorised users and strengthen the healthcare service delivery processes, this would motivate the users, especially if they can capture medical data, analyse it and provide various reports about their activities.

The critical success factors established by the study, if implemented as suggested by participants, will ensure that the system is aligned with the theoretical framework, OmniPHR, as the critical success factors are about an electronic health information system that manages a central database, which is updated through integration, by medical records from various healthcare facilities (Roehrs, Costa, Righi, & Oliveira, 2017). This would address the research problem because the medical records will no longer be fragmented at the point of care, and healthcare professionals will always have access to complete patients' records during the provision of care, thereby improving the quality and safety of care.

When the critical success factors are implemented as suggested, the healthcare professionals' experience in healthcare service delivery will be much improved as they will always have the information they need to provide care; the patients will be better treated when the healthcare service delivery is improved, and their lives will be safe from medication errors; the healthcare administrators will be able to present overall reports regarding the performance of the healthcare facility as all the healthcare service activities would be captured into the system.

Research Question 3: How should the policy/legal framework be formulated to effectively regulate the implementation of a PHIMS to ensure its efficiency?

According to the findings, specific regulations and policy/legal guidelines are needed to regulate and provide guidance to implement a public health information management system (PHIMS) to ensure that all stakeholders view the system in a coordinated and same perspective. Consequently, the findings suggested that two main aspects must be considered in formulating a policy/legal framework to regulate and guide the implementation of a PHIMS to ensure its efficiency. The aspects are:-

a) development of the regulations for the implementation of the PHIMS.

The first regulation to be developed is the sharing of medical records across healthcare facilities to ensure that in the process of sharing, patients' medical records remain private and confidential and that their integrity and security are not compromised;

Second, there must be measures to restrict access to the patients' medical records, to ensure that only authorised users are granted access that corresponds to their role in healthcare service delivery processes.

Third, the regulation would be to make registration at the Ministry of Health by healthcare professionals and their facilities mandatory to ensure their authenticity in operating in the country.

Fourth, demonstrating the adoption of the International Health Regulation Standards, advocated by the World Health Organisation, to ensure that the implementation of a PHIMS is safe for the patients' lives.

Fifth, set up and document clear healthcare service delivery procedures and processes to facilitate periodic audits, planned or forced, to ensure that the implementation of the system complies with the policies and laws of the country;

b) The second aspect for consideration is the development of the policy/legal guidelines for implementation of the PHIMS.

First, develop a Training Policy for users of the PHIMS to ensure that the system is used to its potential and avoid unnecessary errors or complications when using the system. The policy must indicate the importance of training by role when changes are made to the system and how users will be trained to adopt the changes.

Second, develop a PHIMS Security Policy to inform users how to keep the system secure at all times of operation and ensure that the system is protected against any misconduct.

Lastly, develop a healthcare service delivery Subsidy Policy to ensure that healthcare services are accessible and affordable to all citizens regardless of their financial status.

The findings align with the theoretical framework, OmniPHR, because the regulations support the sharing of medical records across healthcare facilities, which will lead to one medical record per patient, as the research theoretical framework guides. Furthermore, the development of the policies supports the implementation of a secure PHIMS, which can only be accessed by authorised users, and with particular adherence to the users' roles in healthcare service delivery procedures and processes.

The findings for the third research question are aligned with the theoretical framework and, therefore, address the research problem in that the regulations support the sharing of the records, which facilitates the integration of healthcare systems across the healthcare facilities, and the policies provide guidance on the implementation of the PHIMS to ensure its efficiency.

In conclusion, the findings acquired through the first research question confirm the research problem because they demonstrate that the healthcare service delivery in Lesotho is risky to patients’ lives. For example, the patient’s medical records are poorly managed, as sometimes they do not exist, and if they exist, they are not complete, meaning they are not reliable, and this can result in medication errors by the healthcare professionals that jeopardise the patients’ lives.

Contrary to the first research question findings, the findings established through the second and third research questions are aligned with the theoretical framework, OmniPHR, as they support the existence of one complete medical record per patient through the integration of healthcare systems across healthcare facilities, and provide responses that address the research problem, such as effective management of patient’s medical records, a patient-oriented health information system that is functional, development of regulations and policy/legal guidelines for implementation of the PHIMS.

The findings demonstrate the significance of the study to a) the healthcare administrators in that they highlight the problematic status of the current healthcare service delivery and provide solutions to the identified problem, which the Ministry can take up to strengthen the healthcare service delivery; b) the findings clarify the challenges encountered by healthcare professionals and the resulting medication errors, which can be avoided through suggested solutions such as effective management of patients’ medical records, i.e. migrating from paper to electronic-based medical records, and formulating policy/legal framework for implementation of a PHIMS; c) the findings highlight the challenges that cause medication errors to the potential patients, indicating how both healthcare professionals and patients contribute in creating some challenges against the provision of care. Moreover, the research has provided solutions such as migrating from paper (healthcare booklets or files) to electronic health information systems by all healthcare facilities, integration of health systems across the facilities to a functional public electronic health information management system containing records shared by various healthcare facilities, and give patients access their medical records, which they can access from anywhere, using internet through their own devices.

Therefore, the research asserts that a public health information management system should be made interoperable, such that patient’s medical records from various healthcare facilities in the country can be integrated such that they update a central database containing patients’ medical records and using black-chain technology to ensure the security of the records across various networks. This solution will strengthen a public health information management system, thereby improving the Ministry of Health’s oversight role on healthcare service delivery and timely reporting on national health data.

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Annexes

Annex 1: Interview questions for Healthcare Professionals (Doctors & Nurses)

Interview Questions for HealthCare Professionals			Health Professional No:	
Date:			Proprietor	Tick
Male/Female:			Government of Lesotho (MoH)	
			Christian Health Association Lesotho	
Designation:			Lesotho Red Cross Society	
			Lesotho Flying Doctors Services	
			Private Facility	
			NGO	
Set 1: a) What challenges do you encounter when using available patients' historical data in providing healthcare for (i) new patients or (ii) returning patients?		Set 2: a) In what ways could patients' historical data across health care facilities in Lesotho be used to provide care with good quality and safety? b) What policies, guidelines, laws or standards, locally or internationally, could be		

b) What functions would be ideal for the design of an electronic Public Health Information Management System (PHIMS) to ensure quality and safety of care?	used to guide the design and development of PHIMS?

Annex 2: Informed Consent form:

Name of Researcher: Litlhokoe Daniel Mohlomi

Project Number: 01

Project Title: The conceptualization of a design for a robust Public Health Information Management System

INTRODUCTION

This consent may contain words that you do not understand. Please ask the investigator or the study staff to explain any words or information that you do not clearly understand.

You are being asked to participate in a research study. This research is being conducted to gather data that will facilitate the researcher to conceptualise a design for patients' records management system that can enhance oversight and coordination for Government of Lesotho on health service delivery and management, nationwide. When you are invited to participate in research, you have the right to be informed about the study procedures so that you can decide whether you want to consent to participation. This form may contain words that you do not know. Please ask the researcher to explain any words or information that you do not understand.

You have the right to know what you will be asked to do so that you can decide whether or not to be in the study. Your participation is voluntary. You do not have to be in the study if you do not want to. You may refuse to be in the study and nothing will happen. If you do not want to continue to be in the study, you may stop at any time without penalty or loss of benefits to which you are otherwise entitled.

If you want to terminate your participation, just inform the researcher by calling or sending a message to the contact numbers provided below.

WHY IS THIS STUDY BEING DONE?

The purpose of this qualitative study is to show that integration of healthcare services delivery within and across healthcare facilities can be used as one of the strategies to strengthen the Public Health Information Management System to ensure its efficiency.

HOW MANY PEOPLE WILL BE IN THE STUDY?

About hundred people will take part in this study, representing Healthcare Professionals, Healthcare Administrators and Healthcare Service Beneficiaries. The research will focus on Healthcare Service Delivery in Lesotho offered by Christian Hospitals Association of Lesotho (CHAL), Lesotho Red Cross Society, the Private Health Practitioners and those owned by the Government of Lesotho.

WHAT AM I BEING ASKED TO DO?

You will be asked to provide your written consent to voluntarily participate in the research study.

HOW LONG WILL I BE IN THE STUDY?

This study will take a total of six months to complete. You can stop participating at any time without penalty.

WHAT ARE THE BENEFITS OF BEING IN THE STUDY?

Your participation will benefit the participant and all other citizens of Lesotho because the findings from the research study will assist authorities to be aware of the type of system that should be designed to enhance health care service delivery and minimise mortality caused by poor health service delivery.

WHAT ARE THE RISKS OF BEING IN THE STUDY?

For a very busy participant, being in the study may take a valuable time away from work. But this can be managed through proper consultation with the participant by the researcher.

WHAT ARE THE COSTS OF BEING IN THE STUDY?

There is no cost to you. However, if the participant may have to travel from one place to the other, the researcher will reimburse costs incurred by the participant. For example, if the focus group meeting is held at a place where some participants would incur some costs, the researcher will pay back the costs.

WHAT OTHER OPTIONS ARE THERE?

You have the option of not participating in this study, and will not be penalized for your decision.

CONFIDENTIALITY

Information produced by this study will be stored in the investigator’s file and identified by a code number only. The code key connecting your name to specific information about you will be kept in a separate, secure location. Information contained in your records may not be given to anyone unaffiliated with the study in a form that could identify you without your written consent, except as required by law.

In addition, if photographs, audiotapes or videotapes were taken during the study that could identify you, then you must give special written permission for their use. In that case, you will be given the opportunity to view or listen, as applicable, to the photographs, audiotapes or videotapes before you give your permission for their use if you so request.

WILL I BE COMPENSATED FOR PARTICIPATING IN THE STUDY?

You will receive no payment for taking part in this study.

WHAT IF I AM INJURED?

No injury is expected to be caused through interviews or meetings with the focus groups.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

Participation in this study is voluntary. You do not have to participate in this study.

You will also be informed of any new information discovered during the course of this study that might influence your health, welfare, or willingness to be in this study.

Your participation to the study may be terminated by the researcher if you use disrespectful language or deliberately refuse to confine your answers to the subject or the interview questions being asked.

WHO DO I CONTACT IF I HAVE QUESTIONS, CONCERNS, OR COMPLAINTS?

If you have questions about the research, please contact officer in charge of the facility (e.g. PS Health/CHAL CEO/Dr-in-Charge (private HCF)). Additionally, you may ask questions, voice concerns or complaints to the researcher.

WHOM DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?

If you have any questions regarding your rights as a participant in this research and/or concerns about the study, or if you feel under any pressure to enrol or to continue to participate in this study, you may contact the UNICAF University at +265 1 755 333

You may ask more questions about the study at any time. For questions about the study or a research-related injury, contact Litlhokoe Mohlomi, telephone number: +266 58881120/62001120.

A copy of this Informed Consent form will be given to you before you participate in the research.

SIGNATURES

I have read this consent form and my questions have been answered. My signature below means that I do want to be in the study. I know that I can remove myself from the study at any time without any problems.

Participant Name & Signature	Date
Legal Guardian/Advocate/Witness (if required)	Date

Annexenex 3: Questionnaire for busy healthcare professionals

Questionnaire for Health Professionals (tick as appropriate)						
Nurse		Doctor		Date:		
Facility Name						
Q1: How are the records of the patients kept at your facility? Paper-based or electronic?						
Q2: How do you gather patient medical history if the patient does not have any record or if the patient is incapacitated? What could work better?						
Q3: What are the challenges that you encounter when providing care for new patients?						
Q4: What challenges do you encounter when using your system in provision of health care for returning patients?						
Q5: What system would you recommend for keep patient records at your health care facility? And Why?						

Q6: If an electronic system could be developed, what elements should it entail, which will improve quality and safety of health service delivery? Please explain!

Q7: What challenges exist in managing patient referrals from one facility to the other? What could be done better or differently?
Q8: What improvement do you think needs to be done in the health sector to enhance management and sharing of patients records for health service delivery?

Annex 4: Interview questions for Healthcare Administrators

Interview Questions for Administrators		Administrator No:	
Date:	____/____/2021	Proprietor	Tick
Male/Female:	+	Government of Lesotho (MoH)	
		Christian Health Association Lesotho	
District:		Lesotho Red Cross Society	
		Lesotho Flying Doctors Services	
		Private Hospital	
Set 1: a) What challenges do you encounter when preparing reports using the current health management system? b) What functions would be ideal for the design of an electronic Public Health Information Management System (PHIMS) to facilitate timely reporting?		Set 2: a) In what ways could patients' current and historical data across health care facilities inform decision making? b) What policies, guidelines, laws or standards, locally or internationally, could be used to guide the sustainable operation of the PHIMS?	

Annex 5: Interview questions for potential patients

Interview Questions for Patients			Patient No:		
Date:					
			Age of patient		
Set 1: a) How do you choose which healthcare facility (clinic or hospital) to go to when you need medical attention? b) How would you prefer to be attended when you go to any health facility in the country for		Set 2: a) What were you requested to produce when you went to a health facility for the first time? And for the subsequent times?			

Annex 6: Focus group meetings discussion points

Name of Researcher: Litlhokoe Daniel Mohlomi

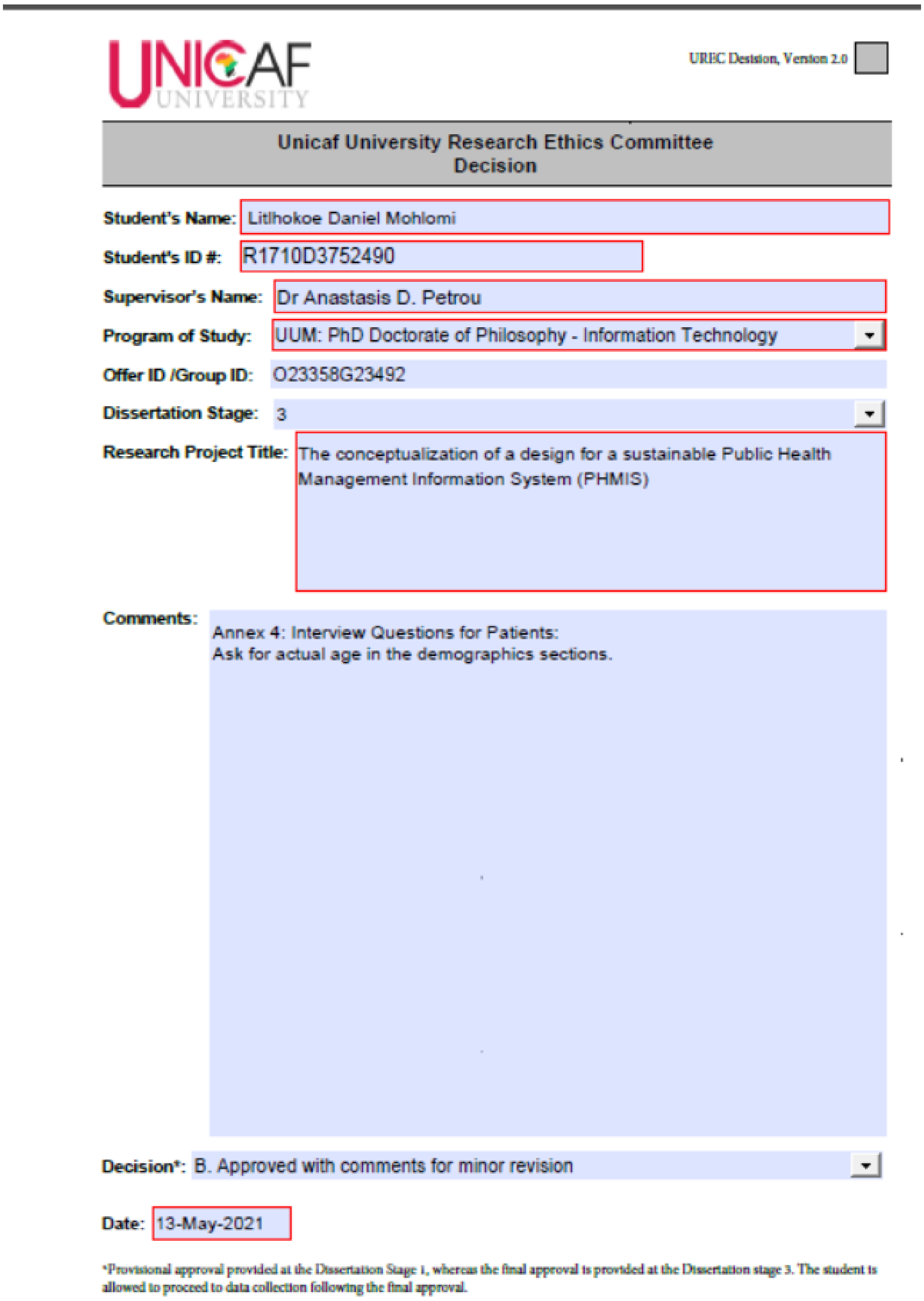
Project Number: 01

Project Title: The conceptualization of a design for an efficient Public Health Information Management System

Healthcare Professionals Focus Group (tick as appropriate)							
N Nurses		Doctors		Date:		Group No.	
Q1: Should the healthcare facilities share data? Could this improve the quality and safety of healthcare service delivery?							
Q2: If a public health Information Management system were to be designed, what elements or features would you recommend it to contain and why?							
Q3: What are the advantages of having the patient's historical data in provision of care?							

Q4: If a public health Information Management system is designed for Lesotho, what regulatory framework would be required to support its implementation?

Annex 7: UREC Approval



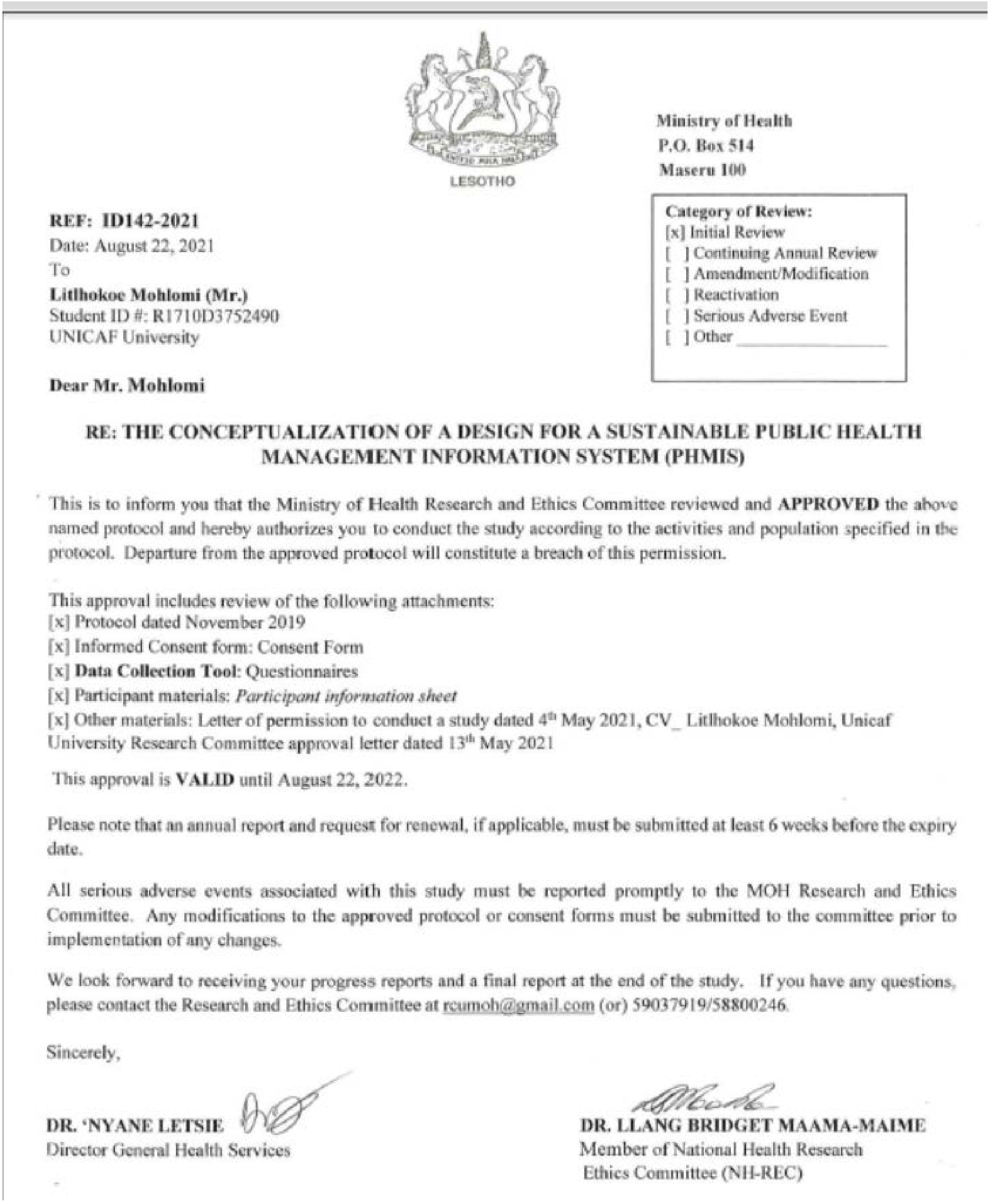
UREC Decision, Version 2.0

Unicaf University Research Ethics Committee Decision

Student's Name:	Litlhokoe Daniel Mohlomi
Student's ID #:	R1710D3752490
Supervisor's Name:	Dr Anastasis D. Petrou
Program of Study:	UUM: PhD Doctorate of Philosophy - Information Technology
Offer ID /Group ID:	O23358G23492
Dissertation Stage:	3
Research Project Title:	The conceptualization of a design for a sustainable Public Health Management Information System (PHMIS)
Comments:	Annex 4: Interview Questions for Patients: Ask for actual age in the demographics sections.
Decision*:	B. Approved with comments for minor revision
Date:	13-May-2021

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Annex 8: MoH REC Approval



LESOTHO

Ministry of Health
P.O. Box 514
Maseru 100

Category of Review:
[x] Initial Review
[ ] Continuing Annual Review
[ ] Amendment/Modification
[ ] Reactivation
[ ] Serious Adverse Event
[ ] Other ____________

REF: ID142-2021
Date: August 22, 2021
To
Litlhokoe Mohlomi (Mr.)
Student ID #: R1710D3752490
UNICAF University

Dear Mr. Mohlomi

RE: THE CONCEPTUALIZATION OF A DESIGN FOR A SUSTAINABLE PUBLIC HEALTH MANAGEMENT INFORMATION SYSTEM (PHMIS)

This is to inform you that the Ministry of Health Research and Ethics Committee reviewed and **APPROVED** the above named protocol and hereby authorizes you to conduct the study according to the activities and population specified in the protocol. Departure from the approved protocol will constitute a breach of this permission.

This approval includes review of the following attachments:
[x] Protocol dated November 2019
[x] Informed Consent form: Consent Form
[x] **Data Collection Tool**: Questionnaires
[x] Participant materials: *Participant information sheet*
[x] Other materials: Letter of permission to conduct a study dated 4th May 2021, CV_ Litlhokoe Mohlomi, Unicaf University Research Committee approval letter dated 13th May 2021

This approval is **VALID** until August 22, 2022.

Please note that an annual report and request for renewal, if applicable, must be submitted at least 6 weeks before the expiry date.

All serious adverse events associated with this study must be reported promptly to the MOH Research and Ethics Committee. Any modifications to the approved protocol or consent forms must be submitted to the committee prior to implementation of any changes.

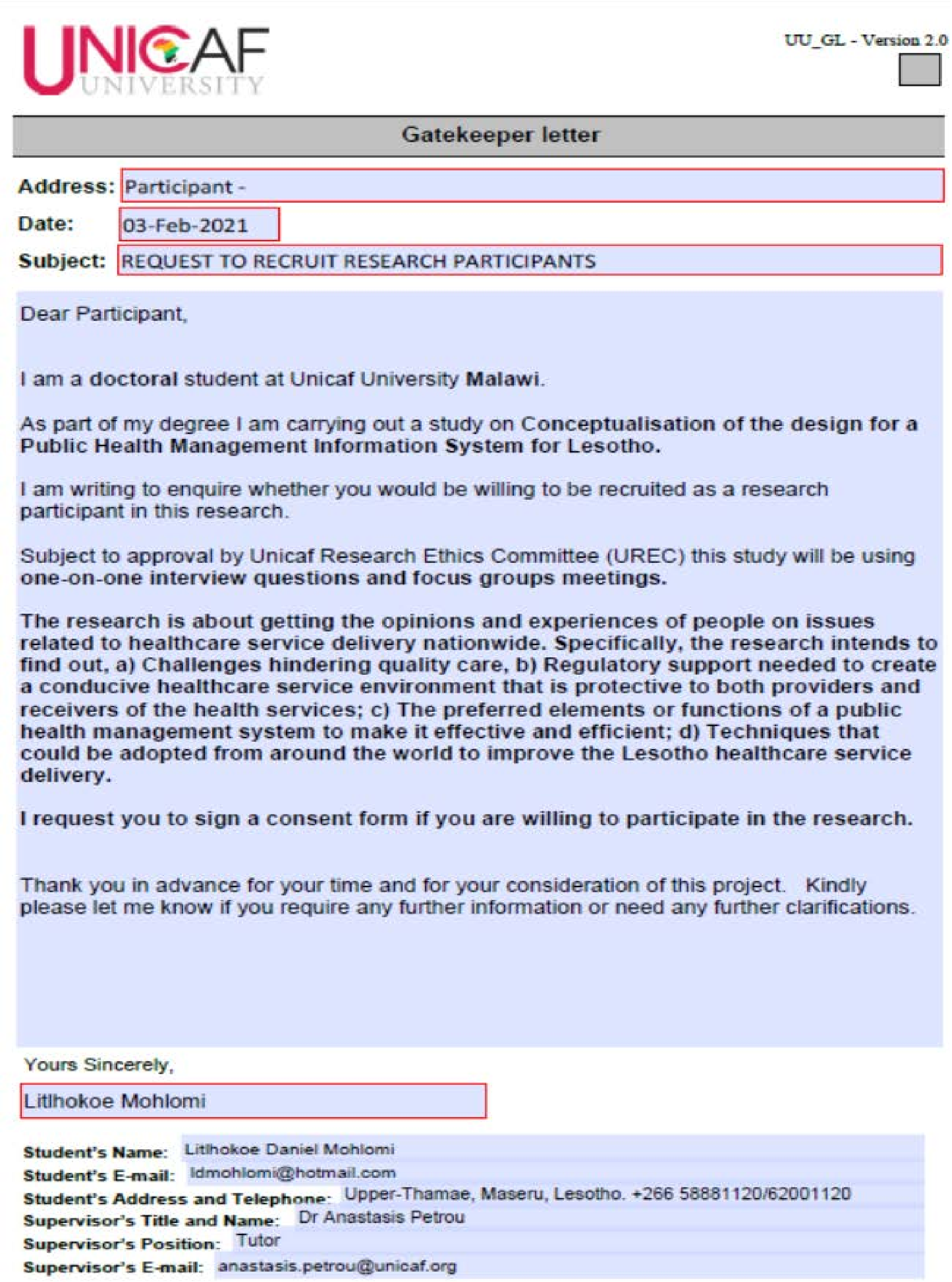
We look forward to receiving your progress reports and a final report at the end of the study. If you have any questions, please contact the Research and Ethics Committee at rcumoh@gmail.com (or) 59037919/58800246.

Sincerely,

DR. 'NYANE LETSIE
Director General Health Services

DR. LLANG BRIDGET MAAMA-MAIME
Member of National Health Research
Ethics Committee (NH-REC)

Annex 9: Research Introductory Letter



UNICAF UNIVERSITY

UU_GL - Version 2.0

Gatekeeper letter

Address: Participant -

Date: 03-Feb-2021

Subject: REQUEST TO RECRUIT RESEARCH PARTICIPANTS

Dear Participant,

I am a **doctoral** student at Unicaf University **Malawi**.

As part of my degree I am carrying out a study on **Conceptualisation of the design for a Public Health Management Information System for Lesotho.**

I am writing to enquire whether you would be willing to be recruited as a research participant in this research.

Subject to approval by Unicaf Research Ethics Committee (UREC) this study will be using **one-on-one interview questions and focus groups meetings.**

The research is about getting the opinions and experiences of people on issues related to healthcare service delivery nationwide. Specifically, the research intends to find out, a) Challenges hindering quality care, b) Regulatory support needed to create a conducive healthcare service environment that is protective to both providers and receivers of the health services; c) The preferred elements or functions of a public health management system to make it effective and efficient; d) Techniques that could be adopted from around the world to improve the Lesotho healthcare service delivery.

I request you to sign a consent form if you are willing to participate in the research.

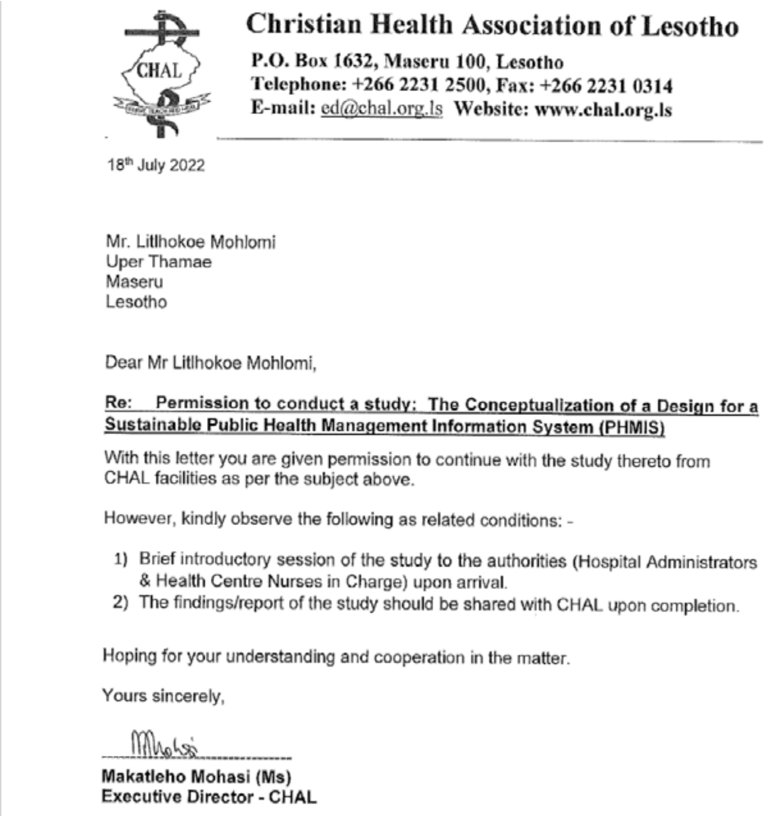
Thank you in advance for your time and for your consideration of this project. Kindly please let me know if you require any further information or need any further clarifications.

Yours Sincerely,

Litlhokoe Mohlomi

Student's Name: Litlhokoe Daniel Mohlomi
Student's E-mail: ldmohlomi@hotmail.com
Student's Address and Telephone: Upper-Thamae, Maseru, Lesotho. +266 58881120/62001120
Supervisor's Title and Name: Dr Anastasis Petrou
Supervisor's Position: Tutor
Supervisor's E-mail: anastasis.petrou@unicaf.org

Annex 10: CHAL Approval Letter



Christian Health Association of Lesotho
P.O. Box 1632, Maseru 100, Lesotho
Telephone: +266 2231 2500, Fax: +266 2231 0314
E-mail: ed@chal.org.ls **Website: www.chal.org.ls**

18th July 2022

Mr. Litlhokoe Mohlomi
Uper Thamae
Maseru
Lesotho

Dear Mr Litlhokoe Mohlomi,

Re: Permission to conduct a study: The Conceptualization of a Design for a Sustainable Public Health Management Information System (PHMIS)

With this letter you are given permission to continue with the study thereto from CHAL facilities as per the subject above.

However, kindly observe the following as related conditions: -

1) Brief introductory session of the study to the authorities (Hospital Administrators & Health Centre Nurses in Charge) upon arrival.
2) The findings/report of the study should be shared with CHAL upon completion.

Hoping for your understanding and cooperation in the matter.

Yours sincerely,

Makatleho Mohasi (Ms)
Executive Director - CHAL